Conceptualising using prompt engineering with ChatGPT in engaging with higher education students

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Abstract

Artificial intelligence (AI) tools like ChatGPT are being rapidly adopted in educational institutions to improve learning and teaching outcomes. However, educators may use ChatGPT to facilitate teaching without examining how prompts influence critical thinking, analytical skills, and students' engagement. Despite the growing popularity and adoption efforts, many institutions struggle to achieve this aim. This could be attributed to a lack of understanding of applying prompt engineering (PE) using ChatGPT to enhance teaching and improve learning outcomes. This study seeks to understand the influencing factors by employing qualitative methods. Existing materials were gathered, and two, critical posthumanism (CP) and new materialism (NM), theoretical frameworks were applied to guide the analysis of the materials. The analysis revealed four critical influencing factors: rules of engagement, use of language, contextualisation, and intentionality. The four factors were interpreted to better understand how they manifested to influence the use of PE with ChatGPT. From the interpretation, the factors' attributes were revealed. The impact of the factors and their attributes is highlighted, which has implications for both learners and educators.

Keywords: prompt engineering, ChatGPT, critical posthumanism, and new materialism

Introduction

Artificial intelligence (AI) technologies like ChatGPT are increasingly being integrated into hybrid (online and face-to-face) learning environments (Hoofman & Secord, 2021). The use of ChatGPT is intended to enhance teaching and learning. However, there are some demerits (Haleem et al., 2022). PE has emerged as a critical skill (Lester et al., 2021). The ability to design, communicate, and refine instructions or inputs in a way that prompts generative AI to produce responses that are more accurate, contextually appropriate, and of higher quality (Lund, 2023; Park & Choo, 2024). PE is crucial for optimising interactions with AI tools. This can shape learners' engagement and influence the quality of education and learning outcomes (Bozkurt & Sharma, 2023; Walter, 2024).

ChatGPT has fuelled fears about how easily students generate assessments, which raises significant concerns about originality and dishonesty (Eager & Brunton, 2023). AI detection tools are not perfect either and have produced false positives (Chechitelli, 2023). This impacts the integrity of academic excellence. The lack of AI literacy further influences existing inequalities in the South African education system, where the digital divide continues to be a fundamental barrier (Ohei et al., 2023; Khoalenyane & Ajani, 2024).

ChatGPT has also produced misleading or "hallucinated" information, which has serious implications if students accept AI responses without verifying their validity (Chelli et al., 2024).

PE is fast becoming a valuable skill in educational and professional domains (Lester et al., 2021). PE allows users to create iterative interactions that develop deeper inquiry to produce more precise and contextually appropriate responses (Spasić & Janković, 2023). Research by Lee et al. (2021) demonstrated that the more students interacted with AI, the better their understanding of its mechanics was. However, using PE with ChatGPT presents several challenges, which include ambiguity, inconsistency, a lack of clarity, and balancing creativity and relevance (Garg & Rajendran, 2024; Leon, 2025).

Additionally, there is an inherent complexity associated with creating effective prompts, but it still requires refinement to provide desired and relevant outcomes (Giray, 2023). This is compounded by users' interpretations of prompts based on their level of AI literacy (Knoth et al., 2024). Not understanding the capabilities and limitations of AI can further obstruct the users' ability to create effective prompts (Giray, 2023; Lund, 2023). Cognitive overload can also be a barrier when balancing multiple technologies. This is where educators can develop more inclusive, equitable, and effective pedagogies that leverage the potential of AI-powered tools (Fox & Powell, 2023; Walter, 2024) within the context of PE (Bower et al., 2024).

This study aimed to explore how PE can enhance teaching and learning. By identifying the critical factors that influence its effectiveness in educational settings, PE can be used as a pedagogical practice. This includes interpreting the key influencing factors and their attributes to gain a deeper understanding of how learners engage with educational material. This paper is structured into six main sections. In the first and second sections, the paper is introduced, and a review of the literature is presented, respectively. The methodology applied in the study is covered in the third section, followed by the theoretical framework guiding the study. In the fifth section, the conceptualisation of using PE with ChatGPT, including the impact, is presented. From both learners' and educators' perspectives, the implications of the study are highlighted. Finally, a conclusion is drawn.

