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Exploring the Role of Generative AI Tools in Enhancing PhD Student Engagement and Academic Success

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Abstract. This study investigates the impact of generative AI tools, like ChatGPT, on the engagement and productivity of PhD students in the CEDUC Laboratory. The research aims to understand how AI may enhance students' research workflows and overall engagement in academic writing, idea generation, and time management.
A structured survey will gather data on PhD students' experiences using AI tools. The results are expected to demonstrate improvements in students' engagement and perceived productivity when using these tools. The findings will provide insights into how AI-driven tools can support PhD students in navigating their research journey more effectively, contributing to the discussion of AI's role in reshaping higher education.

Keywords: Generative AI, PhD Students, Academic Engagement, Higher Education, Research Productivity, ChatGPT, Academic Writing.

1 Introduction

In recent years, higher education has undergone huge transformations that is related to evolving societal needs, technological advancements, and changing pedagogical paradigms. Universities continue to reshape their approaches to teaching, learning, and academic research in parallel to these dynamic transformations in the academic landscape. This evolution reflects broader changes in how knowledge is accessed, processed, assessed in the modern era.

Within this context of educational transformation, the emergence of artificial intelligence demonstrates the most advanced technological developments of nowadays. The rapid advancements of AI technologies have revolutionized various sectors including data analysis, and problem solving.

On what concerns AI and higher education, AI has paved the way for new developed practices of teaching, assessing and learning. From personalized learning, enhanced student support to intelligent tutoring systems, AI technologies are reshaping how institutions work and how knowledge is transmitted and acquired. These tools

are now becoming key to academic activities, supporting everything from facilitated collaboration, accessible resources to pedagogical innovation.

With this in mind, AI is playing a crucial role in doctoral education and how PhD students make their research. The tools that AI make at their disposal offer new approaches to navigating resources, data analysis, and plan making, potentially enhancing both the efficiency and quality of doctoral research. This evolving relationship between PhD students and AI tools represents a vast and complex terrain of research, where many aspects can be investigated. These aspects can include the influence that AI has on PhD students.

This study will look into the potential impact of generative AI tools, such as ChatGPT, on the engagement and productivity of PhD students within the Communication, Education, Digital Usages, and Creativity (CEDUC) Laboratory. By focusing on the use of these tools for academic writing, idea generation, and time management, the research aims to understand how AI may enhance students' research workflows and overall engagement.

2 Literature review

2.1 Artificial Intelligence in Education

Lately, artificial intelligence is expanding across various disciplines, and that includes education (Olaf, Victoria, Melissa, & Franziska, 2019) as one of the major fields that is hosting AI in its practices. From optimizing administrative, enrollment management, students admissions, AI can help manage these tasks at cost-effectiveness and efficiency as mentioned by (Mohammed, 2023). Before AI, these tasks needed extensive human resources and significant time investment, with multiple teams required for task completion.

Moreover, on the teaching level, AI serves in providing a personalized learning (Sherry & Jen-Han, 2020). Personalized learning, being a major factor in students' academic success represents a critical pedagogical approach that tailors educational experiences to individual learning needs, and cognitive capabilities, ultimately enabling more effective and meaningful educational engagement (James, Tracey, Richard, & William, 2016). Through AI's sophisticated algorithms and adaptive technologies, it can build customized learning experiences based on each learner's unique profile (Muh. Putra, Rigel, & Hans, 2023), including their learning pace, preferences, learning styles, and areas of developments. AI with the variety and advanced tools of which it disposes, can have the capacity of creating a personalized learning for each learner based on his level of engagement, and academic performance to generate a tailored content and create appropriate resources.

