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GIFTS: Drink Coaster Design Challenge for Introducing Generative AI to the Client-Centered Design Process in First-Year Engineering

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Abstract

This Great Ideas For Teaching (and Talking with) Students (GIFTS) paper presents a classroom activity designed to introduce first-year engineering students to human-centered design through the creation of a custom drink coaster, guided by generative AI tools. Aimed at developing skills at using AI in academic and engineering settings, the activity scaffolds the responsible use of AI in the engineering design process, emphasizing creativity, client empathy, and iterative development. By simulating client interactions using AI, students practice incorporating user feedback into designs, building confidence and decision-making skills in a low-risk environment.

Motivation

First-year engineering students often arrive from high school environments where generative AI is discouraged, outright banned, or not introduced at all, leaving them uncertain of AI's role in their education or as an engineering tool. There is a growing need to help students explore AI in a meaningful and productive way. This requires not only introducing them to the power of AI but also scaffolding their understanding so that they maintain control, creativity, and decision-making agency within the engineering design process. This activity fills that need by providing a guided, hands-on experience where students leverage AI to help brainstorm, generate ideas, and iterate on design choices, all while focusing on client needs and preferences.

Further, accessing real-world clients in the first-year can be difficult, especially with constrained resources and scaling client-interactions to large numbers of students. Generative AI provides an opportunity for students, early in their engineering education, to practice the steps of conducting client interviews and incorporating client feedback into their engineering designs. Doing so within the context of generative AI provides students with the freedom and flexibility to take risks and explore the process without ruining real-world relationships. For students early in their educational journey, while this isn't a full substitute for real-person interviews, it provides a safe-space for them to develop the skills and confidence for (eventually) doing this on their own.

Finally, through proper framing and implementation, there is a possibility for the activity itself to provide first-year students with a cross-disciplinary experience incorporating more social and humanities-learning components into the engineering curriculum. This helps students make cross-cutting connections and start to understand the positioning of engineering as a discipline within and connected to other contexts and disciplines.

Objectives

This activity provides first-year engineering students with hands-on, scaffolded experiences that introduce them to the potential of generative AI without simply providing "the answers." It offers

them a space to practice interacting with AI, including priming and prompt engineering for generative AI systems, in a low-stakes environment that supports productive client based engineering design and prepares them for more advanced, in-depth applications of generative AI throughout their later studies.

The design activity is structured around the Stanford d-school's Design Thinking Process [1], particularly focusing on empathy and iterative design (Figure 1).

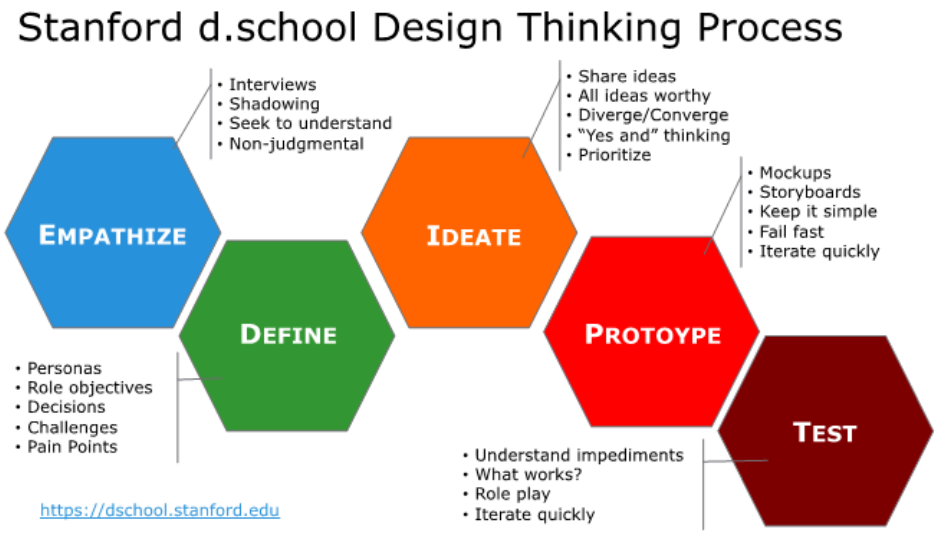

Figure 1. Stanford d.school Design Thinking Process

Practical Implementation Details

The main objective of the activity is for students to create a custom drink coaster tailored specifically to the needs, interests, and personality of a specific client. This is based on an previous activity where students would complete all the same steps of the design process, but through in-person interviews with human clients and creating physical prototypes of actual coasters. The instructor introduction remains the same, highlighting different drink coaster designs that match the needs and interests of users and the use of the engineering design process, but introducing the use of generative AI as a supplementary tool for many of the steps. The choice of designing a "custom drink coaster" was chosen because it's a simple and common item that is easy to prototype with found materials, but could be easily substituted with an alternative.

During the 75-minute classroom session, after an introduction by the instructor, the interactive activity is divided into four active phases: (1) Question Brainstorm, (2) Client Interview, (3) Artifact Generation, and (4) Class Wide Sharing/Reflection.

