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Exploring the Impact of Artificial Intelligence on Academic Writing: Perspectives of Ph.D. Students in the Faculty of Science at Cairo University

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Abstract

This study investigates the integration of Artificial Intelligence (AI) tools in academic writing among PhD students at the Faculty of Science, Cairo University. As reliance on AI technologies grows, understanding students' perspectives on these tools' effectiveness and impact becomes increasingly important. This research explores how AI influences the writing process, enhances research efficiency, and raises concerns regarding academic integrity.

Employing a mixed-methods approach, the study will utilize surveys and in-depth interviews to gather comprehensive data from 32 PhD students across various specializations in Chemistry, including Analytical Chemistry, Biochemistry, Inorganic Chemistry, and Organic Chemistry. The findings aim to illuminate the benefits and challenges associated with AI in academic writing, contributing to ongoing discussions about modern educational practices.

While AI tools can assist with grammar and style, this study emphasizes that they cannot replace the critical thinking, originality, and ethical considerations taught in traditional academic writing courses. Ultimately, a balanced approach that integrates AI support while preserving essential elements of writing education is proposed to prepare students for diverse writing challenges.

Keywords: AI in academic writing; Ph.D. Student perceptions; AI Tool effectiveness; Training and resources; Academic writing skills

The Philosophy of the Work

It is possible to interpret the philosophy of "Exploring the Impact of Artificial Intelligence on Academic Writing: Perspectives of PhD Students in the Faculty of Science at Cairo University" as an invitation to conduct a sophisticated investigation into a complicated issue. The word "exploring" implies a qualitative method, stressing an indefinite inquiry as opposed to a conclusive finding. This fits in nicely with the nature of scholarly research, especially in an area that is developing quickly like artificial intelligence.

The title emphasizes the significance of subjective experiences and individual viewpoints by concentrating on the "perspectives of PhD students," acknowledging that knowledge is created via human narratives.

This method prioritizes student voices and puts their perspectives at the heart of the research. Furthermore, defining the context of "the Faculty of Science at Cairo University" recognizes the institutional and cultural elements affecting these views, enabling a more thorough comprehension of how context affects attitudes toward educational technology.

Additionally, the relationship between "Artificial Intelligence" and "Academic Writing" draws attention to the wider ramifications of incorporating technology into conventional academic procedures. It raises important issues regarding the direction of scientific education going forward and encourages conversation on the revolutionary possibilities of AI tools.

Furthermore, the title subtly brings up moral questions concerning the application of AI in academic writing, including issues with plagiarism, originality, and the integrity of scholarly work.

This highlights the necessity of carefully navigating these issues and is a philosophical investigation into the moral implications of technology's involvement in education.

All things considered, the title represents a research approach that emphasizes ethical issues, contextual knowledge, and subjective experience. It acknowledges the subtleties and complexity of incorporating technology into academic processes and lays the groundwork for a thorough investigation of how PhD students view and use AI tools. To make a significant contribution to conversations regarding contemporary teaching methods and the changing nature of academic writing, one must adopt this philosophical position.

Introduction

The landscape of academic writing presents numerous challenges, particularly for doctoral students navigating the complexities of writing in a second language. In the study conducted by Ead, Hamed [1], titled Academic Writing Challenges Faced by Chemistry Doctoral Students: A Self-Study Informed by Three Writing Theories, the authors explored the intricate difficulties faced by chemistry PhD candidates writing in English. Their research highlighted the linguistic, cultural, and disciplinary factors that significantly influence writing development among these students. Through a self-study methodology involving nineteen participants, the study delved into various aspects of the writing process, including attitudes towards writing, idea generation, revision practices, and the efficacy of academic support systems.

Professor Ead identified five major classes of issues related to academic writing: text, errors, competence, support, and dissemination medium. They emphasized the importance of providing clear instructions on the writing process and fostering effective communication between faculty advisors and their students. These findings underscore the necessity for educational programs to adapt their approaches to better support PhD candidates in their writing endeavors.

Building on this foundation, the current study aims to explore the role of Artificial Intelligence (AI) in academic writing from the perspective of PhD students in the Faculty of Science at Cairo University. As AI tools become increasingly prevalent in academic contexts, understanding how these technologies influence writing practices, enhance research efficiency, and impact academic integrity is crucial. This research seeks to contribute to the discourse initiated by Ead, Hamed by investigating the evolving landscape of academic writing in a digital age, where AI offers both opportunities and challenges.

