

REVIEW

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# A systematic review of the impact of generative AI on postgraduate research: opportunities, challenges, and ethical implications

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## Abstract

The rapid improvement of generative artificial intelligence particularly large language models like ChatGPT, and GPT-4, has presented transformative possibilities in postgraduate research. This systematic review investigates the impact of generative artificial intelligence tools on the quality, efficiency, ethics, and innovation of postgraduate research. A comprehensive literature search across four databases: Google Scholar, Web of Science, IEEE explore, and Scopus was carried out. Following the PRISMA guidelines, a total of 20 peer reviewed published articles between 2019 and 2025 were selected for a detailed review analysis and these were selected based on relevance to the postgraduate research context, explicit declaration of generative AI application, and reported outcomes. The review identified four thematic areas: (i) research productivity and efficiency, where generative AI has improved academic writing, data analysis, and literature reviews; (ii) cognitive and creative support, where AI helps formulate hypotheses, generate ideas, and refine language; (iii) academic integrity and ethical concerns, highlighting the dangers of plagiarism, data fabrication, and an over-reliance on artificial intelligence outputs; and (iv) capacity gaps and skills transformation, pointing out the growing demand for postgraduate researchers to receive ethical and AI literacy training. Despite the potential benefits of generative AI tools in democratizing access to research tools and improving productivity among postgraduate researchers, the review discovered that most academic institutions lack robust regulatory frameworks and institutional guidelines. Additional concerns arise from disparities in regional access to cutting-age AI tools, hence compromising the global research equity. The review concludes with a recommendation for a tailored framework for the responsible integration of GenAI into postgraduate research with a focus on institutional oversight, human-AI collaboration, and ethical application. The findings contribute to the current discussion over the future of AI and provide scholars, researchers and policymakers with evidence-based guidance on how to maximize AI's potential while safeguarding academic integrity.

**Keywords** Generative AI, Postgraduate research, LLMs, Research ethics, AI integration framework



## 1 Introduction

The advent of generative artificial intelligence (GenAI), particularly the large language models (LLMs) led to widespread release and adoption of pre-trained generative transformers such as GPT-3, GPT-4 and Deep Seek within academia [53]. For example Liao et al. [43] conducted a large-scale survey involving 816 verified research article authors to explore their perceptions and use of LLMs in research. The study found that 81% of respondents had integrated generative AI tools into various stages of their workflow. Also Jung et al. [37] found that 75% of the respondents at the private R1 research university actively use LLMs. These findings highlight the widespread adoption and growing trust in generative AI tools among academic researchers.

Large language models are designed to generate human-like prose, code, and even creative content, thereby offering students more options for research assistants [17]. These models are capable of handling large volumes of data, generate logical writing, condense knowledge and simulate creativity. As a result, they assist postgraduate researchers in all stages of research lifecycle, from proposal development to manuscript writing and dissemination.

It is important to recognize that the current adoption of GenAI builds on decades of digital transformation in academia [10]. Earlier foundational shifts from computer-assisted qualitative data analysis (CAQDAS) tools to academic search engines [34] and reference managers laid the groundwork for automation in research workflow [28]. Scholars such as Bayer [6] and Borgman [10] emphasized how digital tools reshaped scholarly communication, collaboration, and knowledge production. GenAI represents a more advanced stage of this evolution, combining automation with cognitive simulation, which challenges traditional notions of authorship, creativity, and epistemic agency.

The integration of GenAI into academic research is rapidly gaining momentum, offering new opportunities to accelerate methodological innovations, speed up literature reviews [24], and improve analytical reasoning [14, 22]. Additionally, these tools play a key role in bridging language barriers, hence promoting scholarly communication inclusivity [18]. Despite these advantages, the integration and adoption of GenAI have got several challenges within postgraduate research. Concerns over academic integrity, diminished critical thinking due to over-reliance on technology specifically AI [29], and possible biases in AI-generated information have been widely raised in various academic discussion forums [17, 58]. These issues raise fundamental questions about the ethical and responsible application of generative AI in postgraduate research settings [49].

While several recent empirical studies have explored perceptions and uses of GenAI in academic work, a focus synthesis of evidence on how these tools impact postgraduate research remains lacking. Existing reviews tend to emphasize general education or institutional perspective, with limited attention to how GenAI reshapes the postgraduate research process including problem formulation, writing, and ethical decision-making. Therefore, a targeted review is necessary to bridge this gap.

## 2 Methodology

This review integrates the Arksey and O'Malley methodology framework for scoping studies (Arksey & O'malley, 2005) with the Preferred Reporting Items for Systematics Studies and Meta-Analyses (PRISMA) guidelines [45]. The Arksey and O'Malley's framework guided the broader scoping objective of mapping the interdisciplinary and

evolving nature of GenAI in postgraduate research, while PRISMA contributed a structured protocol to enhance the transparency, reproducibility, and rigor of study identification, screening, and reporting.

The review process followed five integrated steps driven from Arksey and O'Malley's scoping framework and PRISMA guideline. First, the identification of research questions was guided by Arksey and O'Malley's emphasis on clarifying scope, resulting in four thematic questions exploring the impact of GenAI on research productivity, creativity, ethics, and research capacity. Second, a systematic search was conducted across four databases including Google Scholar, Scopus, Web of Science, and IEEE Xplore using tailored search strings containing keywords such as "generative AI," "postgraduate research," "LLMs," and "AI ethics in academia." This was followed by selecting and screening performed in two phases following the PRISMA protocol, beginning with title and abstract screening and followed by full-text evaluation. The selected studies were extracted and charted in a structured matrix capturing study design, objectives, outcomes, and key findings, enabling thematic synthesis. Lastly, the results were collated, summarized, and reported according to Arksey and O'Malley's framework, synthesizing insights into four thematic areas that reflect both the conceptual scope and empirical evidence within the literature.

