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Generative AI in Higher Education Design Studio

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Abstract: The study's purpose was to investigate the areas of impact within the Design Thinking (DT) framework when using Generative AI (Gen AI) technology concerning user experience (UX), user interface (UI), and visual design education for the college studio environment. 57 Students ranging from first-year undergraduates to graduate program provided discussions and feedback from experimenting with Gen AI tools focusing on DT's early phases—effectively enhanced learning experience regarding UX methods, ideations, and critique sessions, allowing more student engagement with instant data results with variables that require further study about prompt construction. We recommend utilizing Gen AI tools to simulate synthesizing interviews and personas for educational purposes and to aid the wireframe directions for undergraduates in a higher-learning studio environment.

Keywords: Conceptual Design, Design Education, Design Thinking, Artificial Intelligence (AI)

1 Introduction

Artificial Intelligence (AI) technology has changed how people use graphical user interfaces (GUI) in digital applications. Microsoft Edge, an Internet browser, relaunched with an AI search engine in early 2023. The reinvented interface powered by an AI search engine has ChatGPT capability embedded into its system (Mehdi, 2023). The software company incorporated the same technology in another digital product like Microsoft OneNote (Microsoft, 2023). These AI-assisted digital assistant features help users complete tasks through recommendation feeds or conversational chats in interactive texts, images, and voices. Despite the availability of various touchpoints for a user using multiple channels (Salazar, 2016), a designer must be able to conceptualize a graphical interface with an appropriate visual signifier to communicate the states of input and outputs. For example, a well-designed screen design with a typographical scale and a clear content hierarchy can enhance the system's visual cues for humans to interact intuitively—consistency in images and sounds all contribute to delivering a unified product user experience. There are 5.18 billion internet and 4.8 billion social media users worldwide as of April 2023 (Petrosyan, 2023). All these services offer screens as a primary touchpoint for a user, which is why future GUI designers must learn the importance of understanding user behavior and the effects of the design outcome on the usability of the applications. In addition to the conventional effort to improve the human experience, Generative AI (Gen AI) technology has become the subject of an evolution in how people interact with a machine and has become an essential topic in the design field and a higher learning studio environment.

Therefore, this study focuses on UX, UI, and visual design courses to address how Gen AI technology potentially reshapes the educational experience for design students conceptualizing GUI mock-ups. The participating first-year undergraduates to senior graduates utilized Gen AI tools during the study session. Design thinking (DT), made popular by David Kelley in the early 90s at IDEO (Clarke, 2020), became the primary design process used to discuss the effect of Generative AI in the study (Table 1). The labeling of the DT phrases borrowed from Nielsen Norman Group (Gibbons, 2016).

Table 1. Design Thinking Phases

Understand Phase	Explore Phase	Materialize Phase
Empathize	Ideate	Test
Define	Prototype	Implement

By asking the following research questions, the study aims to explore and identify the influence of AI technology in the GUI design cycle and ultimately prepare the higher learning environment for updating teaching methods to train future designers.

- Research core question: How might Gen AI technology reshape the higher education learning environment for UX, UI, and visual design students and instructors?

- Sub-question: How can Gen AI technology improve the educational experience for design students learning the DT's understanding and exploring phase when building a conceptual digital application in a studio environment?

2 Method

The study investigated four UX, UI, and visual design studio courses for undergraduates and graduates. The DT process provided the study with a framework for recognizing Gen AI's major impact on the design cycle. The primary instructor prepared design projects for all fifty-seven college students who enrolled in different courses for the study. In each project, excluding the graduates, the instructor provided instructional steps for the students to follow, including when and how to use Gen AI tools during the DT design process. All projects included UX, UI, and visual design methods with GUI-focused design outcomes to observe how the technology influenced the learning environment. Figma allowed a real-time browser running virtual space to record the students' work during the length of the projects. Each course had its dedicated Figma page, where the students displayed their work process, triggering a conversation among peers and the instructor about the effectiveness or lack thereof of using Gen AI within the design process. The feedback from the students on each project's design phases informed the study on identifying where the Gen AI technology became more practical to utilize within the DT. The study acknowledged the limitation in utilizing Gen AI in the DT's materialized phase, where real user involvement was essential for the learning outcome. Therefore, the study emphasized the influence of Gen AI technology on students learning about the conceptual GUI design process in DT's understanding and exploration phases (Table 2).

