Generative AI Prompt Engineering for Educators: Practical Strategies

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Generative AI Prompt Engineering for Educators: Practical Strategies

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Abstract

Generative AI, such as ChatGPT, produces personalized and contextually relevant content based on user prompts (inputs provided by users). These prompts act as the primary form of interaction between users and AI models, making their quality essential for generating the most relevant outputs. The process of writing, refining, and optimizing prompts, known as prompt engineering, is key to obtaining high-quality desired outputs from generative AI. For educators, proficiency in prompt engineering is crucial for effective interaction with AI as it enhances efficiency and produces the most relevant information. In this paper, we introduce practical strategies for prompt engineering for educators: (a) include essential components, including Persona, Aim, Recipients, Theme, and Structure (PARTS); (b) develop prompts using Concise, Logical, Explicit, Adaptive, and Restrictive (CLEAR) languages; (c) evaluate output and refine prompts: Rephrase key words, Experiment with context and examples, Feedback loop, Inquiry questions, Navigate by iterations, Evaluate and verify outputs (REFINE); and (d) apply with accountability. Examples for special educators and online resources are included.

Keywords

prompt engineering, artificial intelligence, generative AI

Mr Kim, a dedicated special education teacher, heard of the potential benefits of generative AI tools from the media and colleagues. He envisions using AI to craft personalized reading passages, to develop individualized math problems which meet his students' diverse needs, and to utilize the assistant features in writing lesson plans and IEP goals. Moreover, he knows his students can consume digital information quickly and easily by utilizing emerging technologies, so he wants to keep pace with technological advancements. He tried interacting with a generative AI system with the expectations of receiving assistance from emerging technology tools and of designing creative, engaging activities for his students. His initial interaction was an interesting and phenomenal experience. However, whenever he wrote a prompt with a specific purpose, the results were far from ideal. The AI-generated material often missed the mark, either because it was too advanced or because it did not address the specific challenges his students faced. Frustration grew as Mr Kim spent hours tweaking prompts, hoping for a breakthrough. He realized that the key lies not in using AI tools but in understanding how to design and optimize text inputs to interact with AI tools.

In today's rapidly evolving digital landscape, artificial intelligence (AI) has emerged as a transformative force, reshaping various aspects of our lives. Next Move Strategy Consulting (2023) has predicted an explosive rise in the AI industry over the next decade, and its project value is anticipated to reach roughly two trillion U.S. dollars by 2030. Younger generations find themselves on the edge of an era that will be profoundly transformed by AI, ultimately leaving an enduring imprint on their ways of thinking and their career development. In fact, according to the Center for Digital Thriving at Harvard University (2024), more than half (51%) of young people ages 14-22 have already used generative AI products.

In the field of education, AI emerged as early as in the seventies (Guan et al., 2020). For example, an Intelligent Tutoring System (ITS; Sleeman & Brown, 1979) was developed based on an early natural language processing program by Weizenbaun (1966) in MIT as the machine and human interface. During this era, AI in education focused on solving problems such as enhancing operator performance

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automatically (e.g., Hwang, 2003; Ross, 1987). Currently, AI is driving widespread transformations through innovative applications that individualize and optimize the learning experience as well as using big data to perform complex tasks (McCarthy et al., 2022). Chen et al. (2020) have noted that AI already has the widespread impact on educational spaces ranging from the decision-making dynamics of educators to the transformation of classroom tasks and learning experiences. With the U.S. Department of Education's recent commitment to support the use of AI technology (2023), many developers and researchers are investigating the potential benefits and impact of AI in Education. For example, AI has the capacity to help students achieve their educational goals at lower costs as an effective teaching and learning tool by addressing individual students' strengths and needs (UNESCO, 2023). It also provides customized curricular resources for students and substantial support for special education teachers in managing their workloads (Garg & Sharma, 2020; Goldman et al., 2024; Kohli et al., 2021; Waterfield et al., 2024). However, resources (e.g., frameworks, guidebooks, training programs) needed for special educators to use AI tools effectively in the classroom are limited (UNESCO, 2023). Considering that many special educators feel uneasy about integrating emerging technologies into their classrooms without adequate training and strategies (Williams et al., 2004), we intend to make AI pedagogically relevant and provide practical strategies.