## 2.1 Research question identification

The study was driven by four main research questions:

- i. How has generative AI impacted research productivity and efficiency among postgraduate researchers?
- ii. In what ways does generative AI support cognitive and creative aspects of postgraduate research?
- iii. What ethical and academic integrity concerns arise from use of generative AI in postgraduate research?
- iv. What capacity gaps and skill transformations are emerging as postgraduate researchers integrate generative AI into their workflows?

## 2.2 Identification of relevant studies

A comprehensive literature search was conducted across four databases: Google Scholar, Web of Science, IEEE Explore, and Scopus. The search was performed using a combination of keywords and Boolean operators to ensure a thorough reproducible search process. The search string used was: ("generative AI" OR "ChatGPT" OR "GPT-4" OR "large language models" OR "AI in research") AND ("postgraduate research" OR "academic writing" OR "research productivity" OR "AI in academia") AND ("ethics" OR "integrity" OR "AI applications" OR "research challenges"). The search was restricted to peer-reviewed journal articles and conference papers published between 2019 and 2025 to ensure the inclusion of recent studies.

## 2.3 Study selection

The inclusion criteria required that selected studies: (i) explicitly applied GenAI within the context of postgraduate education; (ii) reported empirical data through case studies or thematic analysis; (iii) were published in English; (iv) appeared in peer-reviewed journals or conference proceedings; and (v) were published between 2019 and 2025. An

initial screening of titles and abstracts identified 61 papers. Following a full-text review, a total of 20 studies met the eligibility criteria.

## 2.4 Quality appraisal

In this review, the quality of each included study was critically appraised to ensure the validity, reliability, and robustness of the findings. To achieve this, the JBI Critical Appraisal Checklist was employed as the evaluation tool due to its flexibility and comprehensive assessment of various types of research, including qualitative, quantitative, and mixed method studies. Each study was assessed against the following criteria:

- *Study design*: The clarity, appropriateness, and alignment of the study design with the research questions, ensuring that the design was suited to answer the research questions effectively.
- *Sampling and participation selection*: The adequacy of the inclusion criteria, sampling methods, and sample size, ensuring the study had representative sample that could support the findings and conclusions.
- *Data collection and measurements*: The reliability, validity, and transparency of the data collection methods, including the tools and instruments used. This ensured that the data gathered was appropriate for the study's objectives and could be reproduced.
- *Ethical consideration*: Whether the study adhered to ethical standards, including obtaining ethical approval, informed consent from participants and following research protocol to protect participant rights and ensured the ethical integrity of the study.
- *Data analysis*: The appropriateness and rigor of the data analysis methods used in addressing the study's research questions. This included assessing the clarity of the analysis and its relevance to the study's objectives.

Each study was rated based on these criteria, with a score indicating the overall quality of the study. The appraisal results for each study are summarized in Table 1, highlighting the strength and weakness of the studies included in this review. Studies that met the inclusion criteria were subjected to rigorous appraisal to ensure that only high-quality research contributed to the review's findings. Studies with significant methodological weakness were noted, and their findings were interpreted cautiously, ensuring a transparent and systematic evaluation of the evidence.

## 2.5 Charting of the data

For each selected study, the following characteristics were extracted: Author(s) and year of publication, Study design and methodology, AI tool or model investigated, Study objective(s), Reported primary outcome on research productivity, cognitive and creative support, ethical considerations, and capacity gaps, and capacity gaps, and Key findings. The extracted data on the selected characteristics were presented in Table 2.

# 3 Results

## 3.1 Search results

Figure 1 presents the search results, screening, exclusion, and final inclusion in the study.

**Table 1** Quality Appraisal of Included Studies

| Study                            | Study design (Q1)            | Sampling & participant selection (Q2) | Data Collection & measurement (Q3)          | Ethical considerations (Q4) | Data analysis (Q5) | Overall rating |
|----------------------------------|------------------------------|---------------------------------------|---------------------------------------------|-----------------------------|--------------------|----------------|
| English et al. [25]              | Survey                       | 75 PhD students in UK                 | Idea generation and summarization           | Yes                         | Yes                | High           |
| Hoffman [33]                     | Qualitative case study       | 11 female master's students           | Academic writing, planning, and translation | Yes                         | Partly             | Moderate       |
| Usdan & Chang [56]               | Mixed methods                | 27 postgraduate students              | Impact on writing productivity and grades   | Yes                         | Yes                | High           |
| Noy & Zhang [48]                 | Experimental                 | 453 professionals                     | Productivity in writing tasks               | Yes                         | Yes                | High           |
| Chen et al. [16]                 | Descriptive                  | Postgraduate students                 | Role of GenAI in group discussions          | Yes                         | Yes                | High           |
| Puapongsakorn & Brazdeikyte [50] | Pilot study                  | Researchers                           | GenAI during ideation                       | Partly                      | Yes                | Moderate       |
| Moongela et al. [46]             | Experimental                 | Postgraduate students                 | AI-generated prompts in research            | Yes                         | Yes                | High           |
| Lee et al. [42]                  | Survey                       | Knowledge workers                     | Impact on critical thinking                 | Yes                         | Yes                | Moderate       |
| Aytes et al. [4]                 | Assessment                   | Research proposals                    | Reasoning ability of GenAI tools            | Yes                         | Yes                | High           |
| Athaluri et al. [3]              | Experimentation              | 50 research proposals                 | Citation accuracy in AI-generated content   | Yes                         | Yes                | High           |
| Cotton et al. [19]               | Attitude evaluation          | Students and staff                    | Attitude towards AI use                     | Yes                         | Yes                | Moderate       |
| Kajiwara & Kawabata [39]         | Pilot study                  | Postgraduate students                 | Digital skills for AI use                   | Yes                         | Yes                | Moderate       |
| Zhai et al. [59]                 | Competence evaluation        | Students' skills                      | Use of AI tools                             | Yes                         | Yes                | High           |
| Kaplan [40]                      | Assessment                   | Postgraduate curriculum               | AI training in curriculum                   | Yes                         | Yes                | Moderate       |
| Grande et al. [30]               | Observation                  | Computing students                    | Computing students using AI tools           | Yes                         | Yes                | High           |
| Bianchini et al. [8]             | Assessment                   | Institutional access                  | Access disparities to AI tools              | Yes                         | Yes                | Moderate       |
| Tadimalla & Maher [54]           | Policy proposal              | Postgraduate training                 | AI literacy in post-graduate education      | Yes                         | Yes                | Moderate       |
| Noy & Zhang, [48]                | Experimental survey          | college-educated professionals        | Online experimentation                      | Yes                         | Yes                | High           |
| Doshi & Hauser [23]              | Randomized online experiment | Academic writers                      | Online experiment                           | Yes                         | Yes                | Moderate       |
| Siemens et al. [51]              | Conceptual analysis          | Postgraduate students                 | Conceptual analysis                         | Yes                         | Yes                | High           |