Literature Review

ChatGPT in Higher Education

ChatGPT is an advanced large language model that utilises deep machine learning to generate human-like text-based responses based on user prompts (How ChatGPT and Our Foundation Models Are Developed, n.d.). Benefits range from instant feedback to personalised academic coaching sessions (Cronjé, 2023). According to Fauzi et al. (2023), ChatGPT enhances learning and engagement by "providing useful information and resources, helping to improve language skills, facilitating collaboration, increasing time efficiency and effectiveness, and providing support and motivation". ChatGPT can help students grasp complex concepts and brainstorm ideas (Rahman & Watanobe, 2023). Positive student satisfaction with ChatGPT's responsiveness was reported in studies by Ngo et al. (2024) and Yu et al. (2024).

In the literature, researchers such as Victor (2024) and Sok and Heng (2024) discuss the overuse of ChatGPT, its impact on academic dishonesty, and the negative effect it poses to developing critical thinking, analytical reasoning, and verification skills. There is increasing pressure on educators to identify and detect AI-based plagiarism and maintain academic integrity (BaiDoo-Anu & Owusu Ansah, 2023; Hao et al., 2024). Cronjé (2024) contends that it is essential for "learning tasks to be developed in such a way that learners should use the AI as an intelligent assistant".

Prompt Engineering in Higher Education

PE involves crafting questions, tasks, and scenarios to engage with ChatGPT. Lund (2023) suggests that prompts can be optimised by refining iteratively to generate more relevant and accurate responses. Bozkurt and Sharma (2023) and Mollick and Mollick (2024) highlight the role of using ChatGPT in developing interactive teaching and tutoring activities. Beyond education, AI is used in healthcare and law to teach medical concepts, simulate patient interactions (Motlagh et al., 2023), draft letters, analyse case law (Dai et al., 2023), and assist with administrative activities.

Effective prompt design enhances student engagement and comprehension by giving students room to explore the world through questions (Tsui, 2002). Educators can facilitate the effectiveness of AI use to foster student engagement, logical reasoning, problem-solving, and critical thinking skills (Park & Choo, 2024). White et al. (2023) suggest frameworks for PE to serve as catalysts to encourage students to analyse, evaluate, and synthesise information. Many educators remain sceptical of the use of AI in HEIs (Aljanabi et al., 2023). Lemeš (2024) aptly captures the growing need for research, training and the development of guidelines for higher education: "As AI models become more sophisticated, the role of PE is increasingly important in leveraging their full potential".

Critical Thinking in Higher Education

In Facione (2000), critical thinking (CT) is described as the "consistent internal motivation to engage problems and make decisions". CT enables students to logically interrogate intricate issues, deliberate with diligence, and add articulate arguments (Behar-Horenstein & Niu, 2011). Di Battista et al. (2023) suggest that CT is essential to an increasingly elaborate and interconnected technological landscape. PE can serve as a vehicle to drive CT skill development and increase students' participation (Grecu, 2023). Spasić and Janković (2023) suggest that strategic prompting can encourage students to analyse information and evaluate arguments. Chain-of-thought prompting can develop inquiry and reflection skills in research analysis and debate preparation (Tsui, 2002; Aljanabi et al., 2023).

Existing research has extensively explored the advantages and disadvantages of integrating tools like ChatGPT into educational settings at length. However, few have analysed how PE practices influence the development of critical thinking and problem solving skills, and their effect on learning outcomes. Furthermore, there is limited exploration using the theoretical framework used in this study. By conceptualising these critical impact factors, this study offers a deeper understanding of the implications of using PE in higher education.

Theoretical Framework

Critical posthumanism (CP) and new materialism (NM) were combined to create a theoretical framework for the study: the complementarity of the two theories in practice is demonstrated in Figure 1. The combination of CP and NM makes a good fit for the study, primarily because both philosophies are interrelated and focus on agency, relationality, and ethical awareness (Braidotti, 2019, 2020).

