



Vulindlela – making new pathways

17th DEFSA conference – 21|22 September 2023

The digital supervisor: Key to access or shortcutting research?

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Abstract

Postgraduate students in South Africa and other developing nations face substantial hurdles in completing their research, despite efforts to boost research output and garner subsidies from the Department of Higher Education and Training (DHET). Key issues include research capacity development and supervision burdens. The potential of conversational AIs, like ChatGPT, as research assistants, has been discussed, but more research needs to be focused on using ChatGPT to support novice and student researchers, especially within resource-poor Global South contexts. Large language models (LLMs) such as ChatGPT can support the scientific research process, assisting in generating research questions, developing methodology, creating experiments, analysing data, and writing manuscripts. Responsible use of LLMs in research is crucial, underscoring the need to balance LLM benefits and limitations, retain essential academic skills, and ensure research equity. Our study on ChatGPT's role in postgraduate education offers insights into these areas.

We use a Case study approach at a university of technology in South Africa. The research has two main objectives: firstly, it presents a survey examining current ChatGPT usage among postgraduate students, exploring frequency and common applications, and assessing perceived utility in research work. Secondly, it analyses a Design student's experience using ChatGPT to transform initial ideas into a research proposal to understand its potential and constraints as a 'digital supervisor'.

Findings underscore the potential of AI tools to boost academic productivity and streamline the research process. It also outlines limitations of AI tools, such as accuracy, potential over-reliance, and creativity concerns. The study highlights the necessity of a balanced pedagogical approach, integrating AI and traditional methods, and promoting ethical AI usage. It underscores challenges in AI tool deployment, like access issues and language barriers, particularly in the South African context.

A significant finding is the potential role of AI tools like ChatGPT as digital supervisors, alleviating the burden on human supervisors and strengthening postgraduate culture in design. The study warns against viewing AI tools as complete substitutes for human supervisors and emphasises students' comprehension of AI functions and ethical implications.

The research contributes to design education by demonstrating the potential benefits and limitations of using LLMs as 'digital supervisors' to enhance access to postgraduate studies, particularly in the Global South. It emphasises the importance of incorporating LLMs into student learning and research in design responsibly, ensuring students develop requisite research skills and knowledge. Finally, we

ask what the implications might be for the field of design is whether there is a need to cultivate our own Design AIs.

Keywords: Design education, digital supervision, large language models, postgraduate research.

Introduction

Facing challenges such as high attrition rates, limited supervisory capacity, and student under-preparedness in postgraduate education, South Africa is in urgent need of innovative solutions (Akala 2021, p. 3; Dlamini 2020, p. 111; Mouton 2016, p. 16218; Sonn 2016, p. 234). In this context, the OpenAI-Developed Language Model, ChatGPT,¹ shows promise with its demonstrated applications in education, including academic writing assistance, research support, and language learning (Baidoo-Anu & Owusu Ansah 2023; Halaweh 2023; Kasneci et al. 2023; Kooli 2023; Yan et al. 2023), which align with the needs of South African postgraduate students and supervisors. Despite the potential benefits such as personalised learning experiences and quick access to relevant information, the use of ChatGPT raises concerns, including potential academic dishonesty, privacy issues, and lack of human creativity in outputs, emphasising the need for careful management and regulation in its application in postgraduate education (Baidoo-Anu & Owusu Ansah 2023; Khalil & Er 2023; Perkins 2023; Rahman & Watanobe 2023).

Even though there is a growing body of literature on the use of ChatGPT in research contexts, there is a gap in the research on the use of the technology by students in higher education (Strzelecki 2023). More research needs to be focused on using ChatGPT to support novice and student researchers, especially within resource-poor Global South contexts.

The study contributes to the field of design education by demonstrating the potential benefits and limitations of using conversational Large Language models (LLM) like ChatGPT as ‘digital supervisors’ to increase access to postgraduate studies in a Global South context. By surveying postgraduate students, the study gauges the extent to which students already use ChatGPT in their research activities. It raises important questions about how LLMs can be incorporated into student learning and research qualifications in design, whilst ensuring that students develop the skills and knowledge necessary to engage in research efficiently and ethically. In the conclusion, we consider pertinent questions relevant to the field of design education.

Defining the South African postgraduate education landscape

Since the landmark year of 1994,² South Africa's higher education sector has experienced profound shifts, marked by a significant expansion in postgraduate degrees and an intentional drive to prioritise postgraduate education at the national level (Akala 2021, p. 2; Dominguez-Whitehead 2015, p. 914). This development, spurred by the National Research Foundation (NRF) Funding Framework and governmental mandates, has resulted in a consistent increase in doctoral graduates. The National Plan for Higher Education and the Department of Higher Education and Training (DHET) aim to increase the staff with doctoral degrees from 34% to 75% by 2030 (Mphekgwana, Mabila, Tirivangasi & Makgopa 2020; Manyike 2017). However, these positive strides coexist with the challenge of an expanded

¹ ChatGPT is a large language model developed by OpenAI and designed to function as a conversational agent. It utilises a transformer architecture and has been trained on a vast amount of internet text to generate human-like text responses in conversation settings (Rudolph et al 2023, p. 344).

² South Africa held its first democratic elections in 1994, marking the end of apartheid policies.

workload for supervisors and the pressure to accelerate the production of high-quality graduates (Akala 2021, p. 3–4). Yet, the attrition rates remain a concern, with South African higher education institutions recording some of the highest globally (Dominguez-Whitehead 2015, p. 914–915). Additionally, the transition from undergraduate to postgraduate studies introduces new hurdles, such as low progression rates and a high ratio of part-time doctoral students (Mphekgwana et al. 2020). Therefore, a considered approach is essential for preparing undergraduates for postgraduate studies (Sonn 2016; Dominguez-Whitehead 2015, p. 914–915).

