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The role of student motivation in integrating AI into web design education: A longitudinal study

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Abstract: Amidst the current wave studies of artificial intelligence (AI) in education, this longitudinal case study, spanning Spring 2023 to Spring 2024, delves into the integration of AI in the UI/UX web design classroom. By introducing both text-based and image-based AI tools to students with varying levels of skill in introductory web design and user experience (UX) courses, the study observed a significant enhancement in student creative capabilities and project outcomes. The utilization of text-based generators markedly improved writing efficiency and coding, while image-based tools facilitated better ideation and color selection. These findings underscore the potential to augment traditional educational methods, providing students with novel avenues for creativity and innovation. At the same time, the goal of this study was also to ascertain the factors that led to the adoption of AI tools in the educational workflow, specifically focusing on student major and background, thereby illuminating how AI can be tailored to meet diverse educational needs and foster a more adaptive and innovative learning environment. The findings reveal that students were more receptive to integrating AI tasks into their workflows when these tasks did not directly relate to their major field of study. For example, Computer Science students exhibited less resistance to using AI for selecting color palettes, a task outside their primary focus, compared to utilizing AI for coding. Additionally, the study observed a significant growth in both awareness and usage of AI tools among students throughout the duration of the research. This trend suggests an increasing incorporation of AI technologies into their standard toolkit, highlighting a broader acceptance and integration of AI in educational practices.

Keywords: AI adoption; workflow; UI/UX design; student resistance; technology integration

1. Introduction

The widespread adoption of generative artificial intelligence (GAI) tools like Stable Diffusion and Lensa.ai has not only captured the attention of social media users but also led to their widespread acceptance in the mainstream, as detailed by DelSignore [1]. Despite this growing popularity, traditional artists and designers have expressed considerable skepticism towards AI-generated art, voicing concerns over copyright infringement and questioning its artistic value [2–4]. This tension has been further exacerbated by recent legal cases that underscore the complexities of copyright law in relation to AI-generated artwork. A pivotal case occurred on 21 February 2023, when the U.S. Copyright Office made a significant decision regarding the comic book Zarya of the Dawn by Kris Kashtanova, which featured illustrations produced by the text-to-image AI program, Midjourney. The ruling granted copyright protection solely to the text and arrangement authored by Kashtanova, deliberately excluding the AI-generated images. This decision has sparked a debate on the implications of AI in the realm of artistic creativity, shedding light on both philosophical and practical

considerations concerning the place of these new tools in the creative process [5].

As the capabilities and accessibility of this technology continue to advance, the academic realm is facing growing concerns about the potential for widespread plagiarism, prompting some to advocate for a ban on its use in higher education [6,7]. Yet, with the advent of Web 3.0 and the impending rollout of 6G technologies—poised to significantly enhance the capabilities of the internet through improved processing power and 3D generative technologies—the integration of GAI into educational curriculums emerges as essential. Such integration is key to adequately preparing students for the evolving landscapes of web design, development, and UI/UX. Despite the apparent necessity, there appears to be a notable disinterest within the academic community toward investigating the practical integration of AI into educational practices. The focus largely remains on debating the theoretical and aesthetic disruptions caused by AI, rather than on developing concrete methodologies for its inclusion in coursework [8]. The examination of human authorship by Ajani within AI-generated content delves into the ongoing debate about the essence of "art"—whether it should be viewed primarily as a demonstration of skill or an expression of emotion. This discourse often juxtaposes the importance of capturing the human condition against showcasing technical skill in art [9,10], further complicating the dialogue on the role of these tools in education and creative industries.

The debate over the valuation of GAI and non-fungible tokens (NFTs) within the art world continues to evolve [11,12], yet the undeniable impact of AI on the creative methodologies of contemporary artists stands as a testament to its disruptive power [13]. AI art generators have ushered in a new era of creativity, offering artists unprecedented tools for innovation—ranging from novel color palettes and compositions to entirely new sources of inspiration and methods for iterative creation [14]. Despite these advancements, the exploration of its potential in art remains in its infancy, with critical and methodological frameworks for assessing AI-generated art still under development. The implications of GAI for web design and development have also not been fully explored. There is speculation that traditional coding may become obsolete, replaced by more intuitive drag-and-drop interfaces for website construction. However, human oversight will remain indispensable for refining AI-produced content and ensuring website functionality. This juncture raises fundamental questions about the future necessity of websites and underscores the significant influence the technology has on the fine arts and creative processes at large, marking it as a pivotal moment in the evolution of artistic and creative practices.