The agency possesses the power to act purposely and reflectively, in interrelationships with others (Holland, 2001). From a critical humanism perspective, it is important to understand the relationship between human agency and the role of technology in an environmental context (Herbrechter et al., 2022). It is significant to consider human agency, including language and self-consciousness, in the advancement of technology (Kipnis, 2015). Burriss and Leander (2024) viewed agency as bound up in human–AI assemblages, where humans and non-humans accomplish things as interconnected. Thinking with these theories allows us to pose research, CP and NM questions about PE interconnections with AI: How do

prompts, using ChatGPT, influence students' critical thinking in engagements? What are the factors influencing how prompts are used with ChatGPT, in students' engagements?
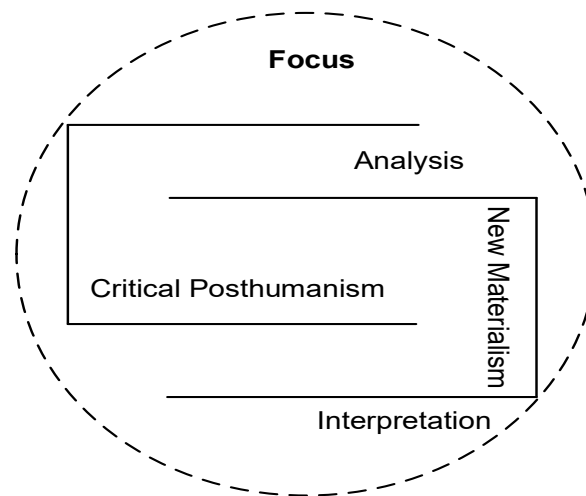

Figure 1. Underpinning Theories

CP and NM offer profound perspectives for progressing pedagogical practices that invigorate AI-education debate. This is particularly important from this study, as we seek to examine and gain a better understanding of using prompts with ChatGPT. CP upends human-centric paradigms by underlining the inextricable relations between human and nonhuman entities (e.g. technology, animals, and the environment) (Schneider, 2015). Advocating that agency extends beyond anthropocentric restraints, CP recommends the reassessment of knowledge development and dissemination (Schneider, 2015; Braidotti, 2019, 2020). NM emphasises the significance of materiality on human experiences and knowledge production (Toffoletti, 2015). This lens reevaluates dualisms, like mind/body and nature/culture, emphasising that both contexts directly influence meaning-making (Barad, 2003; Toffoletti, 2015). Using PE educators can guide students in creating prompts that encourage the contemplation of the ethical and material aspects of their learning experiences to promote critical engagement (Cozza & Gherardi, 2023).

Research Methodology

This research employs qualitative methods to investigate how PE influences students' engagement and critical thinking in teaching and learning settings. According to Iyamu (2018), qualitative methods are best-suited to gaining an understanding of individual and group interactions and experiences in a meaningful manner, especially in information systems (IS) studies. Additionally, qualitative approaches are flexible and particularly useful in understanding cause and their effects in situations, including the multifaceted complexities of student engagement (Bond et al., 2020). Qualitative methods help to explore the nuances of lived experiences in various settings (Fasse & Kolodner, 2000), which is essential in this study.

Qualitative data were collected using document analysis, based on the research objectives (Iyamu, 2018). The focus was to understand how students formulate prompts, the contextual factors that influence their development, and the diverse ways students engage with ChatGPT. The document analysis technique was used to gather data related to the phenomenon being studied. A total of 35 documents were collected. Twenty-nine were journal articles covering ChatGPT and PE, and six were collected conference proceedings. A sample of the documents is shown in Table 1. The documents (peer-reviewed articles) in the Journal and Conference proceedings focus on conversations between students and ChatGPT using

prompts. The articles were gathered from credible academic databases such as EBSCO Host, IEEE and AIS. As an emerging topic, literature addressing this area is limited; however, the documents were purposively selected for their focus on the use of ChatGPT and/or PE in educational settings.