By examining the perspectives of PhD students across various scientific disciplines, this study aims to provide insights into the effectiveness of AI tools in academic writing, the concerns surrounding their use, and the potential strategies for training students to leverage these technologies for enhanced writing outcomes. Ultimately, the findings will inform best practices in graduate education, aiming to equip students with the necessary skills to navigate the complexities of academic writing in an increasingly AI-driven world.

Literature Survey

Academic writing courses have been developed over many years to help students gain the skills needed to succeed in their studies. These courses focus on important writing concepts like how to structure and organize academic papers, properly reference and cite sources, and use appropriate language and style [2]. They also teach critical analysis, practical research skills, how to integrate ideas, and the importance of academic integrity, which includes submitting original and non-plagiarized work [3-5]. Academic writing courses are available in universities, colleges, and online platforms, catering to students, researchers, scholars, and professionals who want to improve their academic communication skills [6]. The main goal of these courses is to teach participants the standard practices and criteria for writing recognized in academic settings [7,2,8].

Despite the benefits of these courses, many students and new writers face difficulties with academic writing [3]. To help overcome these challenges, there is a growing trend of using writing technologies for support. AI-powered writing tools are among these new technologies. These tools use Natural Language Processing (NLP) and are trained on large collections of human-written text [7,9,10]. Research shows that AI writing assistants can improve students' writing skills and boost their confidence and productivity. However, there are concerns that relying on these tools might lead to misuse [11]. For instance, tools like ChatGPT can create unique content that may be undetectable by current technologies and trained academic staff [10], raising serious questions about academic integrity. Other AI programs, such as QuillBot, AI Writer, and Typeset, can rephrase sentences by changing their structure or using synonyms. Wordtune helps non-native English speakers translate various languages into English [9]. Additionally, tools like ChatGPT, Trinka AI, and Writesonic make writing easier for students and save them time [12,3].

Moreover, AI tools like Grammarly, Jasper, and Consensus can help users improve their writing [2,13] and offer opportunities for learning when users notice differences between their original writing and the suggested edits. Despite the rising use of AI in academia, there is a lack of theoretical frameworks to explain how these tools are used in academic writing courses. The literature discusses several models, including the Technology Acceptance Model (TAM) developed by Davis et al. [14], Constructivist Learning Theory based on the work of Piaget and Vygotsky [15], and the Community of Inquiry (CoI) Framework

proposed by Garrison et al. [16]. TAM suggests that factors like perceived usefulness and ease of use influence how successfully AI is integrated into academic courses [17,14,18]. Constructivist theories focus on active learning and collaboration to engage students and help them build knowledge [15]. The CoI framework asserts that AI tools can help create a sense of community, promote cognitive engagement, and support effective teaching in online academic writing courses [18].

Table 1: *Research questions and hypothesis.*

Research Question	Hypothesis
1. How do PhD students perceive the role of AI tools in enhancing their academic writing skills?	PhD students who use AI tools report higher satisfaction with their writing process compared to those who do not.
2. To what extent do AI applications improve research efficiency for PhD students?	There is a positive correlation between the use of AI applications and research efficiency among PhD students.
3. What are the concerns of PhD students regarding the impact of AI on academic integrity?	Concerns about academic integrity are significantly higher among students who rely heavily on AI tools.
4. How do students' backgrounds in different scientific disciplines affect their attitudes towards AI in writing?	Students from disciplines with a stronger emphasis on technology demonstrate more favorable attitudes towards AI in writing.
5. What training or resources do PhD students believe are necessary for effective AI utilization in academic writing?	Adequate training in AI tools positively influences students' perceptions of their effectiveness in academic writing.

Table 2: *Methodology.*

Research Design	Mixed Methods
Participants	30 Chemistry PhD students from the Faculty of Science at Cairo University
Data Collection	
Quantitative Phase	
Survey Instrument	Structured questionnaire
Distribution	Online via email and social media
Qualitative Phase	
In-Depth Interviews	Semi-structured interviews with a subset of participants
Interview Procedure	Virtual or in-person, recorded, and transcribed
Data Analysis	
Quantitative Analysis	Descriptive and inferential statistics
Qualitative Analysis	Thematic analysis
Ethical Considerations	Informed consent, confidentiality, right to withdraw
Limitations	Small sample size, subjective nature of self-reported data