In addition, artificial intelligence enhances higher education in terms of learning analytics. Learning analytics, being ab important factor that serve in tailoring educational programs, gathers and analyzes vast amounts of students' data including engagement patterns, academic performance, and learning behaviors. In other words, it is "*the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the envi-*

ronments in which it occurs"(Khalil & Ebner, 2016). Following this process, educational institutions gain insights into the learning process, enabling them to make data driven decisions, identify at-risk students early (Salas-Pilco et al., 2022) and implement targeted interventions to support academic success. When it comes to mixing AI with learning analytics, institutions get maximum outcome and results since AI algorithms can process vast amounts of educational data at unprecedented speeds(Alfredo et al., 2024), therefore identifying complex patterns and relationships that traditional analytics might be capable of doing. The integration of of this enhanced and AI powered learning analytics represents a strategic shift to improving knowledge retention and better learning outcomes.

Furthermore, education makes use of AI in terms of intelligent tutoring systems, which are designed to provide personalized and adaptive learning experiences (Lin et al., 2023). These systems rely on advanced machine learning algorithms to analyze students' performance in the corresponding course and therefore design tailored learning paths that best suit their unique needs. Controversially to the traditional tutoring systems that take endless efforts and do not have the ability to provide this tutoring support for a large scale of students(Lin et al., 2023), ITSs with their advanced capabilities can recognize individual learning styles, and detect students levels(Marouf et al., 2024), permitting a more enhanced and effective educational experience. ITSs are particularly powerful in complex academic disciplines such as mathematics, science and technology streams with large groups of students.

Finally, Artificial intelligence enhances higher education in terms of automated grading and assessment by leveraging machine-learning algorithms to analyze and assess students' works in diverse disciplines(Messer et al., 2024). These AI systems rely on language processing techniques and pattern recognition tools to evaluate complex assignments that include essays, problem-solving questions, mathematical equations and open-ended answers(Erickson et al., 2020; Ramesh & Sanampudi, 2022) which were challenging for traditional automated assessment tools. AI automated assessments provide consistent and detailed feedback while targeting large numbers of students simultaneously. This technology enables more timely and comprehensive evaluation while identifying students' areas of strength and weakness. On the other hand, AI automated assessment face several challenges that need improvements. Among these challenge (Messer et al., 2024) talk about AI struggling to comprehend nuanced aspects of students responses specially assignments that require creative thinking, complex argumentation or problem solving approaches. As these technologies continue to evolve, their potential to enhance teaching and learning grows.

2.2 Generative AI Tools and Research

(García-Peñalvo & Vázquez-Ingelmo, 2023) defined generative AI, in their review article, as being "the production of previously unseen synthetic content, in any form and to support any task, through generative modeling." It a sophisticated computational systems that take advantage of machine learning algorithms to generate content.

Moving to academic context, in generative AI's initial phase the performed tasks were limited to grammar checking and style enhancements(Nguyen et al., 2024).

However, these tools are now capable of processing and analyzing vast amounts of scholarly information, conducting literature reviews(Nguyen et al., 2024), generating research-related content, and assist in diverse tasks of the research process.

On the other hand, these sophisticated AI raise significant ethical concerns that need careful consideration. First, (Guleria et al., 2023) talked about the issue of originality and intellectual contributions, as questions about whether AI generated content can be considered authentic and original rise. Moreover,(Farayola et al., 2024) talked, in his article, about data privacy and security matters concerning the treatment of sensitive research information. Additionally, there are concerns related to potential biases embedded within AI generative tools that can potentially affect research results and outcomes. Finally, various studies (Ismail, 2024; Zhai et al., 2024) have talked about AI tools overreliance that presents a serious issue in academic research field. Maintaining research originality and integrity while taking advantage of AI tools capabilities need establishing clear guidelines and ethical frameworks for a decent use in academic contexts.

With this in mind, the integration of generative AI tools into academic research fields necessitates a thoughtful consideration for their use and limitations. This consideration includes developing systematic approaches that leverage AI capabilities while maintaining rigorous academic standards, which includes stablishing protocols for AI usage and setting limits(Perkins & Roe, 2024a). This approach aims at taking advantage of the available AI tools while ensuring that they enhance researchers' competencies rather than compromise research integrity(Dwivedi et al., 2023). These elements collectively highlight the transformative potential and complex considerations associated with generative AI tools in academic research, emphasizing the need for balanced, ethical, and strategic implementation approaches.