Addressing challenges in postgraduate growth through applications of ChatGPT

South Africa has made commendable strides in boosting postgraduate student numbers, yet substantial challenges linger. These hurdles include high attrition rates, limited supervisor capacity, and the necessity for a smoother undergraduate-to-postgraduate transition, all of which are crucial for achieving the government's ambitious targets and fortifying South Africa's global competitiveness (Akala 2021; Mouton 2016; Dlamini 2020; Sonn 2016).

The surge in postgraduate student numbers has amplified the strain on supervisors, who now face a significantly higher student-supervisor ratio (Akala 2021). The evolving nature of academic work and an increase in administrative responsibilities further dilute the time available for quality supervision (Akala 2021). Supervisors are also often required to guide students beyond their primary expertise areas, posing additional challenges (Mouton 2016). Faced with these challenges, innovative solutions are required to bridge supervision challenges and support the postgraduate journey effectively. One potential avenue could lie in harnessing the capabilities of emerging technologies like ChatGPT.

ChatGPT and similar technologies offer a range of educational applications, though not without ethical and practical issues. Particularly in writing support, ChatGPT provides assistance with phrasing, tone, style (Kooli 2023), grammatical feedback for language learners and non-native English speakers (Rahman & Watanobe 2023; Sullivan, Kelly & McLaughlan 2023), and help in interpreting complex terms and task structuring (Sullivan et al. 2023).

Content generation is another area where ChatGPT has shown potential, with its abilities ranging from creating code snippets, executing complex mathematical operations, and generating various forms of textual content (Khalil & Er 2023). This includes essays (Khalil & Er 2023; Raman et al. 2023), stories, plays, poems (Raman et al. 2023), and detailed responses to questions (Rospigliosi 2023). As a research tool, ChatGPT's applications are seen in fact-checking (Kooli 2023) and data retrieval (Alshurafat 2023), along with the automation of repetitive tasks like data entry (Kooli 2023). Its value in learning support is notable, aiding in decoding complex concepts (Rahman & Watanobe 2023) and supporting diverse student needs (Sullivan et al. 2023), even contributing to test preparation.

Challenges of integrating AI in postgraduate settings

The widespread application and integration of artificial intelligence (AI) in educational systems, particularly through tools like ChatGPT, has triggered a substantial body of literature discussing potential limitations and ethical concerns. A recurring concern in studies (Khalil & Er 2023; Rahman & Watanobe 2023; Raman et al. 2023) revolves around academic dishonesty risks, particularly plagiarism, as students may exploit AI for content creation. This may have broader implications for academic integrity and raise questions about the reliability of plagiarism-check software used by academic institutions. The quality and accuracy of AI-generated content are also contentious (Shoufan 2023; Peres et al. 2023; Rahman & Watanobe 2023), with identified limitations such as producing false

text (Peres, Schreier, Schweidel & Sorescu 2023; Shoufan 2023) and difficulty in completing complex reasoning (Rahman & Watanobe 2023).

Furthermore, the literature underscores concern around data privacy and security (Kooli 2023; Rahman & Watanobe 2023; Yan et al. 2023), recommending institutional measures for transparency, accountability, and user data control. A major ethical concern is the potential for AI to propagate bias. Raman et al. (2023) pointed to gender bias, arguing that ChatGPT exhibited a bias towards male users, while Rahman and Watanobe (2023) warned of the potential for ChatGPT to generate harmful content, including fake news and hate speech. Another concern is that of accountability and transparency in AI's internal mechanisms and processes (2023). This lack of transparency makes it difficult to hold anyone accountable for the responses generated by the AI, further exacerbating ethical concerns.

Despite the extensive literature on the limitations and ethical concerns of AI technologies in education, some topics appear to be underrepresented. For instance, while data privacy is a commonly expressed concern, discussions on detailed strategies for enforcing data protection and privacy measures in the practical application of AI in education remain scarce. The literature seldom discusses how these technologies might impact pedagogy or affect teacher-student relationships. Moreover, the conversation around how AI can be used responsibly and ethically to support learning while preventing misuse appears to be limited. More discourse is also needed on the social implications of AI integration, particularly in terms of equity and access in education. Sullivan et al. (2023) highlighted this concern, indicating a lack of public discussion about how ChatGPT might enhance participation and success for students from disadvantaged backgrounds. Future research needs to examine these understudied areas to fully understand and navigate the complexities associated with AI applications in education.

While AI technologies like ChatGPT offer immense potential for revolutionising education and research, their use must be tempered with an understanding of their limitations and a cautious approach to their ethical implications. It is imperative for future research to address these concerns and develop strategies to integrate these technologies into the educational landscape effectively.

Research methods

This study uses a case study approach, focusing on a university of technology situated in South Africa. The primary objectives of the study are twofold: Firstly, to analyse the current usage patterns of ChatGPT among postgraduate students through a structured survey questionnaire. Secondly, to provide an in-depth evaluation of ChatGPT's potential as a 'digital supervisor' by analysing the user experience of a Design student researcher.

The first phase of the research entailed the use of a structured questionnaire. This resulted in 35 valid responses. These participants, currently enrolled or intending to enrol in a postgraduate qualification at the aforementioned university, were selected to provide a broad and diverse understanding of the usage of ChatGPT. The age distribution of the participants varied widely (Table 1), with the largest group being between the ages of 25 and 34. With respect to gender, there were 18 male participants, 16 female participants, and one non-binary participant.

Table 1: Age ranges of survey respondents

Age range	Responses by age
25 - 34	11
35 - 44	8
Above 55	6
18 - 24	5
45 - 54	5

The educational backgrounds of the participants were diverse as well, comprising nine doctorate/doctoral students, 13 individuals enrolled in a master's degree, and 13 postgraduate diploma/certificate students. Additionally, the participants represented various departments, with Applied Design being the most represented, followed by Electrical Engineering and Information Technology. The breakdown of these departments is illustrated in Figure 1.