1. Question Brainstorm

Students begin by brainstorming interview questions for a client, with generative AI assisting them in refining those questions. As a human-centered design task, students are encouraged to design questions that will help them gain the perspective, problems, preferences, and needs of a

client. This exercise immediately highlights how effective AI prompting can lead to more insightful suggestions, emphasizing that students need to remain thoughtful, critical, and curious about their interactions with AI.

2. Client Interview

Students then pick a specific historical or fictional client. Students are instructed to prompt AI to embody that client specifically and respond to all inputs from the perspective of that character. The students then conduct a simulated interview with their client using this primed AI chatbot. From the interactions, students take notes and use the conversation to extract design-relevant information, documenting key insights (potentially even using AI to summarize their conversations) that then become the design requirements for the client-specific drink coaster they are creating. Students are encouraged to be critical and curious about their interactions with AI in its role playing, considering discussion questions such as, "*Was the AI conversation believable?*" and "*Did the interview yield novel design requirements unique and specific to the client?*"

3. Artifact Generation

Students then employ generative AI image generation to visualize (and iterate, as needed) on the design of a drink coaster. This involves using the summaries and key insights from the interview to customize a digital visualization of a drink coaster that specifically meets their client's needs.

4. Class Wide Sharing/Reflection

A culminating instructor-led class wide reflection culminates the project. Students present their creations and share their experiences using generative AI. They are asked to communicate new insights, further questions, and their emerging understanding of client-based design. While the activity itself is scaffolded throughout, these student reflections provide instructors an opportunity to guide discussions on creativity, decision-making, and AI's role in the engineering workflow, as well as touching on some problematic and ethical considerations of generative AI.

Examples

This project was implemented at a mid-sized private university in the northeastern United States within a 30-student first-year introduction to engineering design course. Microsoft Copilot is freely available to all students (via university-wide license) which is capable of both text and image generation. However, students were free to use any generative AI resources, and a list of examples are included in the Appendix. To facilitate the first three phases of the activity, and provide documentation to enable effective class-wide discussion by the instructor at the end, an editable slide template (see Appendix) was provided to the students to assist them in working through the activity. This also provides evidence of student work for further assessment and documentation of participation.

Students were given free choice in terms of the historical figure/client they chose for the project (instructor provided examples are included in the Appendix). Table 1 provides student work in

terms of final AI-generated images representing the coasters they designed for their clients (listed below each digital artifact).

Table 1. Examples of student-generated coaster designs, with the specific historical/fictional client listed below each.

		
Sherlock Holmes	Queen Elizabeth I	Mickey Mouse
		
Michael Jackson	Iron Man	Emma Watson

Conclusion

This early-semester participatory activity helps introduce the functionality of generative AI (for text and image generation) and establishes common technical skills amongst first-year students, many who might not have had prior formal experience. Further, it demonstrates the potential and capabilities, as well as limitations and ethical considerations, of the technology in a low-stakes introductory setting, while still emphasizing creativity and user-centered design in engineering. Through small group work and classwide reflective discussions, it also starts building a culture of common expertise and shared creation of successful ideas, techniques, strategies, and solutions to solving engineering challenges on which to build the rest of the semester.

References

[1] Tomlinson, Max. (2018). *The Impact of Design Thinking on Driving Innovation Within Large Businesses*. 10.13140/RG.2.2.24520.62726.

Appendix

Instructor Supplied List of "Potential Clients"

History: ● Cleopatra (*Egypt*) ● Leonardo da Vinci (*Italy*) ● Genghis Khan (*Mongolia*) ● Nelson Mandela (*South Africa*) ● Marie Curie (*Poland/France*) ● Mahatma Gandhi (*India*) ● Queen Elizabeth I (*England*) ● Simón Bolívar (*Venezuela*) **Authors:** ● Gabriel García Márquez (*Colombia*) ● Haruki Murakami (*Japan*) ● Chinua Achebe (*Nigeria*) ● Jane Austen (*England*) ● Hans Christian Andersen (*Denmark*) ● Khalil Gibran (*Lebanon*) ● William Shakespeare (*England*)	**Sports Figures:** ● Pelé (*Brazil, Football*) ● Serena Williams (*USA, Tennis*) ● Yao Ming (*China, Basketball*) ● Sachin Tendulkar (*India, Cricket*) ● Haile Gebrselassie (*Ethiopia, Runner*) **Fom Literature (Fictional Characters):** ● Sherlock Holmes (*England, by Sir Arthur Conan Doyle*) ● Don Quixote (*Spain, by Miguel de Cervantes*) ● Harry Potter (*England, by J.K. Rowling*) ● Arjuna (*India, from the Mahabharata*) ● Sun Wukong (*Monkey King, China, from "Journey to the West"*) ● Aladdin (*Middle Eastern, from "One Thousand and One Nights"*) ● Elizabeth Bennet (*England, by Jane Austen*) ● Anna Karenina (*Russia, created by Leo Tolstoy*)

Generative AI Tools

Text Generation: Microsoft Copilot, Open AI's ChatGPT, Google's Gemini, Anthropic's Claude, Perplexity AI

Image Generation: Microsoft Copilot, Open AI's ChatGPT, Canva, PIXLR, OpenArt.ai

Note: *rapidly changing innovation in the generative AI space means this list is incomplete and potentially out of date.*

Three-Slide Template for Scaffolding Student Work