Generative AI and Prompts

Often referred to as "automation based on association" (U.S. Department of Education, 2023, p. 1), AI is an umbrella term for a wide variety of algorithms and approaches which include adaptive learning, machine learning, generative pre-trained transformers, and natural language processors. Put briefly, it is a machine-based system that can make predictions, recommendations, and decisions influencing real or virtual environments for a given set of human-defined objectives (U. S. Congress, 2024). Generative AI utilizes machine learning techniques to produce outputs (e.g., text, images, sound, video), creating original, personalized, contextually relevant content (Cain, 2024). The past couple of years have seen explosive growth in the use of generative AI tools. For instance, OpenAI released an AI-powered chatbot in late 2022, Chat Generative Pre-Trained Transformer (ChatGPT), and made it widely available to the public. Two months after its launch, ChatGPT had reached over 100 million users, setting a record for the fastest-adopted software (Mercado et al., 2024).

Generative AI is also transforming the landscape of education as the subject receives increasing attention from researchers in the field (Luckin & Cukurova, 2019; Walter, 2024). Generative AI tools like ChatGPT do not require users to have any coding or computer programming skills. Instead, users simply interact with these tech tools using plain, everyday language (Coy, 2023; Harwell, 2023). However, users need to provide a "prompt" to interact with Generative AI. AI systems generate text (outputs) by making statistically informed predictions based on the patterns they have learned and responding to prompts (inputs) entered by users (Ekin, 2023).

The term *prompt* refers to the input provided by users to guide the AI model's output; a prompt serves as the primary means of interaction between users and AI models (White et al., 2023). This textual interface can be a simple question, statement, or specific instruction with detailed descriptions to generate desired responses from AI tools (Amatriain, 2024). In other words, prompts are a form of programming used to customize the interaction with and outputs from an AI model (White et al., 2023). Just as the quality of responses provided by generative AI tools depends on the AI model's algorithms and training data, the quality of responses depends on the quality of the prompts (Dwivedi et al., 2023; Ekin, 2023; Zhou et al., 2023). Thus, in order to obtain high quality outputs from AI tools, users must be able to engineer effective prompts (Eager & Brunton, 2023; Walter, 2024).

Prompt Engineering

Prompt engineering is the process of writing, refining, and optimizing human-defined inputs to obtain high-quality desired outputs from generative AI models (Ekin, 2023; Velásquez-Henao et al., 2023). A specific set of skills, techniques, and methods are necessary to obtain the most precise, accurate, pertinent, contextually appropriate responses. Researchers have explored effective prompt engineering to optimize interactions between humans and AI. For example, Lo (2023a) suggested four guiding principles for prompt engineering: (a) clarity and precision, (b) contextual information, (c) desired format, and (d) verbosity control. These principles emphasize that prompts must be clear and precise to produce an accurate, relevant response. Prompts should also include contextual information for a contextually fitting response, a format desired to meet the user's expectations of structure or style, and a desired length of the response. Based on these principles, Lo (2023b) developed a framework for prompt engineering, known as CLEAR: Concise, Logical, Explicit, Adaptive, and Reflective. Specifically, concise prompts use direct, brief, and clear language. Logical prompts provide instructions in a structured and coherent manner, enabling AI models to follow a clear flow and order of ideas. Explicit prompts clearly specify the expected output format, thereby minimizing the chances of receiving unexpected or irrelevant responses. Adaptive prompts involve an iterative process of experimenting with various prompt formulations, allowing users to flexibly customize their prompts. Finally, reflective prompts emphasize the importance of continuous evaluation for ongoing enhancement.

Another effective prompt engineering example is the Goal Prompt Evaluation Iteration (GPEI) model proposed by Velásquez-Henao et al. (2023). The GPEI has four steps:

(a) defining the objective, (b) designing the prompt, (c) evaluating the responses, and (d) iterating. Under the GPEI model, users begin the prompt engineering process by defining their objective for the prompt activities. The objective will guide the following steps and further iterations. Next, users design prompts that include specific information to achieve the desired output. After obtaining the initial response according to the design, users determine whether the response is complete, accurate, and relevant. During the evaluation process, users rephrase the prompt, request additional evidence, provide counterexamples, inquire about data sources, and/or design other prompts to assess the response. As users evaluate the responses, they iterate on the prompts to adjust the design for more ideal answers.