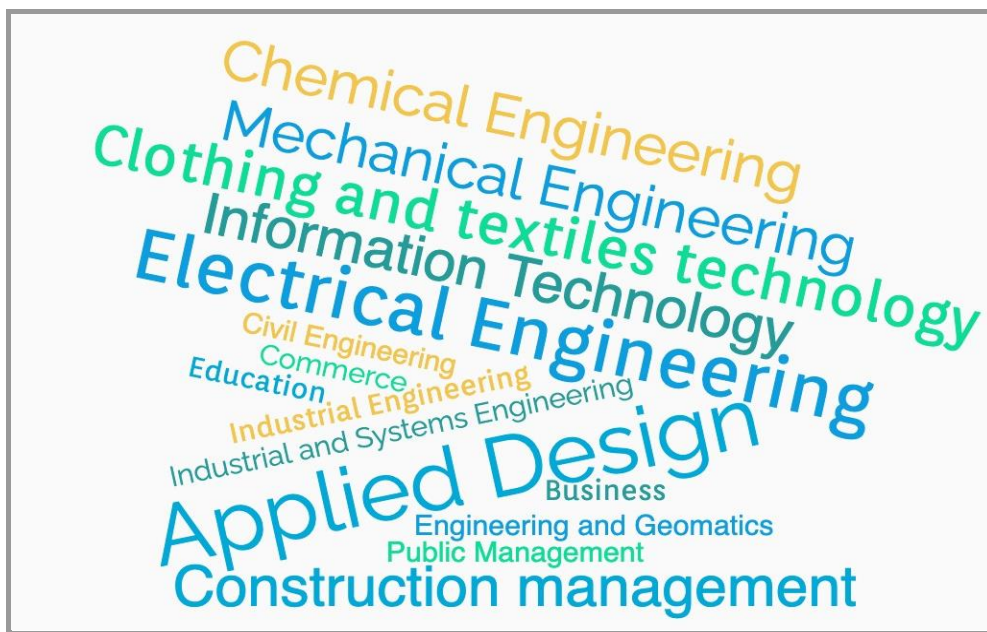


Figure 1: Word cloud visualisation of departmental distribution among survey respondents

In the second phase of the study, a more detailed examination of the use of ChatGPT was undertaken. Specifically, we studied the usage of ChatGPT by a Design student researcher (also a co-author of this paper) in the process of organising initial ideas into a research proposal. The goal was to gather insights into the potential benefits and constraints of employing ChatGPT as a 'digital supervisor'. The study analysed the prompts given to ChatGPT, as well as the satisfaction levels with the responses provided by the AI.

Survey findings

Results indicating the most beneficial application of ChatGPT in research tasks

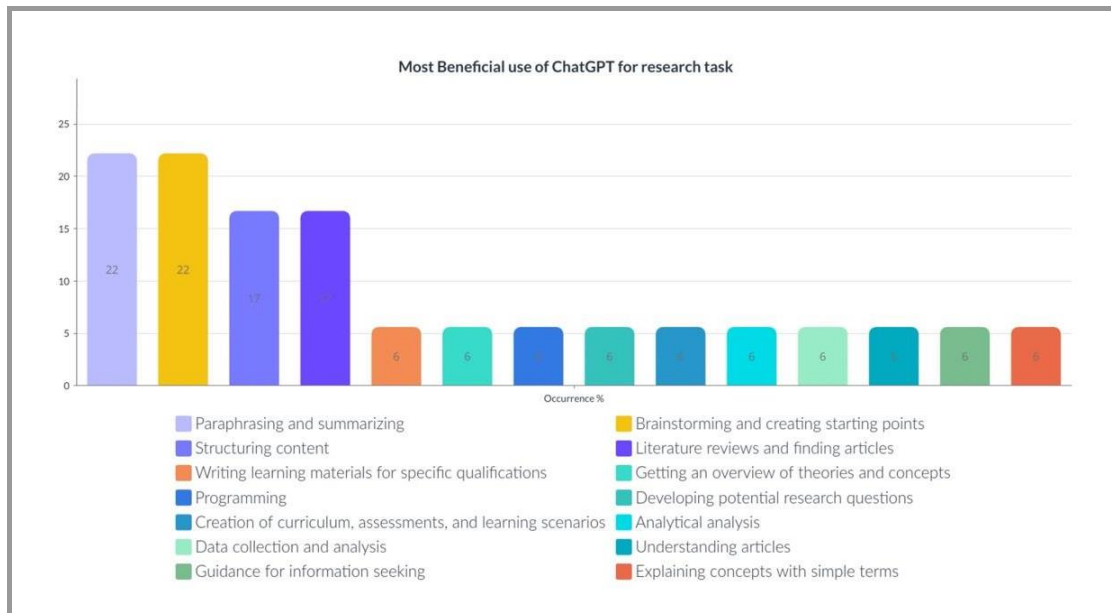


Figure 2: The most beneficial application of ChatGPT in research tasks

Figure 2 illustrates the percentage response rate per category and offers insights into ChatGPT's usage in research, with the most common being paraphrasing and summarising information (22.2% of respondents³). 22.2% of respondents⁴ used ChatGPT for brainstorming and creating starting points in the early research stages. Additionally, 16.7% of respondents⁵ found it helpful in structuring content. 16.7% of participants⁶ used it for literature review and finding articles. Unique use-cases included programming (P12), creating learning materials (P6), developing research questions (P15), providing explanations (P43), and illustrating its diverse range of applications. Some respondents found it useful for understanding articles (P32), data collection and analysis (P30), and information seeking (P33).

³ Respondents P4, P24, P25 and P33.

⁴ Respondents P7, P15, P30, P33.

⁵ Respondents P20, P7 and P16.

⁶ Respondents P9, P41 and P42.

