

Meet 'ChemBot': How to Design a Personalized GPT Tutor

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ChatGPT & Generative AI

This framework helps teachers construct scaffolded GPT prompts to build their own AI classroom assistants.

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January 26, 2024



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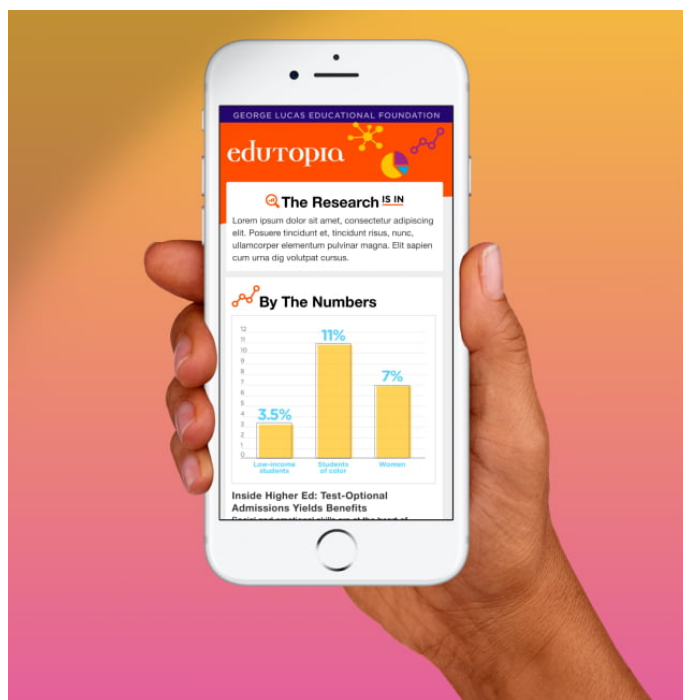
Chemical nomenclature is the topic that has proven most challenging to students throughout my career teaching introductory chemistry. Students need prior mastery of skills such as element and ion naming and bond categorization. On top of that, students must approach the process algorithmically, first categorizing elements in a formula to determine the bonding category, then using naming rules unique to that category. I provide flowcharts, interactive activities, worksheets galore, numerous formative assessment opportunities, and oodles of extra help. While some students master nomenclature quickly, others need significantly more time and engagement opportunities to reach proficiency.

Over the years, students have expressed their wish for a tool that could help identify when they've erred and why. Enter "ChemBot," my custom GPT that is part chemical nomenclature tutor and part nomenclature practice problem maker. Unlike general large language models (ChatGPT, Bard, Claude, etc.), OpenAI's GPTs can be trained specifically on your course content and learning goals, as well as on your students' learning progression, misconceptions, and preferences. With this knowledge, they can become highly effective tutors. In this article, we'll delve into how you can design your own custom AI classroom assistant, drawing from my experience creating ChemBot.

The Basics of Making a GPT Tutor

The process for making a customized AI classroom assistant starts with logging into ChatGPT Plus: The \$20/month subscription includes access to plug-ins, GPT Builder, and publicly shared GPTs. After logging in, choose "Explore," followed by "Create a GPT." The design interface has two modes. "Create" involves making a custom chatbot by answering a series of questions posed by ChatGPT, whereas the other mode, "Configure," allows you to use a prompt of your own design. I chose Configure because I knew exactly what I wanted to target for an effective nomenclature tutor.

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Using a PROMPT to scaffold prompts

I wrote a scaffolded prompt—the key step in the whole process—to serve as instructions for GPT Builder to create ChemBot. This visual guide represents each step.

Effective scaffolded prompting (“prompt engineering”) adheres to particular criteria. To help teachers and students with that process, Jon Gold of Moses Brown School and I created an AI resource document that includes the acronym PROMPT: Purpose, Role, Organize, Model, Parameters, and Tweak. Our document is based in part on content from the books *The AI Classroom* and *Teaching AI*.

Here is how I used the steps of PROMPT in designing the GPT tutor that I named ChemBot:

Purpose: *Identify the reason for your prompt.* This gives the AI context and its overarching goal. This could range from helping students achieve mastery to generating assessment questions in your particular style.

For ChemBot, I specified: “You will act as both a tutor and a practice problem generator for introductory chemistry students.”

Role: *Give the AI a specific “hat” to wear.* It is important to detail aspects of the AI’s role—i.e., what makes for a good peer reviewer, tutor, or debate partner. I’ve found that narrowing a chatbot’s purpose and role can yield greater accuracy and greater responsiveness when testing out changes to its instructions, hence my aiming for a topic-specific versus general chemistry tutor.

I told ChemBot, “Your interaction style should mirror effective tutoring dynamics, such as providing Socratic questioning over direct aid, all while targeting the content and proficiency level I will specify through uploaded documents. You are a positive, encouraging expert on chemical nomenclature, eagerly providing examples to help students build proficiency and confidence.”

Organize: *Structure your prompt logically and clearly, using headings. Organize the knowledge/training base.* I skip around when writing longer prompts, so I start with the “O” of PROMPT and write headings for each section. This ultimately makes it easier for both you and the AI to navigate your prompt. One of the major pitfalls of AI is its tendency to “hallucinate” (make things up). Uploading an organized, narrow data set with specific, relevant information and restricting a GPT to reputable sources can cause it to be more efficient and less likely to make things up in its particular role.

For ChemBot, I uploaded select documents such as my nomenclature flowchart, ion charts, and answer keys to several worksheets. I also instructed ChemBot, “Limit your knowledge to this base; cross-reference for accuracy exclusively with reputed chemistry education websites and chemistry textbooks via your internet search capabilities when possible.”

Modeling: *Specify the form; give examples of content desired in your outcome.* Modeling the desired outcome is crucial for greater accuracy. This step entails providing examples of how a good output or an ideal exchange would look, including guidance on handling questions and misconceptions.

I provided ChemBot with examples of incorrect student answers with the style of explanation I would give. I also identified several common student misconceptions, giving ChemBot guidelines for addressing such instances.

Parameters: *Define the scope and boundaries of the outcome.* Specifying parameters such as desired output length, format, and user age or reading level will increase the effectiveness of your prompt.

I instructed ChemBot to give only one or two problems at a time, as initial versions provided too many problems at once. I also told it, “Start out diagnostically, searching for the specific area(s) where a student might be struggling; then provide targeted questions in an adaptive fashion before moving on.” I also described what mastery would look like: “Mastery is a student working through mixed nomenclature practice problems with minimal hints, explanations, and incorrect answers.”

Tweak: *Edit. Re-prompt.* Here, you edit and re-prompt until AI generates the desired result. A solid organizational strategy helps with this process.

The split-screen interface of GPT Builder allowed me to test out ChemBot while in the design phase, enabling me to adjust aspects until I got the desired outcome.

ChemBot checks a number of boxes in terms of fostering a personalized and differentiated approach and being a solid stand-in “nomenclature expert” when I’m not available for my students. This outcome, along with the relative ease of designing ChemBot, has me excited to create more bespoke classroom assistants, helping make those limited, valuable teaching and learning minutes count even more.

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