Effective prompt engineering is crucial for obtaining high-quality information from generative AI models (Ekin, 2023). By mastering this skill, educators can maximize the positive impact of, enhance their efficiency of, and obtain more relevant information from generative AI in educational settings (Eager & Brunton, 2023; Wang et al., 2024). Although the existing frameworks can provide valuable insights, most prompt engineering frameworks are not relevant for educators mainly because they are driven by computer science specialists with limited pedagogical knowledge (Celik et al., 2022; Luckin & Cukurova, 2019). For existing frameworks to be useful and actionable for educators, moreover, practical strategies need to be supplemented. Grounded in existing frameworks in effective prompt engineering (e.g., Cain, 2024; Lo, 2023a), we propose an educational framework for effective prompt engineering for Generative AI and provide practical strategies that special educators can use in their classrooms.

Strategies for Prompt Engineering: IDEA

To effectively and efficiently utilize generative AI systems, we propose the following practical strategies for educators, *IDEA Framework for Prompt Engineering,* which we have adapted from existing prompt engineering frameworks and models (e.g., Google for Educators, 2024b; Lo, 2023; Velásquez-Henao et al., 2023). As shown in Table 1, the IDEA strategies for effective prompt engineering involve (a) ***I***ncluding essential PARTS, (b) ***D***eveloping CLEAR prompts, (c) ***E***valuating outputs and REFINEing prompts, and (d) ***A***pplying the output with accountability.

Table 1. IDEA Framework for Prompt Engineering.

Step	Consideration
Include essential PARTS	**P**ersona (identify the role) **A**im (define the goal) **R**ecipients (describe the audience) **T**heme (describe the style, tone, restrictions, and any related parameters) **S**tructure (desired output format)
Develop with CLEAR prompts	**C**oncise (brief and clear) **L**ogical (structured and coherent) **E**xplicit (specific and precise) **A**daptive (customized and tailored) **R**estrictive (constrictive and domain-specific)
Evaluate outputs and REFINE prompts	**R**ephrase key words **E**xperiment with context and examples **F**eedback loop **I**nquiry questions **N**avigate by iterations **E**valuate and verify outputs
Apply with accountability	Aware of potential limitations Use a responsibility checklist

Include essential PARTS

AI models can only produce desired outcomes when inputs (prompts) include essential and sufficient information. Google for Educators, 2024b suggests incorporating the following five components into prompts: Persona, Aim, Recipients, Theme, and Structure (PARTS).

First, "Persona" identifies the role. Including the persona in the prompt sets the context for the user's request. For example, educators can identify their roles (e.g., *"I am a lead special education teacher preparing for paraprofessional training,"* "*I am a special education teacher designing co-teaching activities,*") or assigning the AI's role (e.g., "*Act as if you are Martin Luther King Jr.,*" "*As a special education teacher in fifth grade reading class*" and "*You are* ___.").

Second, "Aim" is a statement of objectives that defines the goal of the prompt. Setting the goal is necessary to determine the prompt structure and to refine the prompt during the iterative process (Velásquez-Henao et al., 2023). Examples include "*Create a lesson plan,*" "*Design professional development programs/training for paraprofessionals*," "*Develop a rubric,*" "*Write an IEP goal in reading,*" "*Create word problems,*" and "*Brainstorm ideas.*"

Third, "Recipients" describes the audience. Specifying the audience enables the AI model to produce tailored outcomes; examples include "*for my eighth grade students with dyslexia,*" "*for fifth grade students with mild intellectual disabilities,*" and "*for a 10th grade class, including 5 ELL, 2 with dyslexia, and 3 with reading difficulties*."

Next, "Theme" refers to the style, tone, restrictions, and any related parameters necessary to obtain the most desirable outcomes. AI tools are most effective when users set clear boundaries. Examples of themes include "*Use a formal and professional voice,*" "*Explain in no more than 100 words,*" and "*Be informative and enthusiastic.*"

Finally, "Structure" refers to the desired output format. Users can request a specific output format such as bullet points, table, code, emojis, metaphors, analogies, sketches, graphs, quizzes, games, and more.

Develop CLEAR prompts

Effective AI prompts need to employ clear language to obtain most desired and pertinent outputs. Adapting the CLEAR framework designed by Lo (2023b), we suggest using Concise, Logical, Explicit, Adaptive, and Restrictive (CLEAR) language.

First, “Concise” prompts use clear, brief language. For example, instead of “*Provide me with an extensive discussion of the factors contributing to the decline of endangered species and tell me some solutions which might be helpful in addressing this issue,*” a more concise prompt would be “*Identify three factors contributing to the decline of endangered species and list three possible solutions to address this issue*.”