### 3.2 Discussion of results

The analysis revealed four major thematic areas of impact:

#### 3.2.1 Research productivity and efficiency

English et al. [25] provided valuable insights into the evolving role of GenAI tools in postgraduate research environment, particularly in the United Kingdom. Their survey of 75 doctoral candidates across 19 UK higher education institutions, it was found out that majority of the participants had already used GenAI for example ChatGPT for automating certain research tasks like idea generation, literature search, text summarization and

**Table 2** Summary of the characteristics of the selected studies

| Author                        | Study design/methodology                                                                                                        | Study objective                                                       | Primary outcome                                                                   | Key findings                                                                         |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| English et al. [25]           | Surveyed 75 PhD students in UK                                                                                                  | To examine GenAI usage in automating research tasks                   | Most participants had used GenAI for tasks like idea generation and summarization | Increased research efficiency and time for creative tasks                            |
| Hoffman, [33]                 | Qualitative case study investing 11 female master's students                                                                    | To explore GenAI use, benefits, and challenges                        | GenAI aided in academic writing, planning, and translation                        | Effectiveness use depended on user engagement and evaluation skills                  |
| Usdan & Chang [56]            | Mixed method approach that involved investigating 27 postgraduate students                                                      | To assess the GenAI's impact on writing productivity and grades       | Grades improved from B+ to A; writing time reduced by 64.5%                       | Positive outcomes for both ESL and native English speaker                            |
| Noy & Zhang [48]              | Experimental involving 453 professionals                                                                                        | To measure the productivity using ChatGPT in writing tasks            | Tasks done 40% faster; 18% improvement in output quality                          | Substantial productivity and quality observed                                        |
| Chen et al. [16]              | Descriptive study, employing qualitative approach to explore the role of GenAI in group discussions among postgraduate students | To explore the GenAI's role in group ideation                         | AI simulated ideas in peer review discussions                                     | Improved creativity when used to complement human intelligence                       |
| Puapong-sakorn & Brazeal [50] | A pilot study to investigate how researchers utilize GenAI during ideation processes                                            | To investigate AI in idea generation and sense sensemaking            | Helped researchers generate diverse perspectives                                  | AI added structured frameworks for creativity                                        |
| Moongela et al. [46]          | An experimental study to assess AI-generated prompts in research                                                                | To examine GenAI's impact on divergent thinking                       | Prompt use risked fixation, limiting novelty                                      | Critical thinking was emphasized to avoid over reliance on GenAI                     |
| Lee et al. [42]               | A survey targeting knowledge workers                                                                                            | To evaluate the impact of GenAI on critical thinking                  | Participants over relied on AI with less mental effort                            | Risk of cognitive offloading and overconfidence                                      |
| Aytes et al. [4]              | Assessment of theoretical research concepts and proposals                                                                       | To enhance reasoning ability of GenAI tools                           | Structured reasoning improved and focus                                           | Balanced AI insights with human research goals observed                              |
| Athluri et al. [3]            | Experimentation of developing 50 research proposals using ChatGPT                                                               | To test the citation accuracy in AI-generated content                 | 30% references were had wrong DOI while 16% were fabricated(fake) references      | Low reliability in references generated by GenAI                                     |
| Cotton et al. [19]            | Attitude evaluation of students and staff in higher education institution                                                       | To assess the attitude and policy gaps in higher education institutes | Lack of guidance on acceptable use of AI                                          | Urgent need for clear institutional policies on ethical use of AI                    |
| Kajiwara & Kawabata [39]      | Pilot study among postgraduate student in access to AI usage digital skills                                                     | To promote ethical literacy in AI use                                 | Suggested prompt and citation training                                            | Institutional AI literacy programs were recommended                                  |
| Zhai et al. [59]              | Competence evaluation of students' skills in using AI tools                                                                     | To explore students' capacity in using AI without close supervision   | Unsupervised use linked to reduced critical thinking                              | Guidance is essential to preserve academic rigor                                     |
| Kaplan [40]                   | Assessment of postgraduate program curriculum                                                                                   | To assess AI training in curriculum                                   | Only 28% included formal GenAI education                                          | Recommended revision of postgraduate curriculum to include modules on ethical AI use |