Data Collection and Method for Undergraduate Sessions

The constraints in the project brief allowed more focused discussions about using Gen AI tools within a specific design cycle. The undergraduate students were asked to document their work progression on the Figma page shared with the instructor. The experience of using Gen AI in the DT phases in relation to the design learning objective was discussed during critique sessions facilitated by the instructor. For the instructor preparing to teach the material, the Gen AI technology supported the real-time demonstration of preparing a user interview, observation, and synthesizing qualitative insights to build a fictitious avatar representing the user group for undergraduate students to experiment with. Prompts and the preparatory materials used to generate Gen AI output were documented on the Figma page. The design critique session following each demonstration informed the instructor about the students' perspective on Gen AI's efficiency in improving their learning experience.

Data Collection and Method for Graduate Sessions

In contrast to undergraduate sessions, unstructured instructions given to graduate students enabled them to explore novel ways to evolve the DT design process by implementing the Gen AI technology. The graduate students were given more choices to examine their research methods within DT over the undergraduate classes, allowing the study to experiment with more comprehensive learning models for themselves. Each student documented their work process in Google Drive to share with the instructor, marking each design phase.

2.1. Generative AI in the Understand Phase

Understanding the UX research process is a crucial learning component for design students aiming to be professional UX, UI, and visual designers working for industries. It takes engineers, designers, and other professionals to build a digital product that serves a real user, so understanding the users' needs is necessary (Chien and Yao, 2020). Professional designers empathize with users' goals and pain points through personas constructed from interviews or observations. Likewise, design students in higher education must learn how to discover the users' needs when designing a product or service. However, this discovery phase often requires students to learn how to assemble questionnaires from reading materials or attending lectures before collecting qualitative user data outside the class while developing their interviewing skills. For a student designer learning to apply the qualitative research method in the context of DT during the GUI design cycle, ChatGPT provided the instructor with an instant demonstration to display the importance of curating a type of interview questions and synthesizing persona to increase user empathy.

Table 2. The Research Context and Sampling

	Interview Questionnaire	User Persona	Contextualized Copy	Design Ideation & Contextualized Copy
Design Thinking (DT) Phase	Understand Phase	Understand Phase	Explore Phase	Explore Phase
Number of Student Sampling	11	11	4	31
Student Classification	Senior Undergraduate	Senior Undergraduate	Grad Student	Freshmen Undergraduate

Shared Participation	Same group of students from user persona session	Same group of students from interview questionnaire demonstration	No	No
Generative AI Tools	ChatGPT	ChatGPT	ChatGPT	ChatGPT, Runway, and Dall-E 2
Settings	Classroom 1 with a primary monitor connected to an instructor's laptop	Classroom 1 with a primary monitor connected to an instructor's laptop	Hybrid session periodically meeting with an instructor	Lab 1 with a primary projector connected to an instructor's laptop
Duration of the Session/Project	5 min.	30 min.	15 weeks	2 hours
Data Collection	Critique Session/Discussion	Critique Session/Discussion	Critique Session/Discussion	Critique Session/Discussion
Data Type	Text	Text	Text	Text and Image
Data Storage	Figma	Figma	Google Drive	Figma

ChatGPT: Interview Questionnaire

The prompt used in the ChatGPT to generate interview questions (Virginia Tech University Libraries, 2018) for a conceptual design project was "Create ten open questions about finding attributes, behaviors, preferences, feelings, attitudes, opinions, and knowledge of a social media mobile application users who are between 18-32 years of age," and the ChatGPT provided the ten questions within a second with a minor modification applied afterward by the instructor to make the results more open-ended:

1. How frequently do you use social media mobile applications in a typical week, and what activities do you engage in most while using them?
2. Could you describe the key features or aspects of a social media mobile application that appeal most to you?
3. What factors influence your decision to choose one social media app over another?
4. How do you feel when discovering new features or updates in your favorite social media app?
5. What privacy concerns do you have when using social media apps, and how do these concerns impact your behavior and interactions on these platforms?
6. Could you provide examples of instances when your feelings or attitudes toward a social media app changed due to its content, community, or interactions?
7. How do social media mobile applications influence your perception of current events, trending topics, or societal issues?
8. Can you recall when your knowledge about a specific event or topic was shaped by the information you encountered on a social media app?
9. How does the app cater to your individual preferences and interests?
10. How do you balance your time on social media apps with other activities, responsibilities, and face-to-face interactions in your daily life?