Second, “Logical” prompts are structured and written in a logical flow. The arrangement of components within a prompt can sometimes affect the output (Lo, 2023b). When asking an AI model to perform a complex task, educators may break it down into several smaller tasks so that the AI model can follow logical and sequential steps. For example, “*First, describe ____. Next, explain ____. Finally, list ___.*”

Third, “Explicit” prompts use precise, specific language. For example, rather than “*What can make students more engaged in math class?*”, a more effective prompt would be “*List technology-assisted activities to engage third grade students in teaching equivalent fractions.*” Explicit prompts can reduce ambiguity, thus enabling AI systems to focus on targeting tasks.

Next, “Adaptive” prompts are customized and tailored to meet specific needs. For example, rather than “*Tell me two factors contributing to effective classroom learning,*” educators can use the prompt “*Identify two factors contributing to effective teaching of students with learning disabilities in a small group setting within a resource classroom*.” Customized prompts can be designed and saved as prompt templates in the chat, allowing for future use (Velásquez-Henao et al., 2023). However, educators should be mindful that customized prompts should only include publicly available information. Any confidential information should not be used in AI models.

Finally, “Restrictive” prompts specify constraints such as format, length, and scope, enabling the AI model to generate responses that adhere to the desired parameters (Eager & Brunton, 2023; Ekin, 2023). For example, domain-specific language provides context that helps the AI better understand the nuances of the task. While general or fact-based questions do not require such specificity, using constrictive and domain-specific language makes AI systems more likely to understand and accurately respond to specific tasks (e.g., IEP writing, lesson planning, assessment). This can ensure that responses are relevant and aligned with the particular subject matter or field under consideration.

Evaluate Output and REFINE Prompts

Crafting prompts often requires iterative refinement (Amatriain, 2024; Reynolds & McDonell, 2021). Initial prompts are evaluated and verified based on the quality of AI responses. If the output is unsatisfactory, the prompt needs to be revised and retested. This process continues until the desired response is achieved, in a manner similar to trial and error (Cain, 2024; Walter et al., 2024). Such refinement is essential in fostering critical thinking and exploring further outcomes (Cain, 2024; Chang, 2023). We suggest evaluating output and REFINEing prompts by (a) Rephrase key words, (b) Experiment with context and examples, (c) Feedback loop, (d) Inquiry questions, (e) Navigate by iterations, and (f) Evaluate and verify outputs.

First, when the output is not accurate or relevant, one approach is to rephrase the key words (Velásquez-Henao et al., 2023). Replacing words or rephrasing the prompt can result in different outcomes. It can help users to identify inconsistencies among multiple responses.

Second, experimenting with context and examples can guide AI models to produce more pertinent and relevant responses (Eager & Brunton, 2023). Incorporating examples (also known as “shots”) into prompts is a common technique in prompt engineering to help AI tools understand the desired output more effectively (Walter et al., 2024). For example, we can request to write an IEP goal using the following initial prompt (e.g., “*I am a special education teacher teaching in a resource room. Write one IEP goal in reading for fifth grade students with dyslexia who struggle with staying focused and reading at the Lexile level of 400*.“). Incorporating additional context and examples (e.g., “*Include six components recommended by Kentucky Department of Education [audience, behavior, circumstance, degree, evaluation, and frequency of data collection] in the IEP goal*.” or “*Here is an example: Given multiple tasks, Allison will independently monitor her progress and complete tasks within deadlines 80% of the time in 3 out of 4 trials, as measured by a self-checklist and teacher observation*”) will produce more relevant and pertinent outcomes in line with state guidelines.

Third, the continuous interactions through feedback loops allows AI systems to build context over time and better understand the user’s intent, leading to more desired responses. As interactions between an AI model and a user increase, the responses are more likely to become more accurate and relevant (Amershi et al., 2014).

Fourth, users can input questions, such as verifying accuracy, requesting additional evidence, and/or seeking opposing viewpoints (Velásquez-Henao et al., 2023). Chang (2023) describes the Socratic method, the process of questioning and dialogue, which fosters critical thinking. All these strategies are related to navigating by iteration. Continuous refinement allows the AI model to gradually approach the envisioned response. This iterative approach provides educators with deeper insights into the AI’s operational patterns, thereby enhancing its effectiveness in future interactions (Cain, 2014; Lo, 2023b; Velásquez-Henao et al., 2023).

Finally, while generative AI models are remarkable tools, generative AI tools can often produce incorrect or misleading

Table 2. Online Resources for Prompt Engineering.