Results indicating the overall benefits of using ChatGPT for research purposes

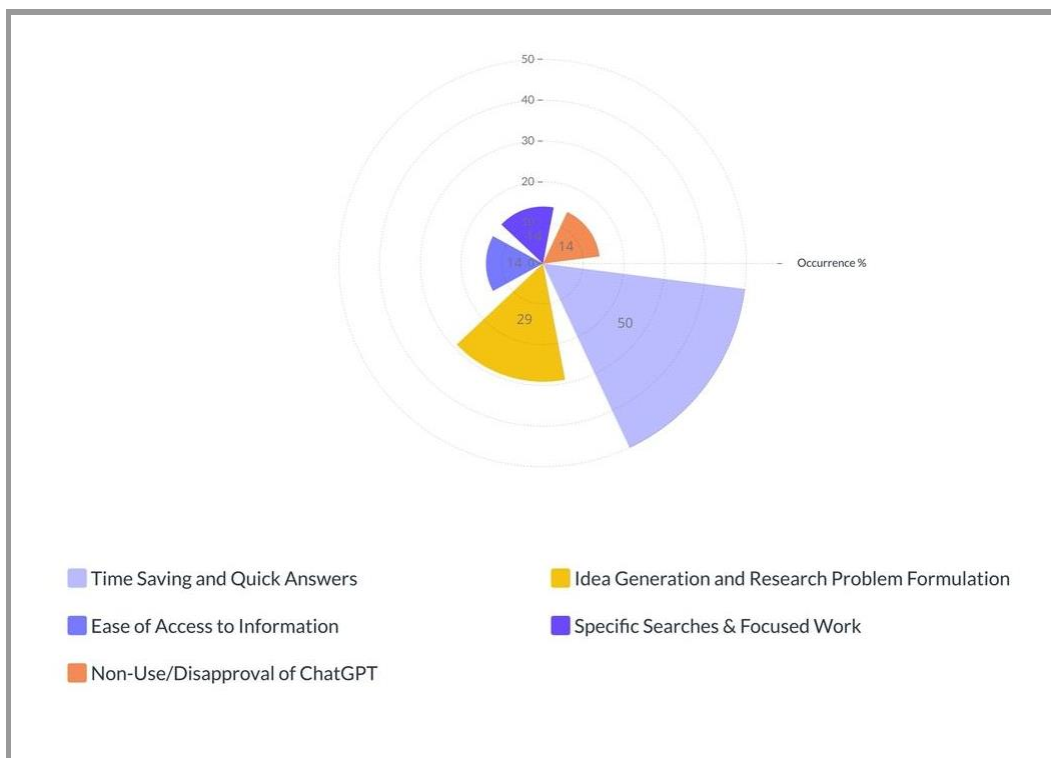


Figure 3: The main benefits of using ChatGPT

A thematic analysis of responses revealed key areas in which respondents found ChatGPT valuable for research purposes (Figure 3). Four themes indicating benefits were identified, with a fifth theme indicating non-use or disapproval. The predominant theme identified was the role of ChatGPT in Time Saving and Quick Answers. Nearly half the respondents⁷ emphasised ChatGPT's ability to rapidly generate ideas and provide quick initial frameworks, saving time.

Idea generation and research problem formulation was also a common theme. Participants noted⁸ ChatGPT's capacity for supporting new idea formulation and aiding in literature presentation, with P15 highlighting its usefulness in question development for research problems.

Ease of access to Information was underscored by respondents,⁹ as ChatGPT offers a convenient gateway to relevant information. Additionally, a few participants¹⁰ lauded ChatGPT for enabling *specific searches & focused work*, helping them maintain focus and conduct targeted searches.

⁷ Respondents P4, P8, P9, P20, P30, P33 and P12.

⁸ Respondents P16, P25, P41 and P15.

⁹ Respondents P29 and P33.

¹⁰ Respondents P7 and P42.