The instructor used ChatGPT to construct ten questions from a prompt to demonstrate how to prepare an interview session, one of the essential methods to gather qualitative insights from target audiences. The Gen AI-generated question output sped up students' learning process on the interview method because of the ChatGPT's instant data output, allowing the cohort to experiment by following the demonstration.

Using the Gen AI technology aided students in learning about the qualitative research method in the DT process while observing the relationship between the questions and the user data, even if it was a synthetic prompt about an artificial user group. Generative AI made the learning the interview method more engaging for the students because of its instant ability to generate content. There was a concern for misinformation or plagiarism (Sedaghat, 2023) when using ChatGPT as a research tool communicated by the instructor and students. However, in this instance, the AI-generated questions were constrained to discuss the effectiveness of enhancing the learning purposes of the study, not to verify the credibility of the generated texts concerning user data. An additional experiment was conducted by the instructor as a pilot study to generate observational sheet content for observing a crowd using the airport kiosk, and the results were similar in that ChatGPT built a template with categories for the future teaching materials for students to learn about the method.

2.2. ChatGPT: User Persona

User persona building is a crucial part of the GUI design process for designers to empathize with people who experience the design solution using the product or service. The user persona provides a fictional avatar representing a consumer group (Miaskiewicz and Kozar, 2011). To illustrate this to a group of students, the instructor demonstrated how to write a prompt by including the user type, action, and objective like the following statement: junior human resource (HR) employee at NASA looking for a guide to personnel recordkeeping (Figure 1). The artificial user story, which served as a ChatGPT prompt, generated a synthetic persona completing a task interacting with a GUI design, demonstrating the importance of user data to the students when designing the interface for people.

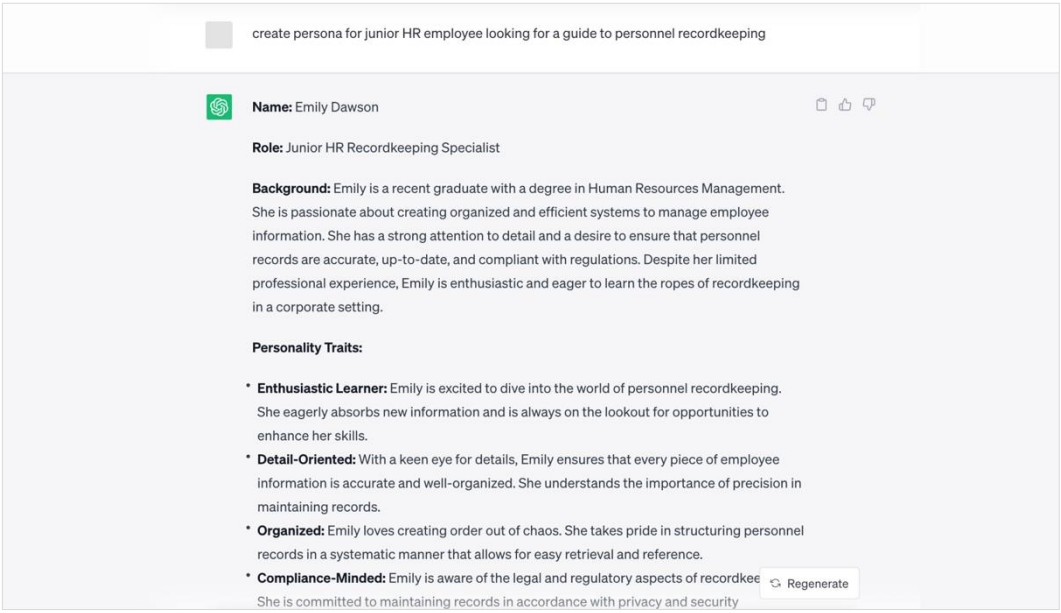

Figure 1. ChatGPT: User persona

Although the persona generated by the ChatGPT came from artificial user information, each persona displayed a detailed depiction of a fictitious avatar by filling the data gap from the prompt. As a next step, students were asked to document the variety of user statements used to generate the personas using ChatGPT (Table 3).