Building upon the insights gained from the Spring 2023 and Fall 2023 semesters, this longitudinal case study aims to delve deeper into the potential applications of both text-based and image-based generative AI content [15]. This study aims to deepen the understanding of the art and design process by computer science students and to enrich those with a background in art and design in their knowledge of coding. The study was driven by the objective to improve the aesthetic and creative copy capabilities of students enrolled in introductory-level web design and user experience (UX) courses, who exhibit a wide range of skills and experiences. The results have been promising, showing that the integration of AI tools into the web design and development workflow significantly enhanced the quality of final projects and reduced the instances of reported deficiencies. Notably, text-based generators were particularly effective in

boosting productivity and improving the quality of writing copy and code. In contrast, image-based generators were instrumental in facilitating ideation and color selection.

A departure from previous findings, the study observed an increased appreciation for AI tools among students, recognizing their utility in enhancing, rather than replacing, creative efforts. Specifically, within the realm of UI/UX, AI was seen to augment productivity rather than creativity per se. Prior research by our team highlighted a hesitancy among students who identify closely with creative disciplines—such as writing, digital art, and design—to fully embrace AI tools, fearing they might supplant their creative input or threaten their professional identity and ethical values. Addressing these concerns, the current study is set to investigate effective strategies for integrating generative AI tools into postsecondary curricula. It aims to reframe the perception of AI as a complement to, rather than a replacement for, the creative talents of students. The goal is to reassure students across various artistic fields that AI tools can enhance their skills and support their creative processes without undermining their unique contributions or ethical standards.

2. Literature review

The integration of generative artificial intelligence (AI) tools into the realm of contemporary art has ignited discussions on the legitimacy of AI-generated artworks and their influence on conventional artistic practices [11,16]. This transition to generative AI outputs introduces poststructuralist debates concerning the identity of the artist and the tangible essence of art [17]. This literature review seeks to explore the existing research and future directions in the study of AI in art. It will specifically examine the effects of social media and the digital landscape on artistic creation and perception, the intersection of fine art with algorithmic processes, and how these elements transform the production and appreciation of art. Furthermore, the metaverse is considered a disruptive platform, dismantling traditional barriers to art engagement and opening up novel avenues for artist-audience interaction. Finally, the review will delve into how the process of creative prompting can redefine the relationship between the creator and their work, employing a poststructuralist lens on meaning-making and the theory of reception to understand how content resonates with and is interpreted by viewers.

Although research exists on the utilization of AI in the art creation process, there is a noticeable gap in discussions about its practical applications, strategies, or workflows for artists and designers in their practice. Previous studies have largely delved into philosophical or theoretical aspects. For example, Coeckelbergh [18] resents a philosophical framework for discussing the capability of machines to engage in art creation. This framework explores fundamental questions regarding the nature of "creation", "art", and the concept of machines "creating art", proposing a fluid and subjective interpretation of creativity. It challenges the clear-cut distinction between human and non-human art, advocating for a view of technology as a collaborator in the creative process. Similarly, Mazzone and Elgammal [19] have worked on AI methodologies for recognizing artistic styles and identifying broad stylistic trends across art history. They call for a reassessment of the relationship between machine-generated and human creativity, suggesting that they operate in parallel,

complementing rather than competing with the emotional and social dynamics of human artistry. Tao [20] describes this synergy as the "actor network" of art, envisioning humans and machines as collaborative agents that enhance the creative capabilities of one another. This approach underscores the potential for a mutually beneficial relationship that leverages the unique strengths of both entities.