Table 1. Data Collection

Focus	Journal	Conference Proceedings
ChatGPT for teaching and learning	Bower et al. (2024). How should we change teaching and assessment in response to increasingly powerful generative Artificial Intelligence? Outcomes of the ChatGPT teacher survey. Education and Information Technologies, 29, 15403–15439.	Dai, Y., Liu, A., & Lim, C. P. (2023). Reconceptualizing ChatGPT and generative AI as a student-driven innovation in higher education. In A. Liu & S Kara (Eds.), Proceedings of the 33rd CIRP Design Conference, Procedia CIRP, 119, 84–90.
	Cronjé, J. C. (2023). Exploring the Role of ChatGPT as a Peer Coach for Developing Research Proposals: Feedback Quality, Prompts, and Student Reflection. *The Electronic Journal of E-Learning, 22(2), 1–15.*	Spasić, A. J., & Janković, D. S. (2023). Using ChatGPT standard prompt engineering techniques in lesson preparation: Role, instructions and seed-word prompts. 58th *International Scientific Conference on Information, Communication and Energy Systems and Technologies (ICEST)*, IEEE, 47–50.
	Fauzi et al. (2023). Analysing the Role of ChatGPT in Improving Student Productivity in Higher Education. *Journal on Education, 5(4),* 14886–14891.	
Prompt Engineering for engagement	Aljanabi, M., Yaseen, M. G., Ali, A. H., & Mohammed, M. A. (2023). Prompt Engineering: Guiding the Way to Effective Large Language Models. *Iraqi Journal for Computer Science and Mathematics, 4(4), 151–155*	Garg, A., & Rajendran, R. (2024). The Impact of Structured Prompt-Driven Generative AI on Learning Data Analysis in Engineering Students: *Proceedings of the 16th International Conference on Computer Supported Education*, CSEDU 2, 270–277.
	Bozkurt, A., & Sharma, R. C. (2023). Generative AI and prompt engineering: The art of whispering to let the genie out of the algorithmic world. Asian Journal of Distance Education, 18(2), 1–6.	Lester, B., Al-Rfou, R., & Constant, N. (2021). The Power of Scale for Parameter-Efficient Prompt Tuning. Proceedings of the 2021 Conference on Empirical Methods in Natural Language Processing, 3045–3059.
	Garg, A., Soodhani, K. N., & Rajendran, R. (2025). Enhancing data analysis and programming skills through structured prompt training: The impact of generative AI in engineering education. Computers and Education: *Artificial Intelligence, 8, 1–11*.	Lemeš, S. (2024). Prompt Engineering. Proceedings of the 3rd International Scientific Conference: Artificial Intelligence in Industry 4.0: The Future That Comes True, 22, 159–170.

Thematic Analysis (TA) was used for the analysis of the data. The data analysis was guided using two theories, critical posthumanism (CP) and new materialism (NM). The theories are discussed in section 4. These theories (NM and CP) primarily focus on relational, human, and non-human aspects of learning making. This allows focus on patterns in participants' experiences, while AI-student chats provide validation of how students use PE in ChatGPT. This helps demonstrate how agency is distributed across animate and inanimate actors. Primarily, the analysis of the data focuses on:

i. The engagement between the actors evolved. This includes responses using AI.
ii. Track shifts in interactive engagement and critical thinking.

Additionally, this enables analysis of prior experiences with AI in formal and informal settings. Also, it paves the way for analysis of how students adapt to AI-responses and familiarity influence interactions. Documents were analysed based on whether themes like PE, student engagement, critical thinking, and AI- or ChatGPT-assisted learning were present. Guided by CP and NM and based on our interpretation, the following patterns emerged: rules of engagement, language, contextualisation, and intentionality. Each of these conceptual categories was expanded to host relevant attributes as demonstrated in Table 2.