3 Research Methodology

This study utilized a mixed-methods approach to explore the impact of generative AI tools on doctoral researchers' engagement and productivity. The research targeted doctoral students from the Communication, Education, Digital Usage, and creativity (CEDUC) laboratory with surveys shared social media platforms like WhatsApp, LinkedIn, and Facebook Messenger to ensure broad participation.

Quantitative data were collected using structured questions to measure familiarity with AI tools, frequency of use, and their influence on research workflows like academic writing and idea generation. On the other hand, qualitative data was collected from open-ended questions that allowed participants to share detailed insights into the advantages and challenges as well as suggestions to improve AI tools, which will make their use more beneficial. Responses highlighted AI's role in enhancing creativity, managing complexities, as well as raising concerns about data privacy, reliability, and ethical issues.

While this methodology offered a well-rounded view of AI's role in research, the small sample size and reliance on self-reported data suggest the need for larger, longitudinal studies to deepen understanding and capture long-term effects.

3.1 Participants

A total number of 15 doctoral students participated in this study through a strategically distributed survey across social media platforms, specifically WhatsApp, LinkedIn, and Facebook, through using instant messaging channels.

The research participants represent a diverse range of doctoral research focuses, as illustrated in Figure 1. The distribution of research topics reveals a notable concentration in certain domains: 40% of the participants are conducting their research in education, representing the largest share. Digital usages constitute 26.7% of the research topics, and creativity taking 20% of the share. Communication and translation represent a smaller research segments, each comprising 6.7% of the participants. Educational practices was the largest cohort of this survey since it the laboratory's primary focus.

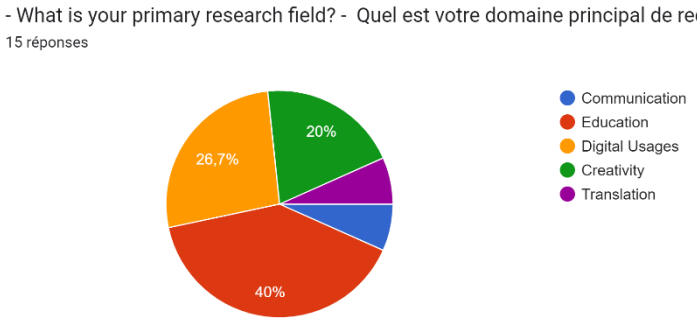

Fig. 1. Research field

The survey participants were systematically categorized based on their current academic progression in their doctoral journey. As shown in figure 2 below, participants demonstrated a nuanced distribution across different academic years: 40% of participants are first-year doctoral students, representing the largest cohort, while 46.7% are enrolled in their second year. The remaining 13.3% are in their third year of doctoral studies.