Conversations around the involvement of machines in artistic creation often extend to the broader question of whether the creative process itself can be considered creative when facilitated by technology. Ahmed [21] approached the subject of AI from a design-based perspective, transcending traditional arts and humanities disciplines. The author posits that the tangible manifestations of AI within media museums should not merely be interpreted as design objects but rather as mediums for design. Through an examination of interactive and immersive media installations, Ahmed suggests that AI's capability to materialize "immaterial humanistic characteristics" such as emotions, experiences, senses, and memories, warrants its consideration beyond being a simple product or conventional design element. The argument is made that the interactions and emotional responses elicited by AI-generated art contribute to the design narrative itself, positioning these responses as integral components of the design. This perspective challenges traditional views of AI in art, suggesting a reevaluation of its role. However, this discussion leaves untouched the contentious debate surrounding one of art's core attributes—creativity—thus leaving room for further exploration of AI's contribution to creative processes.

Discussions regarding AI-generated art frequently pivot to the notion of creativity and the debate over whether such works qualify as "true" art. Csikszentmihályi's [22] model delineates creativity as a process that encompasses a body of knowledge, a volitional agent, and the recognition of experts within a field. Expanding on this, Jennings [23] identifies three criteria necessary for an agent to be considered volitionally creative, emphasizing creative autonomy. This autonomy is seen in the ability of an AI system to operate independently from the initial directives of its programmers or operators, especially when generating art. Nonetheless, Ajani [8] counters by highlighting that creativity is inherently tied to an individual's ability, the accumulation of knowledge, and, crucially, the endorsement by field experts. This implies that for creativity to be recognized as such, it requires external validation, particularly from authoritative figures within the relevant domains of art and design. Thus, despite AI's capability to produce works independently, its "creativity" is contingent upon the acknowledgment and appraisal of experts in the field, suggesting that AI's role in creative domains is not inherently autonomous but subject to expert judgment.

The burgeoning field of AI-generated art underscores a burgeoning interest in the practical applications of generative AI tools for artists and designers. As these tools become increasingly ubiquitous, there is an emerging consensus on the necessity to forge new methodologies for creating and interpreting generative content. A pivotal focus lies in cultivating collaborative and co-creative processes that enable artists to synergize with the technology, thus enhancing the utility of the tools beyond their existing capabilities. As such, it is imperative for artists and designers to adopt a proactive stance towards understanding the potentialities and constraints of generative tools in art creation, aiming to embed them within their practice in ways that transcend

mere novelty. This necessitates the development of novel interpretative frameworks and evaluative criteria that acknowledge the intricacies of human-AI collaboration in the genesis of art. Such advancements could involve redefining the parameters for assessing the creativity and artistic value of generative works and innovating how these creations are presented to and experienced by audiences. Through an interdisciplinary approach that bridges art and technology, artists are positioned to significantly influence the trajectory of AI-generated art, unlocking novel avenues for creative exploration and discourse.

In light of this, the previous study conducted by Lively et al. [15] serves as a foundational step towards understanding how AI can be seamlessly integrated into the educational sphere, specifically within web design and UI/UX courses. The study aimed to empower web designers and developers with cutting-edge AI tools, enhancing the creative and aesthetic capabilities of students with diverse skill levels. The findings highlighted the efficacy of AI in mitigating skill gaps, with text-based generators boosting productivity and coding efficiency, and image-based tools facilitating creative ideation and color selection. Such insights underscore the potential of AI to significantly augment the educational experience, paving the way for a more inclusive and innovative approach to teaching design and technology. This case study's contribution to the discourse on AI in education and art underscores the need for continued exploration into the coalescence of creativity, technology, and pedagogy.