Conceptualising Using Prompt Engineering with ChatGPT

This section presents a conceptualisation of using PE with ChatGPT in engaging with higher education students. From the analysis, we found four critical factors: rules of engagement, use of language, contextualisation, and intentionality. Based on our subjective interpretation, the factors manifest into various attributes, as shown in Table 2. In the third column of Table 2, the implications of attributes are explained. Thus, the table can be used as a set of criteria for setting direction and evaluation of prompt engagement with students in higher education.

Table 1. Conceptualising Using PE with ChatGPT

Factor	Attribute	Description
Rules of Engagement	*Ethics*	Institutions are guided by ethics, and the use of AI for prompts is influenced by various factors such as the complexity of the algorithms. AI may not fully understand the nuances of human interaction and communication, including environmental ethics. Hence, rules of engagement are critical.
	Mitigation	The rules of engagement should be enacted using a fact-checking mechanism. This is essential in PE to enable users to adjust their prompts. Thus, critical thinking is essential to mitigate risks and reputational damages.
	Structure	The bundle of information and thoughts hosted by a user must be structured to align with the environmental rules of engagement. This guides the prompting engagement using ChatGPT. Implicitly, the rules improve the quality and relevance of engagement.
Language	*Complex Tasks*	Despite the existence of language models (LMs) and large language models (LLMs) (Aljanabi et al., 2023), the use of language in PE is increasingly complex. It is therefore important to inquire and gain a deeper understanding of the capabilities, including the limitations of LMs and LLMs, to improve the efficient and effective use of language in PE with ChatGPT.
	Ambiguity	ChatGPT may misinterpret prompts due to inherent language ambiguities, leading to oblivious or unexpected responses. Consequently, critical thinking is required to ensure clarity and specificity in the language using prompts with ChatGPT.
Contextualisation	*Creativity and Relevance*	Due to the structured nature of the algorithms, contextualisation is important to reduce or eradicate errors when using PE with ChatGPT. This includes avoiding using a generalised tone, rather than a specific purpose. Otherwise, it becomes difficult to balance creativity and relevance.
	Inexplicit	Implicit prompts lead to unclear or irrelevant responses. This necessitates critical thinking because ChatGPT struggles with ambiguous prompts, resulting in unexpected or off-target outputs and responses.
Intentionality	*Consistent Outputs*	A user's intent must be understood before generating responses to ensure an appropriate and consistent flow of outputs. This makes inquiry significant. It enables analytical thinking, which addresses potential biases that could have occurred.
	Predictability Determinism	ChatGPT responses are not always deterministic because they can be influenced by the prompt time. Therefore, intentionality remains a critical factor in employing the tool. Also, predictability is important because ChatGPT does not always fully understand the nuances of human intentionality, which can be based on timing.

As shown in Table 2, through the attributes, the factors have an impact on how PE is used with ChatGPT. Thus, the factors can be used to guide how PE is used with ChatGPT, to facilitate interactive engagement,

specifically with students in higher education. Primarily, this is because the factors can potentially impact the interactive engagement from perspectives such as critical thinking, prompt timing, engagement, and inquiry.

The Impact Factors

Impact Factors (IFs) are a set of fundamental indicators created to evaluate the impact of objects (PE) on subjects (AI-assisted teaching and learning) (Mzwri & Turcsányi-Szabo, 2025). These indicators reflect measurable outcomes, like engagement, and the experiences shaped by the entanglement of humans, non-humans, and learning contexts (Turkkila et al., 2022). The impacts which the factors have on engagement using PE with ChatGPT include critical thinking, prompt time, engagement and inquiry, as presented in Table 3.