Table 3: *Results.*

Question	Choice	Percentage
How often do you use AI tools for academic writing?	Never	10%
	Rarely	13%
	Sometimes	47%
	Often	17%
	Always	12%
How effective do you find AI tools in improving your writing quality across your specialization?	Very effective	17%

	Extremely effective	13%
	Moderately effective	25%
	Slightly effective	10%
	Not effective	2%
	Average	20%
	Poor	7%
How often do you use AI tools for literature reviews specific to your field?	Never	8%
	Rarely	15%
	Sometimes	37%
	Often	23%
	Always	13%
Do you believe AI applications are equally beneficial across different chemistry specializations?	Strongly agree	20%
	Agree	39%
	Neutral	17%
	Disagree	13%
	Strongly disagree	8%
How concerned are you about plagiarism when using AI tools, considering the norms in your specialization?	Not concerned at all	8%
	Slightly concerned	12%
	Moderately concerned	27%
	Very concerned	33%
	Extremely concerned	15%
How would you rate your overall experience with AI tools in academic writing within your specialization?	Very poor	5%
	Poor	7%
	Average	25%
	Good	27%
	Excellent	13%
	Very good	17%
How likely are you to recommend AI writing tools to peers in your specialization?	Very unlikely	3%
	Unlikely	8%
	Neutral	17%
	Likely	42%
	Very likely	20%
In your opinion, do AI tools enhance creativity in academic writing specific to your field?	Strongly agree	13%
	Agree	37%
	Neutral	25%
	Disagree	17%
	Strongly disagree	7%
How often do you encounter technical issues with AI tools when applying them to specialized writing tasks?	Never	8%
	Rarely	13%
	Sometimes	33%
	Often	37%

	Always	8%
How important do you think training in AI tools is for Ph.D. students in your specialization?	Not important at all	3%
	Slightly important	5%
	Moderately important	17%
	Very important	50%
	Extremely important	20%
Do you feel that AI tools can fully replace traditional writing methods in your field of study?	Strongly agree	8%
	Agree	20%
	Neutral	25%
	Disagree	33%
	Strongly disagree	10%
How confident are you in your ability to effectively use AI tools in specialized writing tasks?	Not confident at all	5%
	Slightly confident	10%
	Moderately confident	30%
	Very confident	33%
	Extremely confident	17%
How reliable do you find AI-generated content when applied to your specific area of chemistry?	Not reliable at all	7%
	Slightly reliable	13%
	Moderately reliable	30%
	Very reliable	33%
	Extremely reliable	17%
How much do you think AI tools contribute to your academic success in your specialization?	Not at all	5%
	A little	12%
	Moderately	27%
	Very much	42%
	Extremely	17%
How well do you feel AI tools understand your writing style and needs within your specialization?	Not well at all	7%
	Slightly well	13%
	Moderately well	30%
	Very well	42%
	Extremely well	6%
How often do you seek feedback from peers or advisors when using AI tools for specialized writing?	Never	5%
	Rarely	12%
	Sometimes	40%
	Often	33%
	Always	8%
How satisfied are you with the accuracy of AI-generated suggestions in the context of your writing?	Very dissatisfied	5%
	Dissatisfied	12%
	Neutral	18%

	Satisfied	42%
	Very satisfied	17%
How frequently do you feel overwhelmed by the options provided by AI tools in your specific field?	Never	8%
	Rarely	13%
	Sometimes	37%
	Often	33%
	Always	8%
How do you view the ethical implications of using AI in academic writing within your specialization?	Very positively	10%
	Positively	37%
	Neutral	25%
	Negatively	17%
	Very negatively	7%
How essential do you find AI tools for your research process in your field?	Not essential at all	5%
	Slightly essential	12%
	Moderately essential	32%
	Very essential	33%
	Extremely essential	17%
How would you describe the future of AI in academic writing specific to your area of chemistry?	Bleak	3%
	Promising	47%
	Neutral	17%
	Very promising	35%