Online resources	Name & Link
Learning Prompting	Introduction to prompt engineering (https://learnprompting.org)
Google for educators	Generative AI for educators (https://skillshop.exceedlms.com/student/path/1176018)
Microsoft learn	AI for educators (https://learn.microsoft.com/en-us/training/educator-center/topics/ai-for-education)
Coursera	Prompt engineering for educators (https://www.coursera.org/specializations/prompt-engineering-for-educators)
OpenAI Platform	Prompt engineering (https://platform.openai.com/docs/guides/prompt-engineering)
AI models	Prompt Professor (https://chatgpt.com/g/g-qfoOICq1l-prompt-professor) Prompt engineer (https://chatgpt.com/g/g-5XtVuRE8Y-prompt-engineer) Prompt Perfect (https://chatgpt.com/g/g-0QDef4GiE-prompt-perfect)

information, known as "hallucination", in which generative AI models create details or data not based in reality but mirroring their training data (McIntosh et al., 2023). It is a common issue with generative AI models as they are designed to create new content; thus, educators should evaluate, assess, and verify AI responses by being vigilant for hallucinations and other AI errors such as training data biases or inaccuracies, and unsuitable content (Cain, 2014). It is crucial for educators to be mindful of the imperfections inherent in emerging technologies.

Apply with Accountability

Although AI tools show promising benefits, human critical thinking skills are the best way to ensure that the output is accurate, useful, and responsible (Cain, 2024). Educators should be aware that AI has limitations, such as reproducing unfair biases, generating inaccurate or unreliable information, interfering with academic integrity, creating privacy issues, and more (Cain, 2024; Waterfield et al., 2024). It is important to recognize these limitations and use AI tools responsibly with accountability (U.S. Department of Education, 2023). One practical approach is to develop a personal checklist for appropriate and ethical uses of AI. In fact, the Council of Great City Schools and the Consortium for School Networking (CoSN) has developed a K-12 generative AI readiness checklist for implementing AI in schools (Council of the Great City Schools & CoSN, 2023). This checklist provides implementation strategies across six core focus areas: executive leadership, operations, data, technology, security, and risk management. Google for Education (2024a) has also released a responsibility checklist. This checklist provides a list of guidelines which includes review of AI outputs, disclosure of the use of AI, consideration of privacy and security implications, and thoughtful use of AI with consideration of personal judgment.

Online Resources on Prompt Engineering

Given the rapid growth of prompt engineering and its potential to revolutionize various aspects of machine learning, educators need to continually learn and hone their prompt engineering skills. Shown in Table 2, we provide a list of online resources that are relevant for both general users and educators. For example, Google for Educators (2024b) recently released an online course for educators titled *Generative AI for Educators*. This course, designed to support educators in their use of AI tools, was developed through collaborative work between Google and the Responsible AI for Social Empowerment and Education (RAISE) initiative of the Massachusetts Institute of Technology (MIT). The course provides an overview of generative AI and practical strategies for interacting with AI tools, including prompt engineering for educators. There are AI-powered tools that help users craft better prompts, such as *Prompt Professor*, *Prompt Engineer*, and *Prompt Perfect*. These prompt optimization tools specialize in enhancing prompt engineering techniques, assisting educators in developing more efficient prompts and optimizing their interactions with AI models.

Conclusion

After learning the IDEA Framework and reviewing the online resources suggested in this article, Mr Kim understands that prompt engineering is a skill which will enable him to use AI more effectively in the classroom. The IDEA strategies provide Mr Kim with a guideline for effective prompt engineering and enable him to obtain accurate, relevant, and contextually appropriate responses from AI models.

As the popularity of AI tools increases, an increasing number of teachers and students use these tools in the classroom. Generative AI can support special educators in many areas, including as developing instructional materials and writing IEP goals. While prompt engineering has great potential to improve human interactions with generative AI tools and to optimize the outputs of AI models, few resources are available, or even relevant, to special educators. We hope that *IDEA Strategies* will help teachers understand sequential approaches and provide practical strategies to maximize the use of prompt engineering for Generative AI. By employing these strategies, users like Mr Kim can obtain more accurate, relevant, and meaningful results from AI tools.

The field of AI, particularly as it relates to education, will continue to advance; and as it does, new research and applications for AI will emerge in generative AI and prompt engineering. Although the essence of prompt engineering lies in crafting optimal prompts to achieve desired outcomes with specific goals (Amatriain, 2024), the process of prompt engineering can adapt and evolve alongside advancements in AI models. Potential future directions include developing more sophisticated strategies and making resources more accessible both for educators and for students.

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