Table 3. Examples of the user statements used as a prompt

Student 1	As a DEI HR specialist for the Department of Justice, I want to find Diversity data reports throughout the United States on OPM so that I can find growth opportunities for DEI expansion at the Federal employee level.
Student 2	As a newly hired HR Specialist of the US Department of Labor, I want to better understand the process of transferring from one agency to another, to better help others during this process.
Student 3	As a Junior Budget Analyst at Accenture, I want to understand how to manage pay-grade personnel effectively, so that I can confidently contribute to the success of our projects, especially the one involving the U.S. Department of Treasury.
Student 4	As a Traffic Engineer, I want to find data from data.gov relating to causes of vehicle crashes in the city of Chicago, identify trends, and share with relevant parties so that we can use this to improve traffic conditions to prevent accidents.

Student 5	As a Junior Data Analysis Intern for the United States Census Bureau, I want to efficiently find and compile statistics about diversity in population so that I can create a contextualized report.
Student 6	As a temporary Wildland Firefighter, I want to enroll in an FEHB plan that offers affordable and comprehensive medical services so that I can have the right healthcare coverage to address any unforeseen medical needs that may arise during my firefighting assignments.
Student 7	As an Employee Engagement Specialist, I want to analyze Department of Human Resources personnel data so that I can create a solution to improve their employee retention.
Student 8	As a relatively new employee as an Administrative Assistant for the Department of Commerce, I am eager to explore career development and training opportunities to enhance my skills and advance in my career. I want to find resources and guides on how to get a coach and develop my own development plan during my time here through the resources provided by OPM.
Student 9	As a Junior Cybersecurity Analyst, I want to quickly gain broader and deeper understanding of current Cybersecurity best-practices in order to expand and improve on existing ideas.
Student 10	As someone with a not obvious disability, I want to view resources on accommodations and disabilities so that I can understand if the federal government would be a good environment to further my career in urban planning.
Student 11	As an Associate Hiring Manager, I want to craft structured interview questions that not only measure competencies accurately but also adhere to federal policies and guidelines, so that we can assemble a team that can contribute effectively to the EPA's tasks and environmental goals.

The ChatGpt generated the following details in the personas based on the user statements:

- Name of the user avatar.
- The role of the user working at NASA as an HR employee.
- Background of the user.
- Personality traits of the user with seven bullet points.
- The user's goals relate to a specific objective in finding personnel recordkeeping.
- Challenges in completing the task.
- Guidance is needed to help the user complete the task.

Using the ChatGPT in the half-hour session allowed the students to associate the importance of building a persona by understanding the user's role, background, personality traits, goals, and challenges because of its instant data input and output.

2.3. Generative AI in the Explore Phase

As part of the experiments exploring AI technology in design education, the students in this learning session used ChatGPT and Runway to create contextual texts for wireframe content and to explore visual design ideations, replacing the dummy text generator lipsum.com. The study observed how fast Gen AI tools enabled students to build believable UI mock-ups while enhancing the efficiency of learning about the fundamentals of a typeface in GUI compared to a conventional way of manually writing content. The students experimented with Runway and Dall-E 2 in creating images for the same reason: to validate the efficiency of outputting directional options before committing to a particular concept. Because the Generative AI tools combined various data sources to create new concepts (Mollick and Euchner, 2023), students maximized their time refining their UI visual direction using ChatGPT, Runway, and Dall-E 2 in the explore phase of the DT to discuss during the critique session of their perspective on the technology in the learning environment.

ChatGPT: Contextualized Copy

The graduate student, Liz Chen, used ChatGPT to create partial content for the conceptual GUI design of the online application that reduces biases and increases empathy for educators preparing course material. According to L. Chen

(personal communication, August 7, 2023), she replaced the usage of dummy text in the low fidelity wireframe stage with ChatGPT-generated content with the following prompts: “Write a response to 'how has your identity impacted your experience as a design student' from the perspectives of a queer indigenous student" And “Write an intersectional student narrative about how their identity has impacted their experience in the classroom.” The GUI design with detailed written content marked in the red box enabled the design outcome to invoke more realistic feedback from peers and instructors about the written content within the GUI during the critique session (Figure 2). The periotic critique sessions involved presenting the design artifacts with a defined project scope and hypothesis to receive constructive feedback for improvement, followed by the student documenting the discussed key points and storing them in Google Drive. Three other graduate students also utilized ChatGPT to contextualize text-based content in their GUI mock-ups.