**Table 2** (continued)

| Author                 | Study design/methodology                                                                  | Study objective                                                                                                                   | Primary outcome                                                                                              | Key findings                                                                                                                                                                                                    |
|------------------------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Grande et al. [30]     | Observation study involving computing student utilizing AI tools                          | To examine supervisor role in AI usage guidance                                                                                   | Supervisors assisted students to ensure ethical use of GenAI tools                                           | Instructor involvement is crucial in AI use                                                                                                                                                                     |
| Bianchini et al. [8]   | Assessment of variations in institutional and continental access to AI tools              | To assess access disparities in GenAI tools                                                                                       | Limited access among certain groups hindered research productivity                                           | Digital divide reduces exposure to GenAI tools                                                                                                                                                                  |
| Tadimalla & Maher [54] | Policy proposal to integrate AI in postgraduate education                                 | To integrate AI literacy in postgraduate training                                                                                 | Advocated ethics modules and AI resource centers                                                             | Systemic, multi-level integration recommended                                                                                                                                                                   |
| Noy & Zhang, [48]      | Randomized controlled online experiment with 444 college-educated professionals           | To evaluate the causal impact of ChatGPT on professional writing productivity, task structured, inequality, and worker perception | Productivity (measured as quality-adjusted output per unit time), and subjective outcomes like satisfaction) | ChatGPT increased productivity by reducing time spent by 37% and improving output quality by 0.45 68% of treated users submitted ChatGPT's unedited output, suggesting substitution over human-AI collaboration |
| Doshi & Hauser [23]    | Preregistered two-phased randomized online experiment with 293 writers and 600 evaluators | To examine the causal impact of generative AI on creativity, measured via novelty and usefulness of written stories               | Creativity indices, emotional, similarity of content                                                         | GenAI increased individual creativity (up to 11.5% improvement in usefulness for less creative writers), but also stories more similar to one another, reducing collective content diversity                    |
| Siemens et al. [51]    | Conceptual analysis based on post-digital and cognitive science perspective               | To explore how human cognition interacts with artificial intelligence and the implication for knowledge creation and education    | Theoretical framing of AI as both a cognitive partner and a source of epistemic uncertainty                  | AI can extend human cognition but also destabilize education norms and authorship                                                                                                                               |

code generation. These applications were perceived as labor-saving, creating more time for researchers to focus on more on analytical and creative tasks [48].

Similarly, Hoffman [33], conducted a qualitative case study recruiting 11 female masters' students to explore how they use GenAI tools, their perceived benefit, and challenges they face while utilizing these tools. Through interviews and analysis of ChatGPT conversation logs on the institution network, the study found that GenAI enhanced students' efficiency in tasks like academic writing, creative project planning, and translation. Despite the GenAI contribution in improving students' efficiency, the study highlighted that the level of impact is largely dependent on the depth of engagement and user's critical evaluation skills.

In a mixed-methods study with 27 postgraduate students, Usdan & Chang [56] investigated the impact of GenAI-assisted writing on productivity and grade in academic assignments. The results of the study showed that both English and ESL students benefited from the use of GenAI tool by improving the grades from average grade B+ to grade A and reduced the writing time by 64.5%.

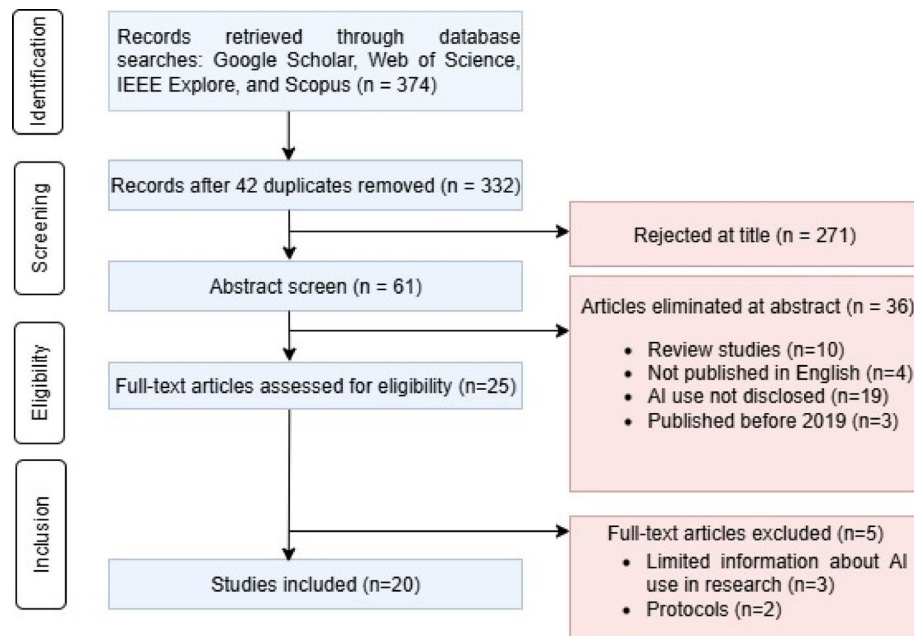


**Fig. 1** PRISMA flow diagram for the selected studies

Noy and Zhang [48] carried out an experimental study to evaluate the productivity of ChatGPT among 453 college-educated professionals tasked with occupation-specific writing assignments. Participants were randomly assigned to two groups i.e. those with and without ChatGPT. Results showed a substantial productivity gain among participants using ChatGPT completing tasks 40% faster than those without ChatGPT. Also, an 18% quality improvement was in the outputs was reported.