The literature thus explored in this review underscores the burgeoning interest and diverse applications of generative AI within the fields of art and education. While studies like those by Mazzone and Elgammal [19] and Coeckelbergh [18] have significantly advanced our understanding of AI's capabilities in mirroring and enhancing human creativity, they also reveal substantial gaps in practical applications and ethical considerations. Notably, the debate around AI's role in the creative process often hinges on philosophical and theoretical discussions, leaving a lacuna in empirical research that assesses the direct impact of these technologies in real-world educational settings. This gap is particularly evident in the lack of longitudinal studies that trace the progression of AI integration over time and its long-term effects on student learning and creative output. Furthermore, while existing research provides insights into the potential of AI tools to augment the creative process, there is a paucity of studies that explore how these tools can be effectively incorporated into educational curricula to enhance learning outcomes and student engagement, especially in diverse fields such as web design and UX.

Addressing these gaps, our current study employs a mixed-methods approach to not only observe the immediate effects of AI tool integration in web design and UX courses but also to track these effects over several semesters. By examining both the quantitative and qualitative impacts of these tools on students' creative capabilities and project outcomes, this study aims to provide a more comprehensive understanding of how AI can be tailored and implemented as a beneficial component of postsecondary education. Moreover, it explores the ethical dimensions of AI use, aiming to ensure that these technologies are used responsibly and inclusively to foster genuine creative enhancement rather than merely automating creative tasks. Through this approach, our study contributes to filling the identified gaps by offering new

insights into pedagogical strategies that can facilitate effective AI integration, thereby supporting a more adaptive, innovative, and inclusive educational environment.

3. Methods

This mixed-methods case study was designed to explore the integration of generative AI tools into postsecondary curricula, aiming to enhance student creative abilities across a range of artistic disciplines. Conducted over three semesters—Spring 2023, Fall 2023, and Spring 2024—the study engaged students from various creative fields, including creative writing, digital art, drawing, 3D design fundamentals, web design, and English composition. The research sought to investigate the pedagogical best practices for utilizing text- and image-based generative AI in web design and development, focusing on student perceptions, performance, and feedback, alongside instructor observations.

The class offered three distinct modes of attendance to accommodate the diverse needs and preferences of students: online, face-to-face, and hybrid. In the online mode, students engaged with course materials, lectures, and assignments entirely through virtual platforms, enabling remote participation from any location with internet access. This format facilitated flexibility for students who preferred or required a fully remote learning experience, allowing them to balance their studies with other commitments or overcome geographical barriers.

Conversely, the face-to-face mode provided students with traditional classroom instruction, where they attended in-person lectures, discussions, and practical sessions on campus. This mode offered opportunities for direct interaction with instructors and peers, fostering a sense of community and facilitating hands-on learning experiences that may be challenging to replicate in virtual environments. The hybrid mode blended elements of both online and face-to-face instruction, allowing students to choose between attending classes in person or participating remotely based on their individual preferences or circumstances. This flexible approach catered to the diverse needs of students, accommodating varying learning styles, schedules, and accessibility requirements. Through a combination of synchronous and asynchronous activities, hybrid classes offered the benefits of both traditional and online learning modalities, promoting engagement and collaboration while accommodating the realities of students' lives.

Participants were drawn from a private Midwestern college in the Saint Louis region, with the sample comprising 33 students in Spring 2023, 7 in Fall 2023, and 12 in Spring 2024. These participants included both undergraduate and graduate students majoring in diverse fields such as computer science, computer information systems, digital marketing, finance, game design, marketing, and art and design. They were enrolled in Web Design I—User Experience, a project-based course that emphasizes advanced HTML and CSS, JavaScript, frameworks, and libraries to delve deeper into web design with a focus on user experience through simulated client projects.

The demographic composition of the study participants offers insightful details into their academic and personal backgrounds. The cohort comprised undergraduate and graduate students with a varied distribution across academic years: sophomores and juniors each represented 26.32% of the participants, seniors accounted for 31.58%,

and graduate students made up 15.79%. Notably, there were no first-year students or participants identifying as "other" in their academic standing. The age range of the study group was predominantly young adults, with 78.95% falling within the 18–24 age bracket and 21.05% aged between 25–34. This distribution underscores the youthful demographic engaged in the study, highlighting the relevance of integrating modern AI tools in educational settings that resonate with younger generations.