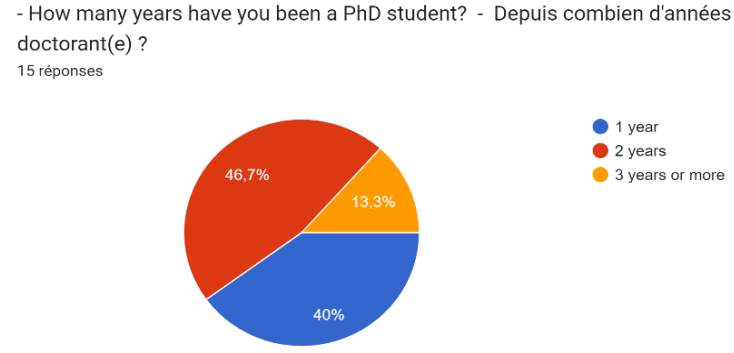

Fig. 2. Academic year

4 Results

4.1 AI tool familiarity

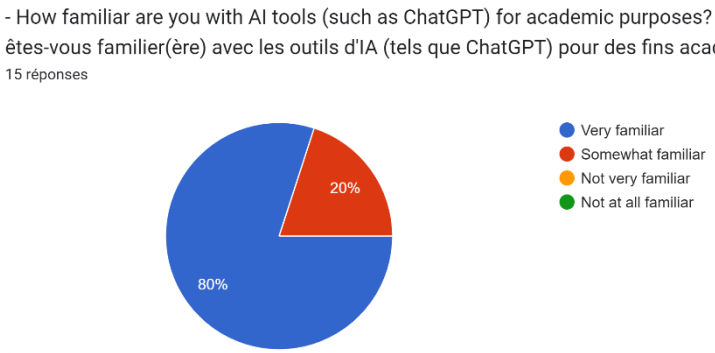

Fig. 3. AI tools familiarity

As figure 3 illustrates, the participants have a high level of familiarity with AI generative tools such as ChatGPT for academic purposes, as 80% of the doctoral researchers surveyed reported being "very familiar" with these technologies, while 20% were "somewhat familiar". However, no respondent reported being not very familiar or not at all familiar.

This suggests that the participants have extensively integrated AI tools into their doctoral research and studies. The overwhelming majority being very familiar implies these technologies are widely adopted within this academic community. This could provide valuable insights into the benefits, challenges, and best practices for incorporating AI into the doctoral research process. With this in mind, the following question analysis will provide a comprehensive and detailed explanation of the use of these AI tools in academic research.

4.2 AI Tool Engagement

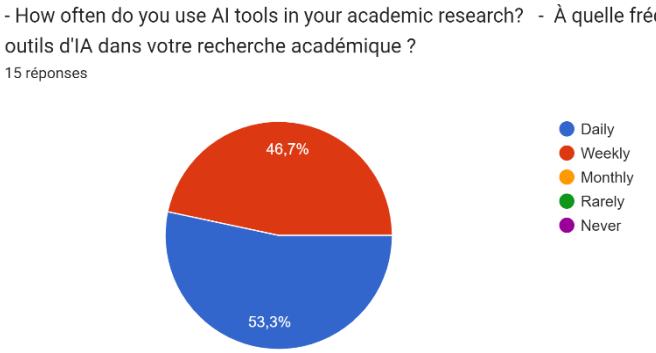

Fig. 4. AI tools frequency use

The results from the survey show that the participants have a high frequency of using AI tools in their academic research. Figure 4 shows that over half (53.3%) report using these tools on daily basis, while 46.7% use them weekly. This suggests that these AI generative tools are extensively integrated into the participants' research activities.

The prevalence of daily and weekly usage indicates the doctoral researchers have found significant value and utility in leveraging AI tools to support their academic work. This level of integration implies the participants have likely identified ways these technologies can enhance their productivity, efficiency, and research capabilities.