Results indicating the limitations of ChatGPT

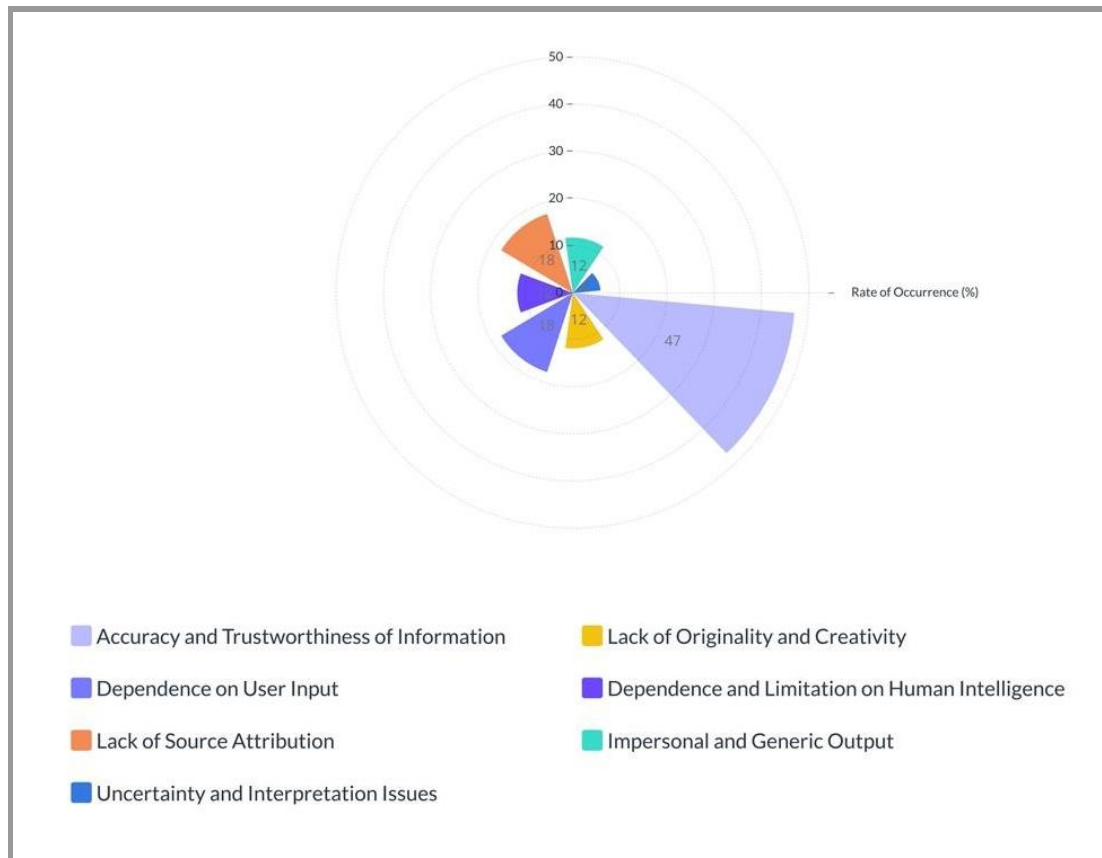


Figure 4: The limitations of using ChatGPT

Participants' concerns about limitations of ChatGPT were distilled into seven key themes (Figure 4). Nearly half (47.06%) flagged the *accuracy and trustworthiness of information*, doubting the reliability of the AI's output.¹¹ The *dependence on user input* was noted by 17.65% of respondents,¹² emphasising that the output quality is tied to the input's clarity and quality. Participants criticised the *lack of originality and creativity* (11.76%), with P7 noting ChatGPT's output often represents a simple regurgitation of information. Also, concerns about *dependence and limitation on human intelligence* emerged (11.76%), with participants¹³ worrying that overuse might diminish independent thinking abilities. The *lack of source attribution* was an issue for 17.65% of participants,¹⁴ and *impersonal and generic output* was another concern.¹⁵ Minor themes included *Uncertainty and Interpretation Issues* (5.88%, P29) and questions about *credibility and authenticity of work* (5.88%, P24). These insights reveal significant considerations that users have about the usage of AI tools like ChatGPT.

¹¹ Respondents P4, P6 and P20.

¹² Respondents P7 and P25.

¹³ Respondents P32 and P41.

¹⁴ Respondents P16 and P33.

¹⁵ 11.76% of respondents, P15.

Results indicating barriers when using ChatGPT

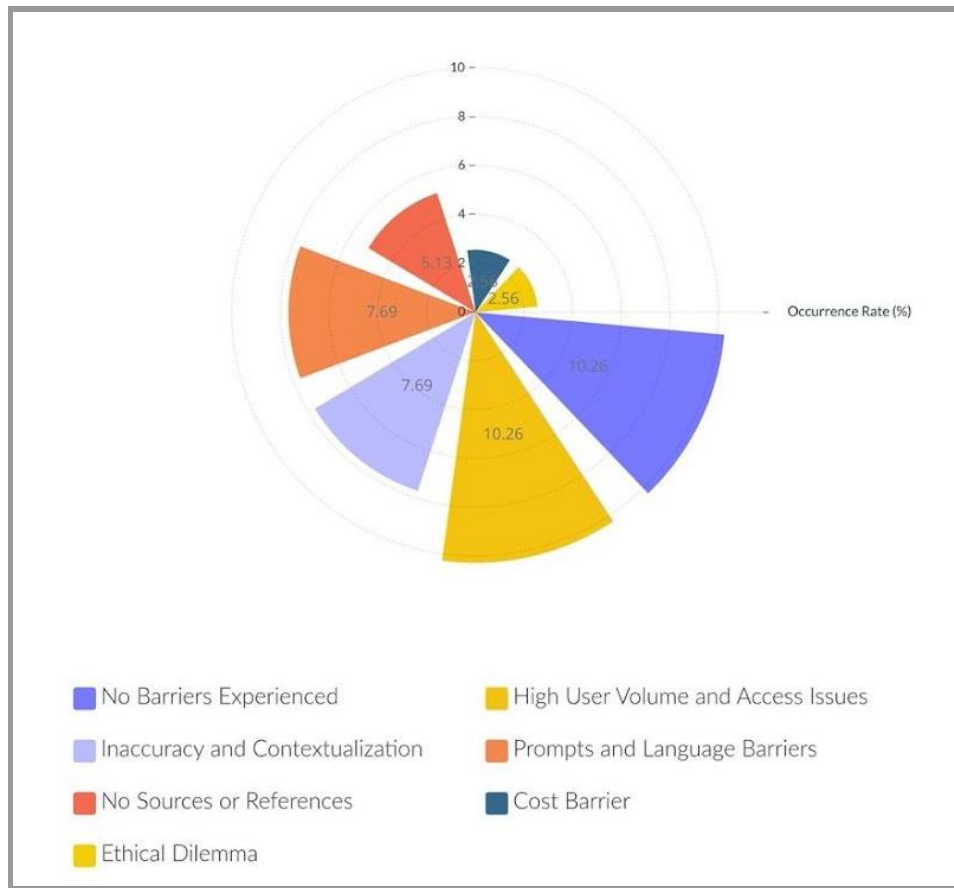


Figure 5: The barriers experienced when using ChatGPT

The dataset illuminated barriers to using ChatGPT (Figure 5). While many participants¹⁶ reported *no barriers experienced*, suggesting a generally positive user experience, several challenges were identified. These included *high user volume and access issues*,¹⁷ potentially resulting from the tool's popularity, and *inaccuracy and contextualisation* issues,¹⁸ indicating room for improvement in response accuracy and contextual relevance. Non-native English speakers pointed out *prompts and language barriers*,¹⁹ emphasising the need for language diversity support. *Cost barrier* was also mentioned as a concern.²⁰ Finally, the *ethical dilemma* of using AI tools was raised (P30), underlining the need to address ethical considerations. Users²¹ desired *sources or references* to validate information, although this is not a barrier.

¹⁶ Respondents P12, P15, P24 and P25.

¹⁷ Respondents P6, P8, P20 and P33.

¹⁸ Respondents P4, P9 and P29.

¹⁹ Respondents P4, P16 and P20.

²⁰ Respondents P24 and P7.

²¹ Respondents P32 and P41.