Gender identity among participants was almost evenly split, with males constituting 52.63% and females 47.37% of the respondents. This near-equilibrium showcases the gender diversity within the study, suggesting a broad appeal of web design and AI tools across gender lines. The categories for non-binary/third gender and those preferring not to disclose their gender identity were not selected by any participant. Regarding ethnicity, a vast majority (94.74%) identified as non-Hispanic/LatinX, with a small fraction (5.26%) affirming Hispanic/LatinX identity. This demographic detail reflects the ethnic diversity of the student body engaging with AI and web design technologies. The racial and ethnic heritage of participants further illustrates diversity, with the following self-identified breakdown: 21.05% Asian, 31.58% Black or African-American, 5.26% Native Hawaiian or Pacific Islander, and 42.11% White/Caucasian. The collective diversity within this cohort underscores the wide-ranging appeal and applicability of AI tools across different racial and ethnic backgrounds. Regarding their student status, a significant majority (63.16%) were not international students, indicating a predominantly domestic student body, while 36.84% identified as international students, highlighting the global interest and applicability of AI in web design education.

The highest level of education attained by immediate family members varied, with a notable distribution across different educational achievements, reflecting a range of socio-economic backgrounds among the participants. This variation suggests diverse experiences and potentially differing perspectives on the integration of AI tools in their academic pursuits. Living arrangements of the students revealed that a majority (68.42%) were residential (living on campus), while 31.58% commuted from off-campus locations. This aspect of their demographic information may influence their engagement and interaction with the course and the AI tools employed within it.

One notable aspect of the assignments involved tasks related to logo design and AI-generated employees. In these assignments, students were tasked with leveraging AI tools to enhance their creative process and streamline design workflows. For logo design assignments, students explored the capabilities of AI-driven platforms to generate logo concepts, refine visual elements, and experiment with various design iterations (**Figure 1**). Additionally, assignments featuring AI-generated employees challenged students to conceptualize and integrate virtual personas into user experience designs (**Figure 2**). Through the use of AI-powered chatbots or virtual assistants, students gained insights into the potential applications of AI in enhancing user interactions and facilitating intuitive navigation within web interfaces.

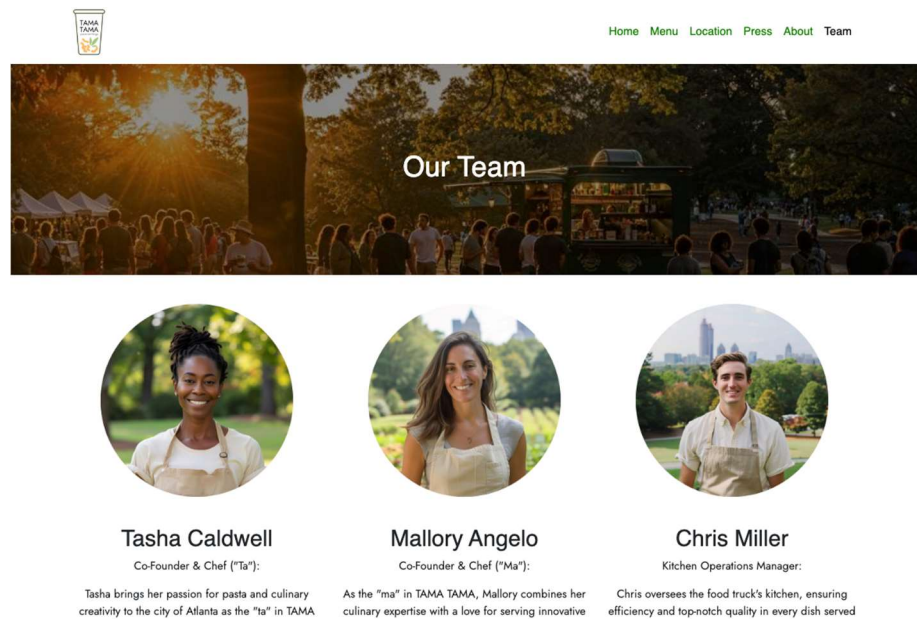**Figure 1.** Student animated logo example assignment.

Figure 2. Student example of AI-generated employees.