The findings from Noy & Zhang's [48] experimental study offer robust empirical evidence that generative AI, epicyclically ChatGPT, can significantly enhance productivity and efficiency in professional writing tasks, which are similar to many of the academic writing demands placed on postgraduate researchers. Experimental findings revealed that participants using ChatGPT completed tasks 37% faster and produced outputs rated 0.45 standard deviations higher than in quality compared to those without access. Although the study did not focus specifically on postgraduate students, the participants' profile-college-educated professionals engaged in mid-level writing closely mirrors the academic competencies of postgraduate researchers. The time-saving and quality-boosting of ChatGPT suggest that, when applied in academic research context, GenAI could streamline activities such as drafting literature reviews, formulating research statements and producing reports, hence improving overall research productivity.

These studies present a collective demonstration of how GenAI tools play a substantial role in enhancing research productivity and efficiency among postgraduate students and professionals. Key reported achievements include time saving, improved quality of research outputs, and elevated academic performance. These achievements are mainly met where GenAI tools are thoughtfully integrated into research workflow. While these tools provide significant advantages, its positive impact depends on the depth of the user's engagement, critical thinking, and ethical application. Efficiency gains must therefore be balanced with intentional human oversight to ensure that AI application remains a means to improve the researcher's intellectual rigor rather than replacing it.

### 3.2.2 Cognitive and creative support

Several studies have documented how GenAI tools been utilized in postgraduate research at different stages to increase productivity and creativity. In this section we discuss some the recent studies that have reported how GenAI has been utilized in research to the cognitive and creative support theme.

Chen et al. [16] assessed the role of GenAI in conceptual design tasks. In their findings, it was reported that many scholars utilize these tools in the early stages of problem definition and idea generation, thus, enabling them to explore a broader range of concepts and approaches. However, the study raises an importance of human oversight to ensure that the final outcomes align with the study objectives and ethical standards.

In the realm of collaborative ideation, Chang & Li [15] explored how LLMs are integrated in group brainstorming sessions. According their findings, GenAI tools are capable of improving brain writing produced in peer or group conversation. Study findings shows that AI can be used to stimulate novel ideas, especially where technology is adopted to enhance rather than replace human contribution.

Puapongsakorn & Brazdeikyte [50] explored the possibility of integrating AI as assistant tools in idea generation, sensemaking, and scientific creativity. Their findings revealed that the integration is possible and provides structured frameworks for developing research ideas hence offering diverse perspectives that may not be possible where traditional methods are solely used.

However, the integration of GenAI in cognitive and creative in research workflow has been criticized. Moongela et al. [46] explored the impact of AI-generated prompts on design fixation and divergent thinking. Study findings revealed that although GenAI offers valuable inspirations, there is a risk of users becoming overly reliant on AI suggestions, which may limit the novelty of their ideas. Thus, there is a need for critical engagement with outputs produced with the aid GenAI tools to safeguard the autonomy of human creativity.

Another study by Lee et al. [42] surveyed knowledge workers in a broader context to evaluate the impact of GenAI on critical thinking. Study findings suggest that, while AI tools offer the opportunity for swift information processing, they may also lead to reduced cognitive efforts and overconfidence in AI-generated content. Thus, the study emphasized the importance of nurturing critical thinking alongside AI tool usage.

Aytes et al. [4] proposed the “Sketch-of-Thought” framework, combining both cognitive inspired reasoning paradigms and linguistic constraints to improve LLM reasoning competence. This move aimed to create a balance between the depths of AI-generated insights with the need for concise and relevant output, thereby empowering researchers in maintaining focus and clarity in their research work.

Noy & Zhang [48] highlighted a notable restructuring of task engagement due to ChatGPT usage, with a decline in time spent on rough-drafting and shift toward idea generation and editing. This implies that GenAI serve as a cognitive aid by externalizing the initial stage of writing, allowing users to focus on refining content and critically evaluating output. While the tool primarily substituted for human effort rather than enhancing collaborative creativity in this study, the efficiency gain in routine aspects of writing can free cognitive bandwidth for more analytical dimensions of research. For postgraduate researchers, this capacity can be harnessed to supplement ideation, clarify complex

arguments, and experiment with different verbal styles, hence supporting both cognitive and creative functions within the research workflow.

Doshi & Hauser [23] conducted a randomized online experiment to examine the causal impact of generative AI on creativity, measured via novelty and usefulness of written stories involving 293 academic writers and 600 evaluators. In their findings, it was revealed that AI can enhance individual creativity by offering idea prompts that act as “springboards,” particularly aiding those with lower baseline creativity. However, since the study focused on micro-fiction writing, direct application to academic context should be interpreted cautiously.

Siemens et al. [51] explored distributed and networked cognition, where AI systems participate in the co-construction of meaning. In their reporting, they contend that this changes the nature of academic creativity from an isolated cognitive function to a hybrid process involving algorithmic suggestion and human interpretation. Furthermore, they believe that GenAI can stimulate new lines of thought or reframe problems, particularly beneficial in research ideation and hypothesis formulation. However, this also challenges the traditional definition of creativity as a solely human endeavor.

In conclusion, these studies portray a multilayered role of GenAI in augmenting cognitive and creative functions in postgraduate research. Whereas GenAI tools present a significant role in idea generation and conceptualization, it is imperative to approach their use with a critical mindset to ensure that human intelligence and creativity remain central to the research process.