Table 4: *Statistical description and explanation of results.*

Category	Key Findings	Implication
Usage Frequency of AI Tools	47% use AI tools "sometimes," 10% never use them.	Increasing awareness and integration of AI in academic practices.
Effectiveness of AI Tools	25% find AI tools "moderately effective," 30% rate them as "very" or "extremely effective," only 2% "not effective."	Many users see AI tools as beneficial, but uncertainty remains about their full potential.
Frequency of AI Use for Literature Reviews	37% use AI tools for literature reviews "sometimes," 8% never do.	Indicates a preference for traditional methods or a need for more training in AI for literature research.
Perceived Benefits Across Specializations	59% agree AI applications are beneficial across chemistry specializations, 21% disagree.	General belief in the versatility of AI tools across different fields.
Concerns About Plagiarism	48% express concern about plagiarism when using AI tools, 33% "very concerned."	Highlights awareness of ethical considerations in academic writing.
Overall Experience with AI Tools	27% rate their experience as "good," 25% as "average," 5% as "very poor."	Mixed experiences may indicate a need for improved training and support.
Likelihood to Recommend AI Tools	62% would likely recommend AI tools to peers.	Positive reception could lead to broader adoption of AI tools in academia.
Creativity Enhancement	50% agree AI enhances creativity, 17% disagree.	Divided opinion on AI's role in fostering creativity.
Technical Issues Encountered	33% encounter problems "sometimes," 37% "often."	Need for improved reliability and user experience in AI tools.
Importance of Training	70% consider training "very" or "extremely important" for Ph.D. students.	Recognition of the skills needed to effectively use AI tools.

Replacement of Traditional Methods	28% agree AI can fully replace traditional methods, 43% disagree.	Ongoing value of traditional writing skills alongside AI tools.
Confidence in Using AI Tools	33% are "very confident," 5% have no confidence.	Need for more resources and training to increase user confidence.
Reliability of AI-Generated Content	63% find AI content "moderately" to "very reliable," 20% view it as "not reliable."	Users need to critically evaluate AI-generated content.
Contribution to Academic Success	42% believe AI tools contribute "very much" to academic success.	Encourages further investment in AI tools for academic writing.
Understanding of Writing Style	72% feel AI tools understand their writing style "moderately" to "very well," 20% disagree.	Suggests room for improving AI tools' personalization features.
Seeking Feedback	40% seek feedback "sometimes," 33% "often."	Collaboration and peer review remain important in the writing process.
Satisfaction with AI Accuracy	42% satisfied with AI suggestions, 17% very dissatisfied.	Need for continued refinement of AI algorithms for accuracy.
Feeling Overwhelmed by AI Options	37% feel overwhelmed "sometimes."	Streamlining options may improve user experience.
Ethical Implications	47% view ethical implications positively, 24% neutral or negative.	Growing awareness of ethical considerations in AI use in academia.
Essentiality of AI Tools	50% consider AI tools "very essential" or "extremely essential" for research.	Strong trend toward integrating AI into academic workflows.
Future of AI in Academic Writing	47% have a promising outlook, 3% view it as bleak.	Optimism about the ongoing evolution and potential of AI in academia.

Table 5: *Compatibility of results with abstract and research questions.*

Category	Discussion Alignment
Integration of AI Tools	Directly addresses students' perceptions and effectiveness of AI tools.
Understanding Students' Perspectives	Provides insights into skepticism and concerns about AI tools.
Influence on Writing Process and Research Efficiency	Highlights students' skepticism about AI's effectiveness in literature reviews and writing tasks.
Concerns Regarding Academic Integrity	Discusses students' worries about plagiarism and ethical implications.
Balanced Approach	Suggests integrating AI while preserving traditional writing education, consistent with the abstract's emphasis on AI limitations and critical thinking.
Perception of AI Tools (RQ1)	Directly addresses students' perception of AI tools in enhancing writing skills.
Improvement of Research Efficiency (RQ2)	Discusses students' lack of perceived improvement in research efficiency.
Concerns About Academic Integrity (RQ3)	Addresses students' concerns about plagiarism and ethical implications.
Background Influence on Attitudes (RQ4)	While not explicitly analyzed, the discussion mentions general attitudes towards AI.
Necessary Training and Resources (RQ5)	Emphasizes the need for comprehensive training and resources for effective AI utilization.

However, like other digital tools, AI tools have limitations, such as occasional errors and inaccuracies in rephrasing. Concerns also exist about excessive reliance on these tools and their impact on academic integrity [2,20]. While AI tools like plagiarism checkers (e.g., Turnitin) and grammar checkers (e.g., Grammarly) are becoming more common, it is uncertain whether they can replace creativity in academic writing. There is debate about how AI affects students' critical thinking, research skills, and communication abilities that go beyond what current automated tools can offer. Scholars warn that academic writing involves more than just grammar and syntax; it requires complex skills like analysis, argumentation, and synthesizing information, which AI cannot fully replicate [21].