Throughout the course, AI tools were intricately woven into the fabric of several key assignments to enhance both the learning process and the creative outcomes of students. In one assignment, students utilized text-based AI generators like ChatGPT to create content for web pages, which allowed them to focus more on design and usability aspects while efficiently handling content generation. For logo design tasks, AI-driven platforms such as Midjourney were employed to generate initial logo concepts, which students then refined and iterated upon. This integration not only sped up the brainstorming process but also introduced students to a wide array of design possibilities that they might not have considered on their own.

Another innovative assignment involved the use of AI to create virtual employees. Students were tasked with designing and integrating AI-generated personas into simulated web interfaces to enhance user interaction. This assignment aimed to familiarize students with AI capabilities in creating interactive and responsive web elements, thereby improving their understanding of AI's potential in enhancing user experience design. Additionally, in group projects, AI tools were used to facilitate collaborative brainstorming sessions, helping teams to organize ideas and develop cohesive project plans through AI-assisted mind mapping software.

By embedding AI tools directly into these assignments, the course aimed to demonstrate the practical benefits of AI in real-world design scenarios, encouraging

students to experiment with and evaluate the effectiveness of AI in various stages of the creative process. This hands-on approach not only demystified AI technologies but also empowered students to leverage these tools in innovative ways to enhance their designs and creative problem-solving skills.

Data collection for this study was conducted using a two-pronged approach: quantitative surveys and qualitative interviews and focus groups. The surveys were designed to assess student attitudes towards AI tools, their self-perception as creatives, and their openness to incorporating AI into their creative workflows. The questions for the surveys were collaboratively developed by a team of course instructors and educational researchers to ensure they were comprehensive and relevant to the study's objectives. These questions were refined based on feedback from a pilot survey conducted at the beginning of the semester to address any ambiguities and better reflect the latest AI tools and issues, including new questions on AI usage, fears related to AI, and changes in perspective after using the tools.

The surveys were administered electronically via the university course management system at two key points: at the beginning of the course (pre-course survey) and at the end of the semester (post-course survey) to capture the evolution of student perceptions. To capture a range of responses, a five-point Likert scale was used, where "1" indicated strong disagreement and "5" indicated strong agreement, allowing students to express varying degrees of sentiment towards each statement presented. This method provided a nuanced view of the shifts in student attitudes and experiences over the course duration.

In addition to the structured surveys, qualitative data were gathered through interviews and focus groups. These were conducted at the end of the semester to delve deeper into students' subjective experiences and viewpoints. Interviews and focus groups provided a platform for students to discuss in more detail their thoughts and feelings about the integration of AI into their coursework. All responses, whether from surveys or interviews, were collected and managed using Qualtrics to ensure the privacy and anonymity of the participants, aligning with ethical standards for educational research.

The interview questions were meticulously crafted by the research team to explore themes related to AI integration that were not fully captured by the survey. This included more personal and detailed inquiries into student experiences with specific AI tools, challenges faced during their creative processes, and their thoughts on the future role of AI in their careers. These questions were refined through a pilot session with volunteer students from a previous cohort to ensure clarity and relevance.

Interviews were conducted individually with participants at the end of the semester, allowing for an in-depth exploration of each student's unique perspective. Each interview lasted approximately 30 to 45 min and was structured in three parts: an introduction to re-familiarize the participant with the purpose of the study, a main section consisting of open-ended questions to encourage detailed responses, and a closing section where participants could add any additional thoughts or clarify previous responses. All interviews were audio-recorded with the consent of the participants and subsequently transcribed verbatim to facilitate thorough qualitative analysis.

Focus groups, on the other hand, were utilized to gauge collective viewpoints and

stimulate discussion among students, which can reveal consensus or diverse perspectives on the use of AI in their coursework. Each focus group consisted of 4–6 participants and followed a semi-structured format, allowing for dynamic interaction among group members. These sessions were also recorded and transcribed, ensuring that the spontaneous and interactive nature of the conversations was captured accurately. Both the interview and focus group questions are detailed in the Appendix of this manuscript. The data from these qualitative methods provided rich insights into the students' experiences and perceptions, complementing the quantitative data from the surveys and giving a more holistic view of the impact of AI on educational practices in web design and UX.