### **3.2.3 Ethical concerns and academic integrity**

The increasing integration of GenAI tools into research workflow has prompted significant attention towards emerging ethical concerns and issues of academic integrity. While several issues have been documented, the existing literature consistently highlights three critical concerns associated with AI-assisted writing: AI hallucination, plagiarism, and citation fabrication.

In order to generate text, GenAI tools use publicly accessible data, the resultant content may be quite similar to the original source of information [38]. If this information is not carefully assessed for plagiarism potentials or published without proper acknowledgement of the source can raise concerns of plagiarism and copyright infringement [17].

In response to user-provided prompts, GenAI tools can produce convincing but entirely factually incorrect information, or illogical and fake, a situation known as AI hallucination [1, 12]. It should be noted that GenAI models are not developed to evaluate authenticity or correctness of the content, instead are trained to predict the next word based on statistical patterns [17]. Therefore, they are prone to producing fabricated content to fit the user needs, hence resulting in misinformation.

Another critical area where GenAI tools have raised concern is generation of fake references, a study by Bhattacharyya et al. [7] found that ChatGPT-generated references are mostly fabricated, with only 7% of citations being accurate. AI tools tend to generate output that reproduce or amplifies biases inherent within the source data. For example Athaluri et al. [3] used ChatGPT to write 50 research proposals, from results obtained, 38% of the reference in protocols had wrong DOI while 16% were completely fabricated.

An investigative study by Cotton et al. [19] that evaluated higher education staff and students' attitude regarding AI-assisted writing raises more concerns. The lack of unified institutional policies and guidelines on what constitutes acceptable use of AI is one of the main concerns highlighted in their research findings. The conclusion expressed concerns about urgent need for higher education institutions to develop a context-specific guidelines that defines ethical and responsible use of AI in teaching, learning and research workflows.

Birhane [9] cautioned against algorithmic biases present in LLMs, which have the potential to strengthen systematic injustices and damaging stereotypes in scholarly discourse. They emphasized that intentional audits and controls are necessary since these biases are often invisible to end users. Furthermore, Kajiwaru & Kawabata [39] stressed the need for AI literacy in mitigating ethical risks. They suggest that there should mandatory training established in institutions of higher learning focusing on prompt engineering, responsible citation practices, and critical evaluation of the AI-accelerated research outputs.

Noy & Zhang [48] carried out an experimentation to evaluate the causal impact of ChatGPT on professional writing productivity, task structured, inequality, and worker perception. Their findings revealed a widespread reliance on ChatGPT's outputs without further human editing for example, 68% of 222 participants which were exposed to ChatGPT submitted unmodified AI-generated content. These findings raise important academic integrity concerns. Undisclosed use of GenAI could result in issues such as plagiarism, over-reliance on unverifiable content, and erosion of individual scholarly contribution. The indistinct lines between AI assistance and authorship call for clearer academic policies and education around the ethical use of these technologies [44]. Furthermore, the study reports that exposure to ChatGPT increased participants' concern about automation, indicating an awareness of broader ethical implications, including displacement and fairness in AI use.

Collectively, these studies reflect a consensus in the literature that ethical concerns and academic integrity issues surrounding GenAI in postgraduate research are not merely technical issues but are deeply tied to institutional culture, policy and the broader academic ecosystem. As such, addressing these concerns requires multi-layered approach that include ethical education, transparency policy frameworks, and active human oversight.

### **3.2.4 Capacity gap and skills transformation**

Many postgraduate students take AI-generated content at a face value because they lack necessary abilities to evaluate its dependability and quality. Numerous research studies have reported on this allegation. For example Zhai et al. [59] discovered that many students use AI in their research workflow without proper guidance, which has been claimed to be a main cause of declined critical thinking among students, potentially weakening academic rigor. Also Kaplan [40] found out that only 28% of postgraduate programs include formal instructions on responsible use of AI tools, despite their rapidly growing adoption in academic research.

Research has also acknowledged the critical role played by supervisors in promoting ethical use of AI in research. For example Grande et al. [30] conducted a study in which computing students discussed LLMs in order to examine their ethical application. Study

results demonstrated that instructors were key in assisting students to evaluate content generated with the aid of AI tools and application of AI in moral decision-making.

Institutional and regional disparities in access to GenAI tools is another key capacity gap documented responsible for inequalities in research opportunities. For example Bianchini et al. [8] reported that researchers in developing or resource-constrained countries often rely on outdated or limited functionality (free packages) of AI tools, if they have access at all. This technology gap not only hinders research productivity, but also limits their exposure to evolving best practices and global academic standards.

The results by Noy & Zhang [48] suggest that GenAI tools like ChatGPT may disproportionately benefit individuals with lower baseline writing abilities, thereby compromising productivity disparities. However, the lack of strong scientific evidence for skill-based heterogeneity in AI benefits also indicates potential leveling for the skills landscape. For postgraduate researchers, this raises the need for training beyond basic tool usage to developing critical AI literacy skills in prompt engineering, evaluating AI-generated content, and integrating output into rigorous academic arguments. The study also emphasizes the urgent need to teach reflective use of AI in research, equipping scholars with the capacity to use tools responsibly and effectively within their disciplines.

In order to address these capacity and skills gaps, Tadimalla & Maher [54] advocate for unified inclusion of AI-related skills in postgraduate programs. Among the integrations suggested, is introduction of ethics modules in research methodology courses, conducting interdisciplinary workshops on responsible use of AI, and creating institutional support systems such as peer mentorship programs or AI resource centers. However, this integration requires coordinated efforts across institutional, pedagogical, and policy level. This capacity building is aimed at boosting individual academic success and promoting inclusiveness in scholarly research while safeguarding academic integrity.