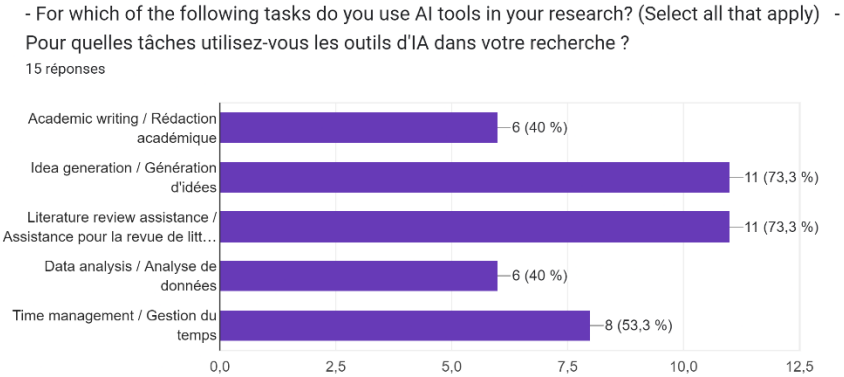

Fig. 5. Research task applications

On what concerns the question of research task application, the survey results show, as illustrated in figure 5, that doctoral students frequently utilize AI tools for various academic tasks. The most common applications are idea generation and creation (73.3%), literature review assistance (73.3%), academic writing (40%), data analysis (40%), and time management (53.3%). This diverse usage suggests the participants have found AI technologies beneficial across multiple aspects of their research activities, from idea generation and analysis to writing and productivity. Further exploration of the specific benefits, challenges, and best practices in this context could provide valuable insights for other graduate students and academic institutions seeking to effectively integrate AI into their research and writing processes.

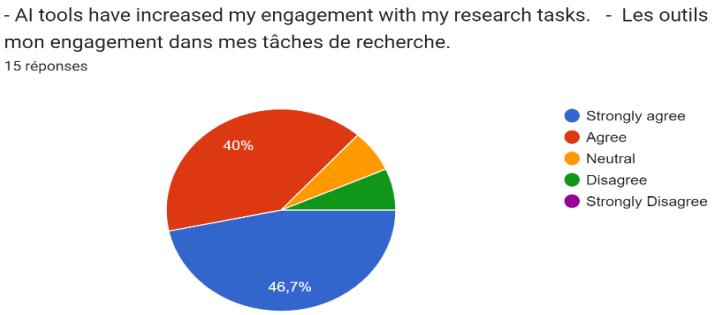

Fig. 6. Impact on research engagement

Additionally, the survey results, as illustrated in figure 6, indicate that the majority of doctoral researchers (46.7%) strongly agreed that AI generative tools have increased their engagement with research tasks, while an additional 40% agreed. This positive sentiment suggests the participants have found significant value and utility in leveraging AI technologies to support their academic work.

4.3 Academic Productivity

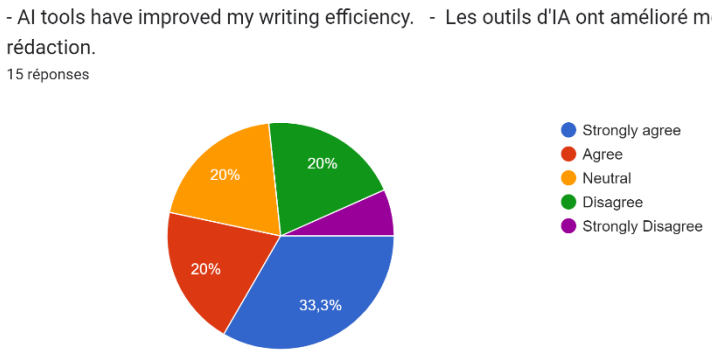

Fig. 7. Writing efficiency

The respondents' answers regarding AI generative tools' impact on writing efficiency present a notably diverse range of experiences among doctoral researchers. Over half of the participants 53.3% report a positive impact, with 33.3 strongly agree and 20% agree that AI tools have enhanced their writing efficiency. On the other hand, we see identical shares (20% each) expressing neutral opinions and disagreement, and a small percentage strongly disagree. This balanced distribution imply that AI generative tools' effectiveness in improving writing efficiency is highly individualized.