Results indicating the responsible use of ChatGPT

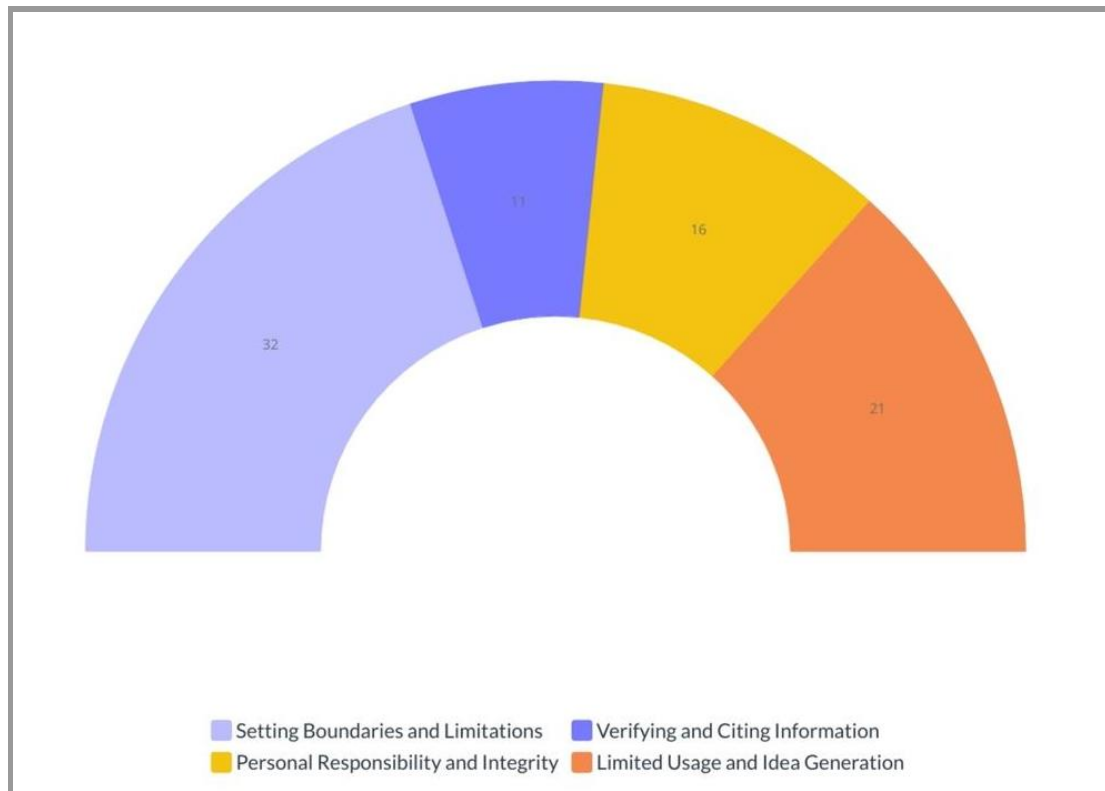


Figure 6: The responsible use of ChatGPT

Several themes emerged from participants' views on responsible ChatGPT use in research (Figure 6). The *setting boundaries and limitations* theme indicates ChatGPT should be used judiciously within defined boundaries, emphasising personal ownership of research.²² *Verifying and citing information* theme stresses critical evaluation and citation of ChatGPT-generated information.²³ The *personal responsibility and integrity* theme underscores upholding ethical standards and academic integrity²⁴ when using ChatGPT. Lastly, *limited usage and idea generation* reflects using ChatGPT for ideation and aiding thought formulation, but not for exhaustive research.²⁵ Overall, the participants' responses demonstrate a conscientious approach to the responsible use of ChatGPT in research.

²² Respondents P4 and P7.

²³ Respondents P8 and P20.

²⁴ Respondents P9 and P29.

²⁵ Respondents P15, P16, P41, and P43.

Results indicating opinions on how ChatGPT can be integrated into teaching and learning

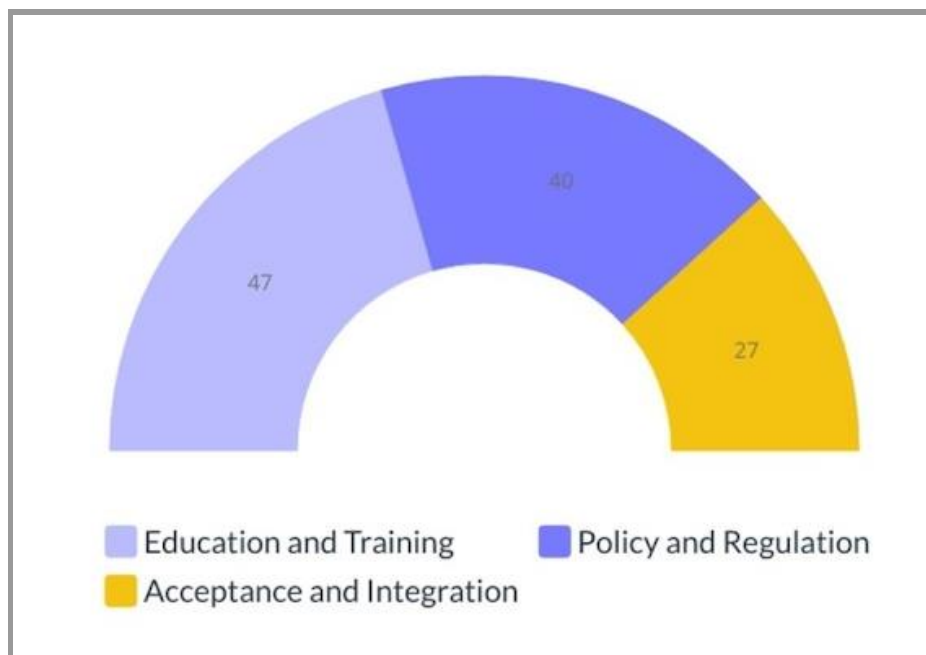


Figure 7: How to Integrate ChatGPT into teaching and learning

In response to how AI tools like ChatGPT might be incorporated into student learning and research (Figure 7), answers relating to *education and training* were most prevalent at 46.6%. Responses emphasised the need for guidance in ethical use of AI tools (P15) and effective question formulation (P33). Almost half (40%) of responses related to the theme *Policy and Regulation*, with participants²⁶ proposing clear AI usage guidelines and development of AI with ethical constraints (P16). The final theme, *acceptance and integration*, related to responses (26,6%) that highlighted the need to accept and integrate AI tools effectively into academia (P20). These themes reveal the complexities of integrating AI into education, requiring comprehensive education, policy creation, and AI tool acceptance.