The study also incorporated an evaluation of the artifacts created by students, including AI-generative content and final website projects, to assess learning outcomes and gather comprehensive feedback on the AI integration experience. This approach allowed for a robust analysis of the effectiveness of using AI in enhancing the creative process within web design courses. Data analysis involved both quantitative and qualitative methods. Statistical techniques were used to compare attitudes and usage willingness between different student groups, while thematic analysis was applied to the qualitative data to identify patterns and insights. The expected outcome of this study is to demonstrate that when generative AI tools are presented as enhancers of creative abilities rather than replacements, students are more likely to embrace them as valuable components of their creative toolkit, mitigating fears of replacement and fostering a more positive perception of AI in creative domains.

3.1. Statistical analysis of quantitative data

Quantitative data obtained from the surveys were analyzed using statistical software to identify trends, correlations, and significant differences between pre- and post-course responses. Specifically, descriptive statistics such as means, standard deviations, and frequency distributions were calculated to summarize the central tendency and variability of responses to each survey item. To assess changes in student attitudes and perceptions over time, paired-samples *t*-tests or Wilcoxon signed-rank tests were employed, depending on the distributional properties of the data. Furthermore, correlational analyses, such as Pearson or Spearman correlation coefficients, were conducted to explore relationships between variables, such as attitudes towards AI and self-perception as creatives.

3.2. Qualitative data analysis

Qualitative data gathered from interviews and focus groups underwent thematic analysis to identify recurring patterns, themes, and insights. This involved a systematic process of coding, categorizing, and interpreting the textual data to uncover underlying meanings and nuances. Initially, two independent researchers familiarized themselves with the transcripts through repeated readings to develop a coding framework. Next, they applied the coding framework to the data, assigning descriptive labels to segments of text that encapsulated key concepts or themes. Through iterative discussions and comparisons, discrepancies in coding were resolved, and consensus was reached on

the final set of themes. The identified themes were then organized into a coherent narrative, supported by illustrative quotes from participants to provide a rich and nuanced understanding of students' experiences and perspectives on AI integration in the educational context.

4. Results

The perception of AI among students prior to the commencement of the class presented a spectrum of apprehensions, with 38.89% of participants reporting no initial fears regarding the technology. A closer look reveals that a notable portion of the students held some level of concern, with 27.78% feeling a little fearful, 22.22% experiencing a moderate amount of apprehension, and a small fraction, 11.12% collectively, expressing significant fears ranging from "a lot" to "a great deal." These findings underscore the diverse sentiments towards AI, highlighting an initial mix of skepticism and comfort among students engaging with AI tools for the first time in an educational setting.

Upon integration of AI exercises into the design process within the class, a significant shift in perception was evident. An overwhelming majority, 83.33% of the students, appreciated the inclusion of AI in the design process, finding it to be a positive addition to their learning experience. This strong preference suggests that firsthand interaction with AI tools can effectively demystify the technology, fostering a more receptive and favorable attitude towards its application in creative tasks. Moreover, the practical benefits of AI exercises were highly recognized by the students, with an impressive 94.44% acknowledging the positive impact these tools had on their success in the course. Only a minimal 5.56% did not see a direct benefit, with nobody remaining undecided. This overwhelming endorsement of AI's utility in enhancing the design process and contributing to academic success highlights the potential of AI as a powerful educational tool. It suggests that when students are provided with opportunities to engage directly with AI, perceptions shift from apprehension to recognition of its value in augmenting their creative and technical capabilities.