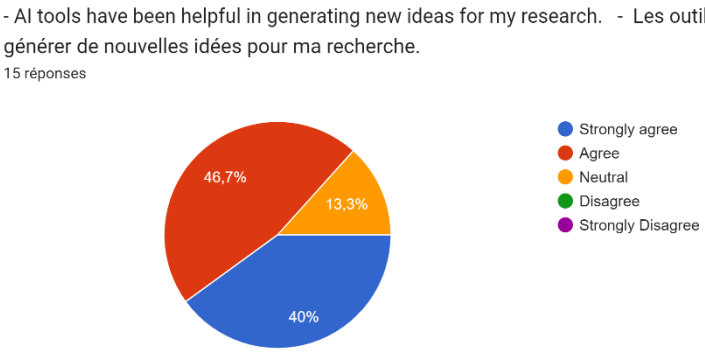

Fig. 8. New idea generation

On what concerns AI tools being helpful in generating new ideas for academic research, the survey respondents reveal a remarkably positive sentiment. Figure 9 illustrates 86.7% (40% strongly agree and 46.7% agree) report that AI tools have been beneficial in generating newa research ideas. These results demonstrate that AI tools is emerging as a valuable brainstorming partner in the academic research process, potentially offering new perspectives that researchers might not observe or consider. The absence of negative replies is particularly revealing; it implies that even researchers who may be sceptical of AI in other contexts value its capacity to stimulate fresh research ideas.

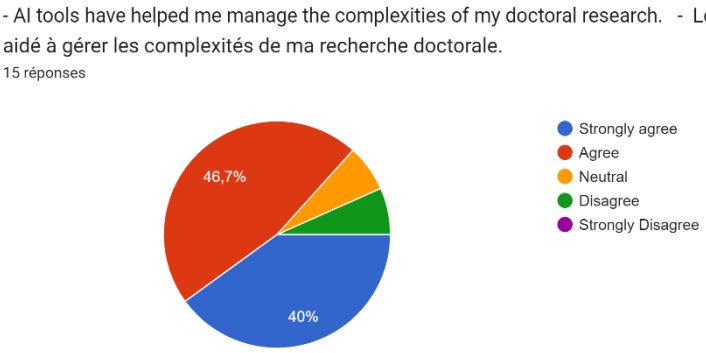

Fig. 9. Complexity management

As illustrated in figure 10, the respondents report positive answers in relation to the question to management of research complexities. 86.7% (40% strongly agree and 46.7% agree) indicate that AI tools have been valuable in managing their research challenges. This robust positive response suggests that AI is serving as more than just a basic research tool; it is becoming an integral partner in helping researchers handle the multifaceted challenges of doctoral research tasks.

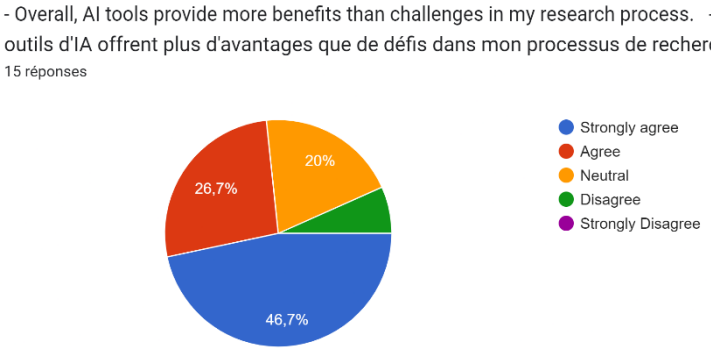

Fig. 10. Balancing Benefits and Challenges in Research

This graph shows the participants' perspectives towards the benefits and challenges of using AI generative tools in research tasks. A significant proportion (46.7%) strongly agree that AI tools provide more benefits than challenges, while 26.7% agree, indicating a generally positive reception. Meanwhile, 20% remain neutral, suggesting a degree of ambivalence, and a small minority (6.7%) disagree. Notably, no participants strongly disagreed. These results suggest that while most students view AI tools as advantageous in research, a minority may perceive limitations or lack sufficient familiarity with these tools to fully endorse their usefulness.

4.4 Overall Perceptions

What are the main benefits you have experienced using AI tools in your research?
Time saving / Time management
AI tools can be used to quickly summarise complex texts or identify key concepts in scientific articles.
They provide easy and, above all, rapid access to information, and improve the quality of editorial work.
Paraphrasing (quillbot), improving grammar (grammarly), finding quotations (scite)
Answering questions without reading
AI tools are easy. They provide you with information quickly and rapidly.
Among the benefits that IA provided, I can cite ideas generating, data analysis, and plan generating.
Getting inspired by new ideas
Mainly with organization of ideas for my research paper.
Economy in finding sources. defining and understand new concepts.