Case study findings

This section examines the use of ChatGPT by a Design student researcher. The Design student in this case began using ChatGPT in the research process at an advantage²⁷ – having read many articles for several years. They wanted to find a “way in” to start their project. The student wanted to use ChatGPT to start writing a research project proposal (for a PHD by publication). The student researcher employed ChatGPT 3.5, following a systematic process for optimising the AI's contributions to their project. Table 2 delineates the steps that the student followed and presents the outcomes of their interaction with ChatGPT.

²⁶ Respondents P9 and P15.

²⁷ We acknowledge that this student may be considered better prepared than the average student embarking on postgraduate studies in South Africa. This is especially true, as the student has been reading on a subject for a while.

Table 2: A student journey with ChatGPT – Part 1 (authors 2023)

	Student feeling/ motivation	Student Action & Prompt	ChatGPT response
1	"All the info is in my head, and I am having trouble trying to shape that into a way forward"	Used a SELF AUTHORED Blog post to ask ChatGPT: <u>Prompt:</u> REWRITE this as a research problem statement	Wrote a research statement. Student: OK result but thin
2	"I needed more depth in the statement"	Used an important paper in the field. Copied the FINDINGS section to ask ChatGPT: <u>Prompt:</u> DISCUSS this research result	Wrote a discussion of the findings. Student: GOOD result - nice synthesis of the findings
3	"I wanted a better research topic"	Used the findings section (again) with original problem statement to ask ChatGPT: <u>Prompt:</u> SUGGEST research topics	Topic suggestions provided Student: POOR result
4	"I feel like ChatGPT didn't understand me"	Used the findings section (again) with original problem statement to ask ChatGPT: <u>Prompt:</u> SUGGEST TOPICS for further research	Further topics for research provided Student: GOOD result - many more applied options given
5	"I need some research objectives now"	Used the findings section (again) with original problem statement to ask ChatGPT: <u>Prompt:</u> WRITE research objectives for topic selected	Research objectives provided Student: GOOD result - but was missing the framework I needed. But I hadn't input any framework into the question.
6	"I like this framework, I'd like to include it in my study"	Used the favourite framework to ask ChatGPT: <u>Prompt:</u> How might the selected framework impact the study	Reasonable response to the question Student: GREAT result - gave some weight to the particular approach I'm interested in.
7	"I like Grounded Theory. Wondering how I could use it in my research"	Ask ChatGPT: <u>Prompt:</u> How could I APPLY Grounded Theory to my research	Research steps provided Student: POOR result - It was very generic and general. It gave research steps to data collection, etc. It did not use any application of the method, nor whether it would be a suitable theory.
8	"Decided to abandon the Grounded Theory track. I don't think it understands"	Ask ChatGPT: <u>Prompt:</u> What RESEARCH DESIGN would be suitable for my study?	Research steps provided Student: OK result - It was very generic and general.

Upon reflecting on the initial usage of ChatGPT, the student expressed that the research design result was more suited for an undergraduate or master's level task, as the depth and application of research provided by the AI fell short of the required standard for a doctoral proposal. This reflection instigated a discussion among the authors regarding the potential of ChatGPT to function as a supervisor.

Motivated by these conversations, the student embarked on a series of further interactions with the AI. Leveraging the more advanced version, ChatGPT 4, the student engaged in a role-play scenario to

test the AI's potential to offer specific methodological suggestions. Table 3 presents an account of the subsequent steps taken by the student.

Table 3: A student journey with ChatGPT – Part 2 (authors 2023)

	Student feeling/ motivation	Student Action & Prompt	ChatGPT response
1	"Maybe I should ask ChatGPT to be the supervisor?"	Ask ChatGPT: Prompt: ACT LIKE A PHD SUPERVISOR and suggest 5 research methodologies to match my research problem. GIVE AN OVERVIEW of each method and WHY it would be a good fit	Gives 5 research methods Student: GOOD result - all 5 options are reasonable suggestions
2	"I need a less generic selection of methods"	Rephrase the question and include some information on specific design research methodologies. Ask ChatGPT: Prompt: ACT LIKE A PHD SUPERVISOR and suggest 5 research methodologies to match my research problem. GIVE AN OVERVIEW of each method and WHY it would be a good fit	Gives 5 research methods Student: GOOD result - included more design specific suggestions Also a POOR result - This is not accurate – as it includes some research tools, not methods

The student commented that they would like to follow that process of ChatGPT prompt, with “the (real) supervisor sitting next to me”, as it would provide ample material that could be critiqued swiftly by the supervisor. The supervisor could also identify if the student was heading in the wrong research direction.

The main reflections of the Student researcher were:

- *Speed*: ChatGPT is a useful way to sift your ideas fast
- *Logic*: ChatGPT is a useful tool to put my thoughts into a logical format – and out of my head. By acting as a sounding board/interlocutor and allowing for role playing, ChatGPT enables me to sort my ideas. It can suggest other ideas for research directions
- *Building confidence*: ChatGPT is a useful tool to make my thoughts into a presentable format – before I need to present or discuss them with others. I feel more prepared to answer questions – I am bad at asking questions of the supervisor. This suits my avoidance behaviour and helps me with my language (second language English).

Discussion

Our research contributes in significant ways to the expanding knowledge surrounding the application and impact of AI tools in academic settings, specifically within postgraduate contexts. The results take on greater importance when observed through the lens of the South African landscape, providing insights into how such AI tools might be instrumental in fostering a more robust postgraduate culture both locally and globally.

Our findings underscore the transformative potential of AI tools like ChatGPT in reshaping the pedagogical landscape at a postgraduate level. The data suggest their utility in facilitating research tasks such as summarising, paraphrasing, and reviewing literature, reflecting broader international

dialogues on the role of AI in enhancing academic efficiency and productivity (Lund & Wang 2023; Alshater 2022).