#### **4 Framework for responsible AI integration in postgraduate research**

Drawing on the findings of this review and guided by theoretical insights from socio-technical systems theory [11], postdigital education [27], and digital labor studies [20], this framework (see Fig. 2) propose a structured, yet flexible, model for the responsible integration of GenAI in postgraduate research. The framework is built around three interdependent pillars: Institutional Oversight, Human-AI Collaboration, and Ethical Use. By merging these dimensions, the framework recognizes that AI tools do not operate in isolations, but are embedded in sociotechnical systems that shape research agency, pedagogical norms, and practices.

##### **4.1 Institutional oversight**

Sociotechnical system theory (STS) posits that optimal outcomes in complex environment arise from the co-design of social and technical components within an organization [47, 55]. In the context of GenAI integration, this theory highlights the importance of aligning institutional policies, training programs, support structure, and curriculum reforms with technological capabilities.

The institutional oversight tier of the framework operationalizes STS by emphasizing capacity building, policy development, and periodic auditing thereby recognizing that AI adoption must be embedded within human-centric governance and feedback systems.

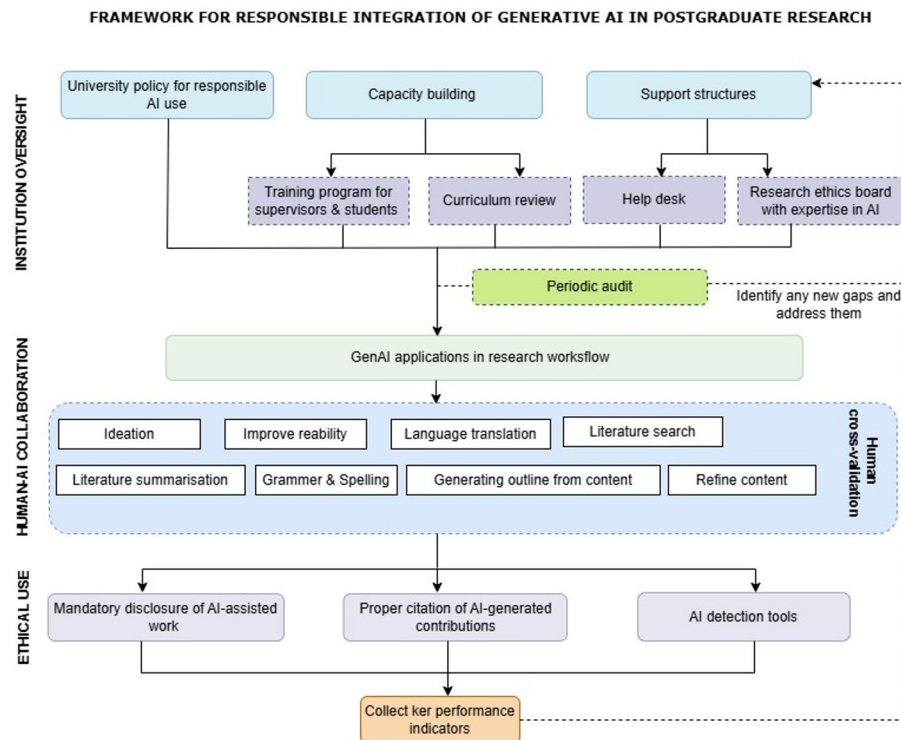


**Fig. 2** Framework for integration of GenAI in postgraduate research

For instance, the inclusion of AI-literate ethics boards and technical help desks reflects STS's insinences on mutual shaping of human roles and technical affordances [5].

The oversight process is initiated by developing a clear institutional level policy that define boundaries and guidelines on acceptable practices, thereby providing a foundation for ethical conduct and responsible adoption. Capacity building is a core element, this involves developing specialized trainings for both students and supervisors to equip them with required knowledge and skills to navigate the evolving landscape of AI-assisted research workflow and comprehensive curriculum reviews to embed modules for AI literacy, specifically in research methods courses. To ensure continuous support, essential support structures must be established. These include a help desk to offer technical and ethical guidance, and formation of research ethics board equipped with expertise in GenAI technologies. Most importantly these structures are subjected to periodic audits to systematically assess the integration of AI practices across research workflows, hence, enabling the institution to identify gaps and make necessary periodic adjustments.

#### 4.2 Human-AI collaboration

Postdigital pedagogy offers a fine understanding of how digital technologies, including AI, are connected with human learning practices in ways that shape the boundaries between digital and analog, automated and cognition [35, 41]. This theoretical lens informs the Human-AI Collaboration pillar of the framework by framing AI not as a replacement for human creativity but as a co-participant in scholarly inquiry. Tasks such as ideation, literature summarization, and language enhancement are not outsources to AI but are reconfigured into hybrid cognitive practices where critical thinking and

machine assistance interact iteratively. Postdigital pedagogy also reinforces the importance of human cross-validation, ensuring that AI outputs are interpreted, challenged, and refined through reflective academic judgement [36]. In doing so, the framework aligns with the pedagogical imperative to maintain learner agency, epistemological integrity, and dialogic knowledge construction in the age of ubiquitous AI.

#### 4.3 Ethical use

The Digital Labor Studies perspective critically examines the conditions under which digital outputs are produced, the commodification of intellectual labor, and the blurred lines between authorship and automation [57]. This theoretical grounding is central to the Ethical Use pillar of the framework, which calls for mandatory disclosure of AI-assisted contributions by the researchers, to ensure that they openly communicate both the extent and the nature of AI's role in their work, proper citation to ensure that AI-generated outputs are appropriately acknowledged and accurately attributed, and AI detection tools to assist the institution and researchers in identifying instances where AI-generated content is present, hence reducing the risk of undisclosed or irresponsible use. To close the feedback loop, the framework suggests a systematic collection of key performance indicators (KPIs) that monitors ethical compliance, and the impact of AI integration on research quality and outcomes. These elements directly confront the ethical challenges posed by AI-generated content in academic work, particularly the potential for intellectual misattribution of labor [52].