Fig. 11. Overall Perceptions

The open-ended responses shed light on several key benefits of using AI tools in research. Time management emerges as a prominent theme, with tools aiding in summarizing complex texts, identifying key concepts, and providing rapid access to information. Participants also emphasized how AI enhances the quality of editorial work, such as grammar improvement (Grammarly), paraphrasing (Quillbot), and finding citations (Scite). Other noted advantages include facilitating idea generation, organizing research papers, and performing data analysis. Additionally, AI tools inspire creativity, simplify complex concepts, and provide quick answers without extensive reading. Overall, the responses reflect how AI tools help in research tasks by improving efficiency and supporting deeper academic inquiry.

What challenges or limitations have you faced when using AI tools?
Not accepted by the supervisor
Sometimes they can give incorrect information.
AI tools cannot replace human expertise in complex or highly technical areas.
Some of the more powerful tools have become chargeable.
Irrelevant information, biased data, inexistent sources
Too many AI tools
It provides false information sometimes, and also inexistent resources
It doesn't provide correct information sometimes so we should be careful
The amount of times you have to use it per day
I think AI will never reach the human capacity but somehow the limitation are kind of surpassed all possibilities.
Data privacy
Prompting

Fig. 12. Limitations

The responses reveal several challenges and limitations faced by PhD students when using AI tools in research. A recurring concern is the accuracy and reliability of information, with mentions of incorrect, irrelevant, or biased data and even nonexistent sources. Some students noted that AI tools are not able replace human expertise, particularly in complex or technical fields. Others face practical issues such as tools becoming chargeable, data privacy concerns, and restrictions on daily usage. Additionally, the overwhelming number of AI tools available can make selection and integration into workflows difficult. A lack of acceptance by supervisors also presents a barrier, and some respondents identified prompting as a challenge, reflecting difficulties in effectively communicating with AI systems. These responses highlight a blend of technical, ethical, and practical limitations in the use of AI tools for academic research.

Please share any suggestions for improving the integration of AI tools in academic research.
Of course they are very important, but I encourage the development of the skills needed to use these tools effectively and, above all, in accordance with the ethical standards of scientific research!
It is a tool to be used for enhancing readability of academic works, and the overall quality of the research. Yet, the use should be ethical checking information carefully in order not to affect the results of research.
It would be better if AI had access to up to date resources so that it can help with literature reviews
We can use it to get inspired by the new ideas it provides but we should also be careful and not to passively accept any idea
A premium subscription provided by the university would be perfect :)
Learn about the prompts and how to ask questions to the AI. The structure of the question needs to be built and enhanced many times.
Train PHD students on the use of AI tools to maximize benefits and minimize reliance on the tool

Fig. 13. Suggestions for Improvements

The suggestions emphasize a balanced and ethical approach to integrating AI tools into academic research. Many respondents emphasize the need for skill development, calling for training doctoral researchers on effective usage. Ethical considerations, such as carefully verifying AI-generated information to maintain the integrity of research, are also stressed. Others suggest improving AI tools by ensuring access to up-to-date resources, which would enhance their utility for tasks like literature reviews. Additionally, fostering institutional support, such as providing premium subscriptions through universities, is seen as a practical step. Overall, these suggestions aim to optimize the benefits of AI tools while addressing potential pitfalls and promoting responsible usage.

5 Discussion

Our study on doctoral students' engagement with generative AI tools reveals several significant patterns that both align with and extend existing literature. The high level of AI tool familiarity among participants (80% being "very familiar") reflects the growing integration of AI in educational practices, supporting (Zawacki-Richter et al., 2019) observation of AI's expanding role across educational disciplines.