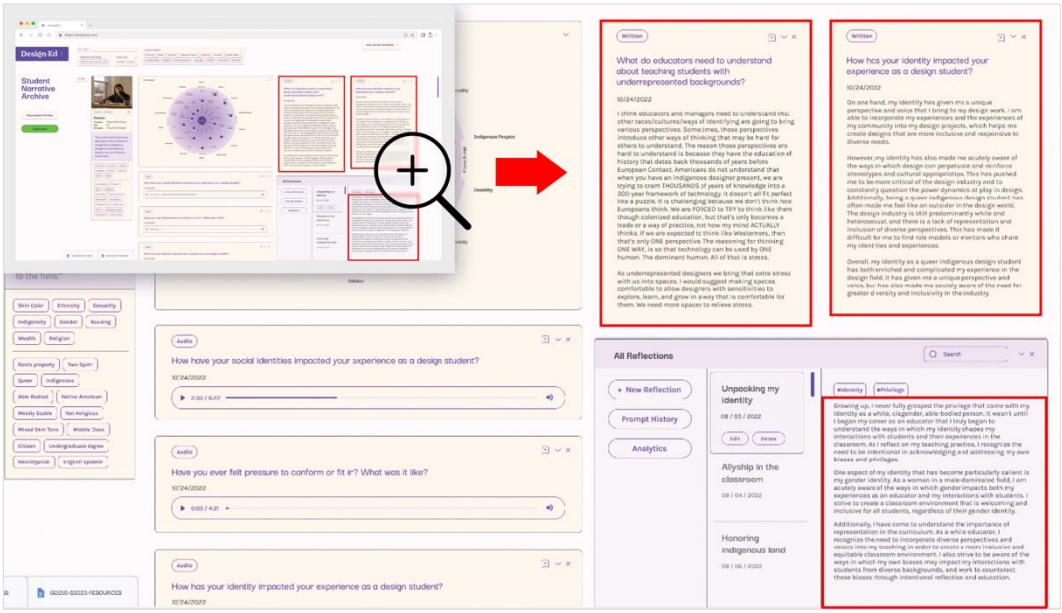

Figure 2. Design Ed GUI design. The interface image by Liz Chen

ChatGPT, Runway, and Dall-E 2: Design Ideation

Another project from an undergraduate course experimented with ChatGPT and Runway to generate ideas for the content and image so that students could learn design principles when designing GUI for mobile. The first project was given to freshmen to construct a catchphrase for the mobile marketing page for any chosen product. The session aimed to teach students how to use a proper grid, margin, padding, spacing, typography, and image manipulation to create a single GUI wireframe for iPhone. By creating the tagline, subtext, price information, and call to action button using ChatGPT, the cohort spent more time learning the topic. The instructor gave the students steps to complete the project as follows:

1. Use the prompt in the ChatGPT: “Brainstorm some ideas combining wearable devices and fitness.” The underlined nouns can be interchangeable depending on individual interest in designing mobile GUI.

2. Highlight the keyword of your interest from the generated sentences.

3. Using the keyword from ChatGPT, run another prompt: “Write a tagline for a smartwatch.”

4. Start with the Runway or Dall-E 2 prompt for image ideation: “Smartwatch with built-in GPS.” The underlined noun should come from the keyword selected from ChatGPT.

5. Set the number of image outputs and composite a new image based on the concept ideas generated from the sites.

Students then used the tagline with other sentences generated from ChatGPT as body content and the composite picture as a header image for their GUI design (Figure 3). With the amount of time saved from ideating phrases and image direction, the students could focus on the learning objective: to learn the design foundation while exploring new ideas using Gen AI technology. In addition to the time better spent on practicing design efficiency, Figure 2 indicated that the contextual text generated from ChatGPT enabled a design critique session to discuss the relationship between the line length and its effect on readability and communication with the students (Carter et al., 2018). Many designers have used placeholder text when working without the finished copy from the clients or the writer.

