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Generative AI and Prompt Engineering: The Art of Whispering to Let the Genie Out of the Algorithmic World

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Abstract: The capabilities of generative AI in education, serving as a co-creator, highlight the crucial role of prompt engineering for optimal interactions between human**a**n**i**ty and Large Language Models (LLMs) that utilize Natural Language Processing (NLP). Generative AI's potential lies in responding to well-crafted prompts, making them essential for unleashing its capabilities in generating authentic content. To optimize this process, prompt engineers, encompassing various stakeholders in education, must grasp how language nuances impact generative AI's responses. By approaching a conversational generative AI strategically, with clear purpose, tone, role, and context, a prompt-based conversational pedagogy can be established, enabling communication and interaction that facilitate teaching and learning effectively. Such approaches are crucial for harnessing generative AI's power while ensuring meaningful and contextually relevant interactions.

Keywords: prompt engineering, prompt design for AI, co-creation with AI, generative artificial intelligence, AI in education (AIEd).

Highlights

What is already known about this topic:

- Generative AI's emergence in large language models has vast implications, as it closely mimics human language and comprehension.
- Prompt engineering is optimizing AI language model's responses by formulating effective and specific inputs.
- AI language model's efficacy depends on algorithms, training data, and prompt quality.

What this paper contributes:

- This paper posits that co-creation involving generative AI presents a potent approach in the field of education, underscoring the significance of human-machine interaction facilitated by carefully crafted prompts.
- This paper emphasizes the importance of educators developing prompt engineering skills to harness the full potential of generative AI in educational contexts effectively.

Implications for theory, practice and/or policy:

- Prompt engineers should understand how language nuances impact generative AI's capabilities, enabling authentic and well-tailored content generation for effective teaching and learning interactions.
- Approaching generative AI strategically, with clear purpose, tone, role, and context, fosters a prompt-based conversational pedagogy.

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Introduction: Another Day in the AI Paradise

And nowadays, the idea of AI is not really science fiction anymore - it's just science fact.
– Lisa Joy

The emergence of generative AI signifies a critical advancement in large language models (LLMs) within the domain of natural language processing (NLP), carrying extensive implications across various facets of our lives, including education. Generative AI possesses the remarkable ability to produce text that closely resembles human language, while also comprehending natural language input in a manner akin to human understanding. This technology has been specifically designed to excel in NLP applications such as chatbots, virtual assistants, language translation, and content generation. With the potential to attain mastery over human language, a technology renowned for its complexity and sophistication, generative AI holds the promise of uncovering patterns that might elude human perception (Bozkurt, 2023a). Nonetheless, to fully harness the capabilities and unleash the potential of generative AI within the educational landscape, the acquisition of prompt engineering as an essential competency by educators has become imperative.

Reflections from the Related Literature

Success in creating AI would be the biggest event in human history. Unfortunately, it might also be the last, unless we learn how to avoid the risks.
– Stephen Hawking

The efficacy of AI language models is influenced not only by their underlying algorithms and training data but also by the quality of the prompts they receive (Liu et al., 2023a; Lo, 2023; White et al., 2023). By strategically harnessing generative AI's capabilities through meticulous prompt engineering, users can enhance its potential to refine the valuation process and obtain precise, contextually relevant information (Cheung, 2023). In certain cases, users can even extract outputs from the generative AI model that it is restricted or prohibited from generating, through a process known as jailbreaking (Liu et al., 2023b) or reverse engineering. A well-designed prompt can elicit meaningful and informative responses, while a poorly constructed prompt may lead to irrelevant or nonsensical outputs (Lo, 2023).

The benefits and challenges of employing generative AI in education have been extensively discussed in the related literature (Baidoo-Anu & Owusu Ansah, 2023; Bozkurt et al., 2023; Chan & Hu, 2023; Hsu & Ching, 2023; Lodge et al., 2023; Sharples, 2023; Tlili et al., 2023; Yu et al., 2023). Generative AI can serve as an effective co-creation technology and facilitate the creation of learning content (Bozkurt, 2023b). However, communication and interaction between humans and generative AI revolve around engaging in critical conversations between these entities, highlighting the significance of crafting appropriate prompts which require us to understand prompt engineering.

Prompting: Tell Me Your Wishes and I Will Make Them True

"You are my master! Was that your first wish? Three wishes are yours to command."
– from Aladdin and the Magic Lamp

Metaphorically, if generative AI is Aladdin's magic lamp, your wishes are your prompts that you will engineer. To get the genie out of the magic lamp, you need to use skillfully crafted prompts. From this perspective, prompt engineering refers to the process of designing, crafting, and refining contextually appropriate inputs or questions in order to elicit specific types of responses or behaviors from an AI language model. The goal of prompt engineering is to optimize how the model responds based on the structure, content, and tone of the question, thereby facilitating more accurate, useful, or engaging interactions. In the context of AI language models, prompt engineering involves formulating effective

prompts that yield desired responses, ensuring clarity, relevance, and specificity. To write good prompts, one can consider the following strategies:

- Define the objective: Clearly articulate the purpose of the prompt. What kind of response or information are you seeking? Identify the specific learning outcome or desired interaction.
- Understand the model's capabilities: Familiarize yourself with the AI language model's strengths, limitations, and the types of queries it performs well on. This knowledge will help you craft prompts that align with the model's expertise. In some cases, you can jailbreak the AI language model by giving it specific roles.
- Be clear, to the point, and concise: Write prompts that are straightforward and unambiguous. Avoid unnecessary complexity or vagueness, as it may lead to confusing or irrelevant responses.
- Provide context: Set the scene or context for the prompt, enabling the AI model to understand the task or subject matter better. Contextual cues can guide the model's response and ensure it stays on topic.
- Provide examples: If you can, provide examples of the kind of output you want the language model to generate. This will help the language model understand what you are looking for.
- Fine tune, optimize and debug prompts: Refine prompts iteratively to elicit more accurate, relevant, and contextually appropriate responses from the model. When prompts are not yielding the desired results or producing inaccurate or irrelevant responses, debugging prompts becomes necessary to diagnose and resolve these issues
- Specify the format: If you require a particular format or structure in the response, clearly indicate it in the prompt. For instance, if you want a step-by-step answer or a pros-and-cons analysis, include instructions accordingly.
- Include key details: If there are specific elements or variables that should be considered in the response, mention them explicitly. This helps guide the model's attention and ensures it incorporates relevant information.
- Test and iterate: Experiment with different variations of prompts and evaluate the model's responses. Adjust and refine the prompts based on the desired outcomes and the quality of the generated responses.
- Consider safety and ethics: Ensure that prompts avoid generating biased or harmful content. Be mindful of potential risks and adhere to ethical guidelines when crafting prompts to maintain responsible AI usage.

By following these strategies, educators, researchers, and users can optimize prompt engineering to elicit meaningful and accurate responses from AI language models while aligning with their specific objectives and requirements. From this perspective, it can be argued that prompt engineering in education can be used to encourage critical thinking, spark creativity, and foster deeper understanding of the subject matter.

Conclusion: Prompt Engineering for Co-Creation

Prompt engineering is the art of communicating and interacting with generative AI
– Aras Bozkurt

Teaching and learning are fundamentally social endeavors, emphasizing the significance of co-creation in educational contexts. From this perspective, co-creation involving generative AI presents a compelling method for harnessing the capabilities of generative AI in education. However, when we refer to the social aspect, we typically consider interactions among living entities within the teaching and learning processes. Nevertheless, co-creation through conversational generative AI technologies challenges these assumptions and signifies the need to prioritize human-machine interaction. To unlock the full

potential of conversational generative AI, it becomes crucial to establish clear and purposeful conversations, and this is precisely where prompt engineering assumes a pivotal role.

Generative AI possesses immense power, but its true potential is unlocked when guided by human prompts. When humans direct the output of generative AI, the creative possibilities seem limitless. The key to facilitating effective communication and interaction between humans and generative AI lies in skillfully crafting prompts. Crafting and engineering the right prompts is of utmost importance as it directly impacts the capabilities of generative AI. Prompt engineers, who can be individuals from various educational backgrounds, should possess an understanding of how subtle nuances in language can significantly alter the meaning of a prompt. Eventually, a well-crafted prompt serves to enhance the capabilities of generative AI, allowing for more meaningful and contextually relevant outcomes.

An essential aspect of prompt engineering is ensuring that our prompts enable the generation of authentic content. This necessitates crafting prompts that are carefully tailored and well-structured. Additionally, considering the powerful computing capabilities of conversational generative AI, it may be advantageous to adopt a mindset akin to interacting with a baby. Similar to how we engage with infants, we should be clear about our purpose, tone, role, and context when communicating with generative AI. By establishing a chain of conversation, we can effectively pre-train the generative AI and guide it towards the desired context. Embracing such an approach highlights the need to invest in prompt-based conversational pedagogy, where communication and interaction between humans and machines facilitate effective teaching and learning experiences. Drawing a parallel to Aladdin's story, we find ourselves playing the role of the masterminds, with generative AI mirroring the eager anticipation of a genie trapped within a lamp. We hold the privilege to issue three, perhaps even more, commands, to free this *gen[i]*erative AI from its realm of algorithms.

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The movie Terminator, specifically Terminator Genisys (2015), deserves recognition for its attempt to stimulate critical thinking. Through the character Skynet, the film delivers thought-provoking lines such as "primates evolve over millions of years. I evolve in seconds. And I am here. In exactly four minutes, I will be everywhere" and "I'm not machine, I'm not man, I'm more." These statements serve as a stark reminder that we should not succumb to the allure of advanced generative AI without exercising skepticism and vigilance. Rather than being captivated by its seemingly limitless capabilities, Terminator Genisys prompts us to approach this technology with a critical mindset and exercise caution.

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Conflict of Interest

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Data Availability Statement

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