The prevalent daily (53.3%) and weekly (46.7%) usage patterns demonstrate how tools have become integral to doctoral research workflows. This integration particularly manifests in idea generation and literature review assistance aligning with (Nguyen et al., 2024) findings regarding AI's evolved capabilities beyond basic grammar checking to more sophisticated research tasks.

Particularly noteworthy is the strong positive impact of AI tools on research engagement, with 86.7% of participants reporting enhanced ability to manage research com-

plexities. This finding resonates with (Saaida, 2023) observations about AI's efficiency and cost-effectiveness, though in our study, these benefits extend beyond administrative tasks to core research activities.

However, our findings also reveal important challenges. The mixed responses regarding writing efficiency (53.3% positive, 40% neutral or negative) reflect the complexity of integrating AI tools into academic writing. This mirrors (Guleria et al., 2023; Huang, 2023) concerns about originality and intellectual contributions in AI-assisted work. Participants' concerns about data privacy and reliability echo (Farayola et al., 2024) cautions regarding data security in research contexts.

The suggestions for improvement provided by participants align with (Perkins & Roe, 2024b) emphasis on establishing clear protocols for AI usage. The call for institutional support through premium subscriptions and structured training programs reflects (Dwivedi et al., 2023) argument for balanced implementation approaches that enhance rather than compromise research integrity.

A particularly significant finding is the strong preference for using AI in idea generation and creativity (73.3% adoption rate), supporting (García-Peñalvo & Vázquez-Ingelmo, 2023) definition of generative AI as a tool for producing new content. However, participants' cautious approach to verification and accuracy aligns with (Zhai et al., 2024)warnings about overreliance on AI tools.

These findings suggest that while AI tools significantly enhance doctoral research processes, their effective integration requires careful consideration of both opportunities and limitations. The high engagement rates coupled with expressed concerns about accuracy and reliability indicate a sophisticated understanding among doctoral researchers of AI's role as a complementary tool rather than a replacement for scholarly expertise.

Looking forward, these results suggest the need for structured institutional frameworks that support AI integration while maintaining academic rigor, as suggested by (Ismail, 2024) Such frameworks should address both the technical aspects of AI tool usage and the ethical considerations that emerge from their application in academic research.

6 Limitations

This study has several limitations. First, the small sample size of 15 doctoral students from one research laboratory limits the generalizability of the findings to other disciplines or institutions. In addition, the reliance on self-reported data may introduce biases, such as participants over-reporting the benefits of AI tools. Also, the cross-sectional design only captures data at one point in time, preventing an understanding of the long-term impact of AI tools on research productivity and engagement. These limitations suggest that that further research with a larger, more diverse sample and a longitudinal approach would provide a more comprehensive understanding of AI’s role in academic research.

7 Conclusion and future work

In conclusion, this study highlights the role of generative AI tools in enhancing doctoral students' engagement and productivity, especially in in key research tasks such as idea generation, and time management. The findings suggest that these tools significantly support research tasks, foster creativity, and improve efficiency, providing valuable support in their academic pursuits. On the other hand, several challenges were highlighted including concerns about the accuracy and reliability of AI generated content, data privacy, and ethical implications, which need careful integration of AI tools into academic research. Addressing these challenges is important to ensure that AI tools are used responsibly and effectively without compromising the integrity of research.

For future work, expanding this research to include a larger and more diverse sample of doctoral students, such as targeting all the doctoral students across all disciplines in university Mohamed First, which would provide a broader understanding of how AI tools are adopted across different academic contexts. Additionally, future research could delve deeper into the specific AI tools used by students and their contribution to different research tasks, offering recommendations for their application in specific fields. Finally, future studies should focus on establishing ethical frameworks and guidelines for the responsible use of AI in academic research, ensuring that these tools are integrated in a way that supports academic integrity and fosters innovation.

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