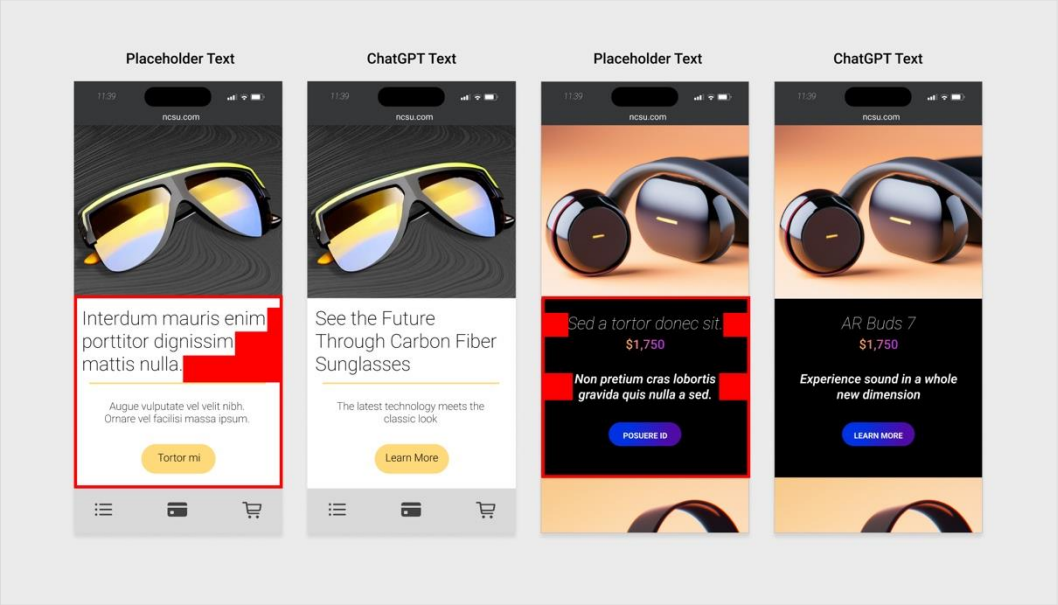

Figure 3. Mobile GUI design. The interface image by Gabe Cox and Sean Evans

However, the autogenerated dummy text often creates different line lengths and spacing from the approved actual vocabulary, an example marked by red outlines and the boxes in Figure 3. The dummy text in the UI design phase makes it harder for students to get proper feedback regarding the "Unity within the space" when learning the fundamentals of using a typeface in the layout (Carter et al., 2018). As the side-by-side comparison in Figure 3 suggests, the placeholder text creates a different positive and negative shape than contextualized written content. Inserting a natural language into the visual layout of the wireframe generated by ChatGPT allowed for specific discussion about spatial relationships and the written content in the GUI design outcomes concerning Gen AI's efficiency in offering more accurate typographical feedback during the critique session.

3 Results and Discussions

The students tackled project-based design problems emphasizing a conceptual approach to solving pain points for end users. The study used Gen AI technology as an educational tool for undergraduate students to learn about UX, UI, and visual design methods and identify potential implications for improving the DT process. The graduate students, however, experimented with the technology to find an opportunity to improve the DT's explore phase regarding each student's independent projects as a part of the learning experience using the Gen AI tools.

Based on the student critique and discussion session, the study identified the understanding and exploring phases of DT as the most practical areas to enhance the learning experience, especially for undergraduate studio environments (Figure 4). Gen AI tools like ChatGPT, Runway, and Dall-E 2 increased student engagement by allowing them to simulate the construction of an interview questionnaire, persona building, contextualized content, and design ideations with an instructor simultaneously.