Table 2. The Impact Factors

Impact Factor	Description
Critical Thinking	The depth of critical thinking that can be achieved when using PE (Walter, 2024) with ChatGPT is influenced by factors such as rules of creativity, complexity, and predictability. By employing a Socratic method approach in prompting, the practice can encourage users (students and educators) to refine their prompts, evaluate AI's responses and iterate feedback (Chukhlomin, 2024). This active learning process can foster a deeper analysis of the content, encouraging users to be more intentional and analytical when engaging with their coursework (Doyle et al., 2025).
Prompt Time	Response time influences the development of prompts. It is used to indicate the significance of timing (time spent crafting, iterating and responding) when applying the PE concept (Garg et al., 2025). Prompt timing is not only about speed. It relates to the intentionality and contextualisation, which are essential components of meaningful engagement and practice of critical thinking (Rathod & Kale, 2024).
Engagement	Engagement reveals the capability of users in their use of ChatGPT for interaction purposes (Leung, 2024). Through intentionally structured prompts, users can develop an interest in engagement through AI responses (Leon, 2025). This boosts motivation and willingness to explore topics in a deeper sense of things. Also, it can assist with sustained attention, resulting in a more structured, relevant, and fruitful engagement in teaching and learning processes.
Inquiry	Inquiry promotes how PE and ChatGPT influence users' engagements (Mzwri & Turcsányi-Szabo, 2025) in controlled environments such as institutions of higher learning. An inquiry-based approach is key to developing a culture of interaction, mitigation, investigation and critical evaluation of implicit and ambiguous responses. This practice enables users to ask multi-layered and meaningful questions and explore alternative perspectives (Dai et al., 2023).

Implications of the Study

The study highlights three implications, which include IT personnel, Educators, and Learners.

IT personnel – the study reveals that PE is more than a technical skill. It is a pedagogical and cognitive strategy that can be used to influence student engagement, critical thinking. Also, it reaffirmed that PE bridges human intent and AI output, including the significance of how users interact with AI (Jakkula, 2024). Beyond interface and user experience, the limitations of AI tools require the implementation of guardrails, or complementary human oversight in education-based, AI-driven tools (Shanuka et al., 2024).

Educators – Interaction between learners and educators is beyond traditional engagement. This includes the use of PE and ChatGPT, to facilitate interaction and engagement. Thus, educators need to be more innovative by learning how the apply PE and ChatGPT to enhance teaching and improve the quality of content. Another implication for educators is educating the learners on how to apply AI tools for learning purposes, to ensure ethical considerations.

Learners – Instead of using AI as a quick fix to find answers, learners need to reframe how they view ChatGPT and significantly reevaluate how they apply it. Through purposeful prompting, learners can take ownership of their learning to pursue knowledge independently and clarify misunderstandings on demand (Bozkurt & Sharma, 2023). Without proper guidance, learners may continue to misuse ChatGPT by over-relying on it for surface-level questions and answers or fail to interrogate the validity of its responses. The continued mishandling of AI tools can lead to diminished cognitive development, ultimately affecting graduate employability (Hasanein & Sobaih, 2023).

Conclusion

The research helps us to gain a better understanding of the factors that influence PE with ChatGPT, for academic engagement purposes. The influencing factors and their attributes are revealed. This guides both learners and educators in their engagement using PE with ChatGPT, to pose and answer questions. While providing insight into these very important aspects of learning, it also assists in developing strategies for educators to use in their lesson development to enhance pedagogical methodologies.

This research contributes to the larger dialogue on how AI tools like ChatGPT, educators, institutions and policies are co-creating new educational paradigms. The study has the potential to advance the use of CP and NM in educational technology research, as they do not seem to have been used in studies relating to PE and ChatGPT. The complementarity of the two underpinning theories can assist when mapping how students co-think with AI in learning contexts and how this entanglement shapes interactions, enhances or constrains critical thinking, comprehension and engagement. This study contributes a posthumanist understanding of PE to examine the distribution of agency, ethical, and contextual dynamics of AI use in education. Practically, this study uncovers the myriad ways that ChatGPT and other AI tools can be integrated into learning and teaching activities. The findings can influence policies on how to use AI to enhance educational excellence in academic spaces. Future studies could address how policy changes are executed, specifically in developing assessment practices involving PE. Moreover, research into how PE can be applied or the development of a framework on using PE pedagogical practice is needed to ensure the meaningful integration in educational spaces.

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