#### 4.4 Implementation strategies

While the proposed framework offers a strategic vision for the responsible integration and adoption of GenAI in postgraduate research, its effectiveness depends largely on contextual adaptability, particularly in institutions with limited infrastructure, uneven digital access, or immature regulatory frameworks. Therefore, to bridge implementation gaps, the following practical strategies are proposed:

1. *Phased Roll-Out*: Adopting a phased approach enables the institution to gradually and effectively integrate GenAI into postgraduate research workflows. Phase 1 focuses on awareness and foundational digital literacy. This can be achieved by launching GenAI awareness campaigns and embedding basic AI literacy into existing workshops. These initiatives can be implemented even in the absence of advanced infrastructure. Phase 2 involves piloting GenAI within a selected number of postgraduate programs. These pilot projects should be guided by clear ethical protocols and continuous monitoring to assess both benefits and challenges. Based on lessons gained from these pilots, the institution can then proceed to Phase 3, which entails the development of a formal institutional policy, establishment of an ethics board with AI expertise, and full integration of AI literacy into the research curriculum. This approach aligns with organizational learning theory [26], which suggests that institutions in uncertain environments should adopt incremental change anchored in experimental feedback [31].
2. *Leveraging Open-Source and Freemium Tools*: Institutions with constrained budgets can utilize open-source or low-cost GenAI tools like OpenAI's ChatGPT free-tier, Hugging Face models or BLOOMZ for ideation and writing, Zotero and Connected Papers for research synthesis, Grammarly basic for writing improvement. This

approach align with principles of open education resources (OER) and digital inclusion [21], helping level the field for under-resourced institutions [13].

3. *Partnership Models*: Institutions lack internal AI expertise can form collaboration with universities, tech incubators, or non-government organizations that focus on digital transformation. For instance, collaborating with AI research hubs to co-develop training programs, applying for international grants that support ethical AI adoption in education (e.g. UNESCO)
4. *Mobile-First and Offline-Enabled Platforms*: Where internet bandwidth is limited, mobile-first platforms and offline-enabled educational tools like Kolibri and MoodleBox can serve as delivery channels for AI training and collaboration. This strategy is particularly relevant for rural campuses. It aligns with appropriate technology principles [32] that promote solutions tailored to local constraints.
5. *Minimalist Ethical Oversight Models*: In institutions without formal research ethics board or large departments, a faculty-level oversight committee trained in GenAI ethics can temporarily assume oversight roles. Alternatively, institutions can adopt open ethical toolkits, such as the Montreal AI Ethics Guidelines or UNESCO AI Ethics Framework to develop their policies. This approach ensures minimum ethical safeguards without extensive bureaucratic layers allowing flexible and responsiveness.

## 5 Conclusion

This review has explored the impact of GenAI on postgraduate research through analyzing four thematic areas including research productivity, cognitive and support, ethical concerns, and capacity gaps. The findings highlighted significant potentials of GenAI tools like large language models in improving productivity, supporting ideation, and promoting inclusivity within academic workflows. These tools also offer a seamless literature review process, hence improving the writing quality, and support in conceptual development, hence offering significant value to postgraduate researchers when responsibly applied.

The review also identified key challenges associated with academic integrity such as AI hallucination, plagiarism, fabricated citation, and eroding critical thinking resulting from over-reliance. Moreover, low AI literacy, limited institutional guidance and uneven access to GenAI tools, pose significant barriers safeguarding academic integrity amidst of AI adoption.

To better understand these finding in academic context, this review recognizes current denotes about how technologies like GenAI is changing education and research. Generative AI is not just a tool, it plays an active role in shaping how we think and learn, often blurring the boundary between human and machine thinking. Although it can make research more efficient, it also brings risks, such as reducing the value of human academic work and encouraging dependence on AI for original ideas. These concerns point to a larger shift in how knowledge is created, where students might rely too much on AI and lose opportunities to think deeply and build knowledge on their own.

As solution to mitigate these challenges, this paper proposes a three-pillar framework for responsible adoption of GenAI in postgraduate research anchored on institutional oversight, human-AI collaboration, and ethical use. The proposed framework emphasizes the need for integrating AI literacy into teaching curricula, strengthening

researcher accountability, and building institutional policies that ensure fairness, transparency, and academic rigor.

In summary, making the most of Generative AI while avoiding its risks requires more than just knowing how to use tools to a deeper understanding of how they work and affect research. The real challenge is to build a research culture where AI is used thoughtfully not as a shortcut to knowledge, but also a helpful partner guided by strong ethical values, teaching goals, and university policies.

#### Author contributions

V.M. wrote the main manuscript and prepared Figs. 1–2 and C.K. performed grammatical checks and contributed to language editing, G.M. and J.R. conducted the literature search and performed data curation. All authors reviewed the manuscript.

#### Funding

This study did not receive any funding.

#### Data availability

No datasets were generated or analysed during the current study.

#### Declarations

##### Ethics approval and consent to participate

Not applicable.

##### Consent to publish

Not applicable.

##### Clinical trial number

not applicable.

##### Competing interests

The authors declare no competing interests.

Received: 30 June 2025 / Accepted: 21 August 2025

Published online: 29 September 2025

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