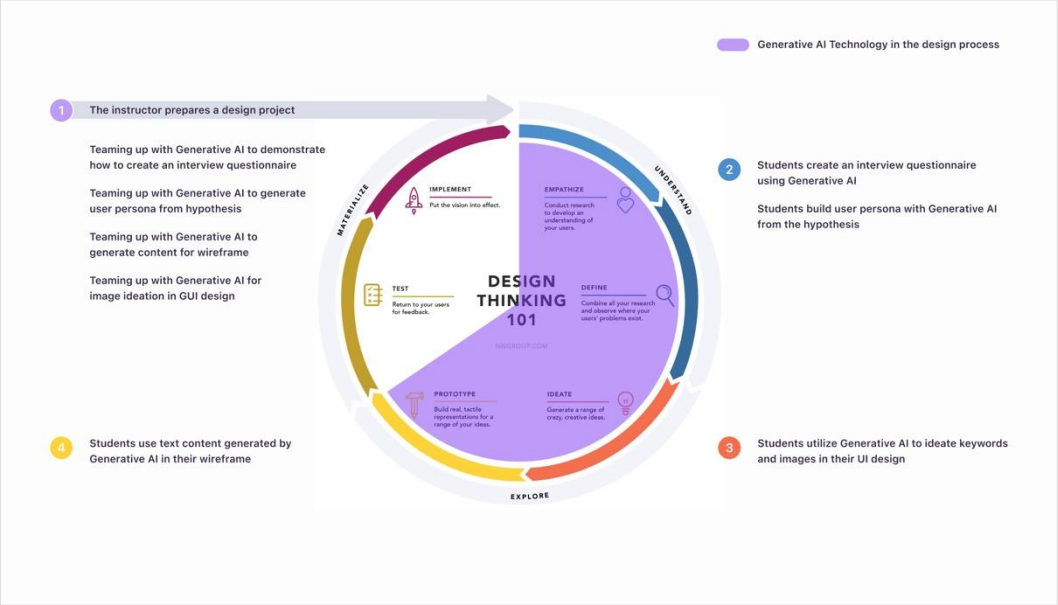

Figure 4. The design thinking framework. The image was modified from the diagram from Nielson Norman Group (https://www.nngroup.com/articles/design-thinking/)

Interview Questionnaire

The positive responses from the undergraduate students regard the efficiency of the technology in saving time to generate contextualized content as a supplementary tool for demonstration or lecture about the topic. Generating data using Gen AI tools took less than five minutes when eliminating the time it took to build input data. For example, the instructor used ChatGPT in the DT's discovery phase to lecture on constructing an interview questionnaire. At the same time, the students experimented with the tool on their laptops to see the direct correlation between the framing of prompts and generated interview questions. ChatGPT enabled the learning session to be more engaging and interactive through its capability to run prompts simultaneously from individual devices without delay. The AI-generated interview questions addressed user aspects described in the prompt about a particular age group using a specific product. This efficiency implies that Gen AI tools can improve learning quality by enabling students to observe the relationship between input and output data, thus enhancing their understanding of the qualitative research method. The benefit of instant data output also means that instructors and students can curate generated interview questions to discuss optimal ways to gather specific qualitative user information.

User Persona

When asked about the usage of ChatGPT in persona-making in a learning session, the undergraduate students favored its capability to output prompts instantly, which aided in understanding the types of user information needed to increase user empathy for a designer. The cohort expressed that ChatGPT allowed them to practice constructing the persona and observe how various prompt structures generated different background attributes of an artificial avatar and its effects on influencing a design decision for DT's ideation phase. The practical usage of the ChatGPT in a production environment was questioned during the discussion session. One student expressed that she would rather write things without Gen AI in the future because of the lack of validity and credibility built into the generated content regarding ChatGPT. There is a component of mistrust, according to the student participant. The study also acknowledges concerns about amplified bias through AI technology (Ntoutsi et al., 2020). These are legitimate concerns when implementing and relying on the tool to generate personas in a production environment.

However, the students discussed that Gen AI tools improve learning efficiency by instantly outputting data, enabling them to simulate the persona-making process. Utilizing Gen AI justifies itself in the educational environment as a preparatory simulator voiced by positive student feedback because of the projects' speculative nature in working off artificial data in the first place.