The current systematic literature review examines the important issue of whether AI tools are replacing academic writing courses in universities. This study is significant because it addresses the critical role of AI in helping students develop their academic writing skills. Strong writing skills are essential for effectively communicating ideas, conducting research, analyzing texts

critically, and succeeding in various educational and professional fields [22,18]. However, the rise of AI writing assistants raises concerns about overreliance on technology, which may hinder the development of these important skills. It is crucial to explore how AI tools can support or undermine the learning goals and teaching methods of human-led academic writing instruction [20]. While AI grammar checkers and language models can assist with editing and ensuring originality, it remains uncertain if they can adequately teach higher-order skills such as rhetorical analysis, synthesizing sources, formulating evidence-based arguments, following disciplinary writing conventions, and developing an authentic voice. There are also unresolved questions about the impact of AI on academic integrity, critical thinking, and the writing process with guidance from instructors [10].

The findings of this review could provide insights into how to integrate AI while maintaining the quality and rigour expected in university-level writing education. The motivation behind this review is to synthesize current research on this topic, aiming to help educators, administrators, and educational technologists make informed decisions about the role of AI in teaching academic writing. The results could influence future curriculum development, instructional practices, writing program policies, and the effective use of AI tools alongside human instruction. As many universities are already using or considering AI writing aids, it is important to understand the implications of AI for this essential area of higher education.

The results indicate a generally positive reception of AI tools in academic writing, with many users recognizing their benefits while also expressing concerns about reliability, ethical implications, and the need for training. As AI continues to evolve, fostering user confidence and addressing technical challenges will be crucial for maximizing its potential in academic settings. The survey results illustrate a nuanced landscape of student perceptions regarding AI tools in academic writing. While there is an acknowledgment of their potential benefits, significant concerns about effectiveness, reliability, and ethical implications remain. The findings highlight the need for targeted training and clearer guidelines to help students navigate AI tools effectively while maintaining the integrity and quality of their academic work. Addressing these concerns will be essential for integrating AI into academic writing practices in a way that complements and enhances traditional methods.

Conclusion

The statistical analysis of the results reveals a generally positive outlook on the use of AI tools in academic writing among respondents. A significant portion of users engage with these tools regularly, indicating a growing acceptance and integration of AI in academic practices. While many perceive AI tools as effective and beneficial in enhancing writing skills and productivity, there are notable concerns regarding ethical implications, reliability, and the potential for overreliance on technology. The mixed experiences reported suggest that while AI can aid in the writing process, it is not a complete substitute for traditional writing skills and critical thinking abilities.

The findings highlight the need for improved training and support to help users maximize the potential of AI tools while addressing concerns about plagiarism and maintaining academic integrity. As AI technologies continue to evolve, understanding their role and impact on academic writing education is crucial for developing effective pedagogical strategies.

Recommendations

Enhance Training Programs: Institutions should develop comprehensive training programs that focus on how to effectively use AI writing tools. This training should cover not only the technical aspects but also ethical considerations and best practices to mitigate plagiarism risks.

Promote Balanced Use: Encourage a balanced approach to using AI tools, emphasizing that they should complement rather than replace traditional writing skills. Educators should highlight the importance of critical thinking, analysis, and personal voice in academic writing.

Improve AI Tool Reliability: Developers of AI writing tools should prioritize enhancing the reliability and accuracy of their products. Continuous updates and user feedback mechanisms can help improve the user experience and satisfaction.

Foster Collaboration and Feedback: Institutions should encourage a culture of collaboration among students, where seeking feedback from peers and instructors becomes a standard practice. This can help students refine their writing skills and reduce dependence on AI tools.

Monitor Ethical Implications: Academic institutions should establish clear guidelines and policies regarding the ethical use of AI tools in writing. This includes educating students about academic integrity and the importance of originality in their work.

Conduct Further Research: Ongoing research is needed to explore the long-term impacts of AI tools on academic writing skills, critical thinking, and overall student success. Findings from such studies can inform curriculum development and instructional practices.

Integrate AI into Curriculum: Institutions should consider integrating AI tools into the writing curriculum in a way that enhances learning outcomes. This could involve assignments that require students to use AI tools thoughtfully, promoting a deeper understanding of their strengths and limitations.

By implementing these recommendations, educators and institutions can better harness the benefits of AI tools in academic writing while addressing the associated challenges, ultimately enhancing the quality of writing education.

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