This brings to light the pressing need for innovative pedagogical approaches that incorporate these emerging technologies. The discourse around adapting pedagogy and educational praxis to AI-driven shifts (Baidoo-Anu & Owusu Ansah 2023; Kasneci et al. 2023) finds a clear echo in our study. Here, it is about cultivating a learning environment where AI tools are used effectively to streamline the research process while ensuring a critical understanding of these tools – their functions, their use, and their limitations.

An intriguing finding from our research is that ChatGPT seems able to generate ideas and kickstart the research process with suggestions. This observation challenges the simplicity of the concern that as ChatGPT does not do well in creativity and critical thinking (Mhlanga 2023), the result of using it would always result in generic outcomes. We suggest, like Halaweh (2023) and Kasneci et al. (2023), that if combined with best practices from human authors, AI tools might stimulate a more dynamic and creative approach to research, enriching the postgraduate learning experience.

Simultaneously, our study sheds light on the challenges and limitations associated with the use of AI tools like ChatGPT, including issues regarding accuracy, potential over-reliance, and concerns related to creativity and originality. This highlights the importance of developing a pedagogical framework that promotes the responsible and critical use of AI tools, resonating with broader calls for ethical AI practices (Kooli 2023; Mhlanga 2023).

Our study also brings to the fore certain barriers to effective AI tool use, such as access issues and language barriers. These challenges are especially relevant in the South African context and provide important insights that can guide improvements in AI tool design and inclusivity. This could help enhance accessibility and usability for a diverse range of student populations.

Mapesela, referenced in Akala (2021, p. 2), reiterates that despite its pivotal role in postgraduate research, doctoral supervision is relatively poorly understood. Heath and Yousefi, Bazrafkan and Yamani (in Akala 2021) provide some of the roles the supervisor is expected to play. These include “numerous formal and informal competencies”, that become needed in relation to the students’ capabilities (Koen & Bester, in Akala 2021). Many of these qualities are also required in the supervision role of postgraduate and master's level students. A single supervisor may have heavy demands on them because of this variety of roles. However, the entire scope and weight of supervision responsibilities can be lessened by considering other role players (Bitzer & Albertyn 2011, p. 882). Table 4 indicates human supervision roles and suggests which of these roles could likely be fulfilled by ChatGPT.

Table 4: The potential of ChatGPT as a digital supervisor (built from Akala 2021)

	Human Supervisor roles	Potential of ChatGPT – as a Digital supervisor
1	Provide time	No
2	Provide research expertise	Can provide limited expertise.
3	Support to foster research skills	Can provide research tools, but with limited application/s
4	Support to foster professional attitudes	Unlikely, re ethical concerns
5	Mentoring in the research process	Unlikely
6	Create a professional relationship	Unlikely
7	Selection of research topic	Yes
8	Preliminary design research	Yes
9	Assist students with personal problems	No
10	Assist with Students' academic language and presentation	Yes

The summary in Table 4 suggests that ChatGPT and similar AI tools could potentially drive the nurturing of a stronger postgraduate culture in South Africa. By boosting efficiency, kickstarting the writing process, and aiding the research process, these tools might help to create a more engaging and supportive postgraduate environment. Within the South African setting, their capacity to provide targeted support for second language learners might open up avenues for greater academic inclusivity and success. However, these tools are not substitutes for the crucial role of human supervisors, and their effective usage hinges on students' understanding of AI operational aspects and ethics. As AI continues to evolve and permeate academia, a balanced, thoughtful integration with current pedagogical practices, emphasising a collaborative approach between AI tools and human actors, will be essential in leveraging the benefits of AI in fostering a thriving, inclusive, and innovative postgraduate culture.

Conclusion

While our study provides significant insights into the current use of AI tools in postgraduate education, it also lays the groundwork for potential future investigations. Several areas emerge as relevant avenues for further exploration, providing a more nuanced understanding of AI's place in academia.

The design of a comprehensive pedagogical strategy tailored towards integrating AI tools into the postgraduate curriculum is clearly crucial. Further studies could delve into the specifics of this

framework, outlining how AI could be balanced with more traditional methods, thereby nurturing students' critical thinking skills while encouraging ethical AI use.

Our study also underlines limitations in current AI tools, such as accuracy and concerns over originality and copyright. These pose fascinating questions for subsequent research: How might these issues be resolved to bolster AI's academic utility? An especially pertinent question for the field of design is whether there is a need to cultivate our own Design AIs, to cater specifically to the needs of postgraduate design students. Given the comparative youth of the design field, the volume of published design articles is somewhat constrained – particularly when contrasted with older, more developed academic domains (Bayazit 2004, p. 28). How do we guarantee the authenticity of data sources utilised by AI in aiding design postgraduates? Furthermore, how can we establish guidelines that diminish over-dependency on AI, encouraging greater independent thought and creativity in students?

One aspect of our findings is the barrier to access and language limitations, particularly relevant to the South African context. Future research must address these challenges, investigating how AI tools could be more inclusive and multilingual, ensuring equitable access across diverse student populations.

Lastly, our research prompts us to consider AI's impact beyond direct academic applications. It would be beneficial for future work to delve into AI's role in enhancing other aspects of postgraduate education. Although it can currently act as a sounding board or interlocutor (Jeon & Lee 2023), roles such as mentorship, collaboration, and supervision need further development.

While this was a mere introduction to the use of AI in design research, we conclude that *the digital supervisor has not yet arrived* – as the relationship building and support offered by the human supervisor have not yet been developed (in an equitable way). In addition, students would need specific preparation to maximise their efficient and ethical use of LLMs. There is the added concern that students may reject the human supervisor – as a result of the perceived challenge of managing a real-world relationship. Ultimately, this study illuminates a pathway towards further research, aiming to expand our understanding of the most effective and ethical ways to incorporate AI tools into postgraduate education. The implications extend beyond South Africa, potentially enhancing the global academic landscape and fostering a more vibrant postgraduate culture.

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