Contextualized Copy and Design Ideation

All four graduate students utilized ChatGPT to generate contextual content for their speculative GUI wireframes based on in-person user interviews. The self-guided exploratory learning model for the graduates differed from more instructional format used in undergraduate courses. The graduate students periodically met with their peers and an instructor to review the design progress during the 15-week time frame. The responses regarding Gen AI technology's impact on their learning

process were less enthusiastic than what undergraduate students discussed. Because the graduate students' learning objective emphasizes discovery through factual user data collection, the ChatGPT's inability to confidently generate facts hindered the cohort from incorporating the tool more into their design process. "It runs into problems when…Asked to provide specific factual information" (Euchner, 2023). Although the graduate students benefited from using ChatGPT to generate contextualized texts for their high-fidelity mock-ups that allowed for more in-depth discussion about the UI design during the feedback session, the cohort expressed more concern when using the technology outside of contextualizing non-user data in the wireframes. On the other hand, the similar benefit of using Gen AI tools had a greater impact on the undergraduate course learning to ideate and build wireframes with contextualized texts according to the students. For the ideation session, the contextualized texts generated from ChatGPT mirrored the authentic product wireframes that triggered an in-depth discussion about the types of information within the GUI design. The Gen AI technology also exhibited a potential for instructors to change how they prepare teaching materials before and during the design studio courses. Because of the immediate delivery of the results based on the prompt, the demonstration of UX research methods in the class made it possible for students to learn and practice the topic in a single session.

Reflection

The study acknowledges the mixed views about the limitations of using the technology as a supplemental tool to replace conventional design methods. There are discrepancies in how undergraduate and graduate students view the tools as a part of their learning journey because of the differences in their learning objectives. The projects in this study emphasize acquiring practical skills for the undergraduate and speculating discoveries for the graduates. As a result, Gen AI tools enhanced the instructional demonstrations for undergraduate courses, and the graduate students had to explore a novel technology usage in relation to DT's exploring design phase. Regardless of the various degrees of positive and negative feedback from both student groups, it is essential that we further investigate how the technology might reshape UX, UI, and visual design in a higher learning environment.

Future Study

Based on the observation of the design sessions from this study, writing similar prompts in various ways influenced data output, suggesting further investigation in synthesizing input data when using ChatGPT. So, two areas must be studied to examine the full extension of the potential impact of Gen AI technology within design practices taught in higher education. The first would be to observe the increased accuracy of generated data output when given more detailed information in the prompt. Second, the need to construct a specific design prompt framework to maximize the consistency of the data output echoed in the engineering sector (White et al., 2023).

4 Conclusion

By investigating the usage of Gen AI as part of the DT process in a higher education environment, this study indicates that the most valuable areas of the technology are in preparing undergraduate students to learn about the interview, persona, and design ideation when building GUI wireframes. The tools effectively create a live interactive demonstrative session for the students learning the design process with conceptual UX, UI, and Visual projects. The graduate students, however, communicated that using Gen AI tools limits adding value to their learning experience, besides aiding them in generating contextual content for the UI mock-ups. On the contrary, most undergraduate students shared a positive aspect of using the technology: the effectiveness of generating preparatory research documents like interview questions, understanding the importance of user empathy through persona creation, experimenting with the ideation phase for constructing wireframes, and the inclusion of natural language to enhance the quality of typographical design feedback during the critique sessions. Gen AI tools such as ChatGPT enabled undergraduate students to quickly type in synthetic user information as prompts to generate interview questions to understand relationships between the attributes of a user and the types of questions to ask when conducting the interview session. Undergoing the DT's understanding phase of the projects, the Gen AI tool's time-saving efficiency allowed an instructor's quick demonstration of building personas with the students. During the DT's exploration phase, the students benefited from generating contextualized texts and multiple visual design artifacts using ChatGPT, Runway, and Dall-E 2 to receive detailed spatial layout feedback on their GUI design directions.

Because the influence of Generative AI technology on broader design curricula is challenging to quantify in statistical numbers, feedback sessions enabled this study to examine the students' learning experiences using the tools in the studio environment to identify areas of potential impact. Adapting the new tools was receptive, especially to undergraduates tackling GUI projects, and the technology has proven to be more effective as a demonstrative learning simulator than anticipated. Investigating other Generative AI tools and types of prompts relating to data output for a specific workflow will provide more insights into the impact and standardized technology usage in design education, especially for those in UX, UI, and visual design disciplines. As for now, the design curriculum in higher education could benefit from using Gen AI as an interactive educational tool, as experimented in the study, to enhance the learning experience for undergraduate students learning to understand user research and to explore conceptual GUI design solutions.

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