The findings reveal how the integration of AI within the curriculum significantly transforms the educational journey for art and design students, diminishing initial apprehensions towards AI through hands-on involvement. This approach fosters a widespread recognition of the beneficial impact on educational outcomes concerning these tools. Specifically, art and design students come to appreciate the enrichment AI brings to their design process, preparing them with an advanced outlook on its role in their prospective careers. When examining the responses from art and design students about their initial fears regarding AI, the data indicates a nuanced range of sentiments. A slight majority, 42.86%, reported no initial fears, underscoring a substantial openness towards AI technologies within this group. Interestingly, 14.29% expressed a little apprehension, and a combined 42.86% conveyed moderate to significant concerns, with 14.29% experiencing a lot of fear, though none reported a great deal of fear. This distribution suggests that while a segment of art and design students held reservations about AI, a practical engagement with the technology could potentially alleviate these fears.

Regarding their enjoyment of AI exercises as part of the design process, 71.43% affirmed their appreciation, with a minority of 28.57% remaining undecided, indicating a generally positive reception of AI integration into their coursework. Notably, none expressed a dislike for the inclusion of AI, highlighting the potential for AI to complement traditional design methodologies effectively. Furthermore, a unanimous 100% of art and design students recognized the AI exercises as beneficial to their success in the course, with no students reporting otherwise. This universal acknowledgment underscores the value of integrating AI into design education, enhancing learning outcomes and equipping students with relevant skills for navigating future professional landscapes.

In contrasting the experiences of non-arts majors, such as those in computer science, with those of art and design students regarding the integration of AI into their coursework, several fascinating insights emerge. Non-arts majors began the course with a varied set of apprehensions toward AI. Approximately 36.36% of these students reported having no initial fears, mirroring a level of openness similar to that observed among the art and design cohort. Interestingly, an equal percentage (36.36%) felt a little fearful, while 18.18% experienced a moderate amount of fear, and a small fraction (9.09%) expressed a great deal of concern. Notably, none of the non-arts majors reported a high level of fear ("a lot"), suggesting a broader distribution of apprehension levels than seen in the art and design group.

The reception of AI exercises as part of the design process among non-arts majors was overwhelmingly positive, with a staggering 90.91% of students indicating their approval. This statistic surpasses the approval rate seen in art and design students, highlighting a potentially greater enthusiasm for AI's role in the educational process within non-arts disciplines. Only a minimal 9.09% remained undecided ("maybe"), and there were no indications of disapproval ("no"), underscoring the broad acceptance of AI across different academic backgrounds. Furthermore, the perceived benefit of AI exercises on course success was similarly high among non-arts majors, with 90.91% affirming the positive impact—closely aligning with the unanimous agreement observed among art and design students. However, a slight divergence emerges as 9.09% of non-arts students did not find the AI exercises beneficial, a contrast to the complete consensus within the art and design group.

Across the entire student population, the utilization of AI tools for assignments reveals a significant inclination towards integrating technology into their academic endeavors. A substantial 88.89% of students engaged with text-based AI generative content, such as ChatGPT, during the class. This high adoption rate underscores student eagerness to explore and leverage AI capabilities for text generation, pointing to a robust curiosity and acceptance of new technological tools in enhancing their academic work.

Similarly, the incorporation of AI for image-based content creation was notable, with 72.22% of the students utilizing AI applications like Midjourney, Jasper, Crayion, and DALLE-2. This indicates a considerable interest in experimenting with these tools to support visual aspects of their projects, showcasing student openness to embracing them across different creative dimensions. The commitment to incorporating AI into their academic projects was further evidenced by 88.89% of students using AI applications in their final projects. This widespread use highlights the perceived utility

and relevance of AI tools in completing substantial coursework. Among those who integrated AI into their projects, a varied approach was observed: 28.57% used text-based generative AI, 17.86% utilized image-based generative AI, and another 28.57% employed both types for content creation. Additionally, 25% of students used AI tools to find inspiration, indicating a multifaceted application of AI in the creative process.

Reflecting on the impact of AI on the quality of their final projects, 82.35% of students felt that the inclusion of AI applications had improved their work, with only 17.65% remaining uncertain about its effect. No students reported a negative impact, which suggests a predominant perception of AI as a beneficial tool in academic projects. This positive feedback underscores the potential of AI to not only enhance the efficiency and creativity of students' work but also to contribute to higher quality outcomes.

When comparing the overall student engagement with AI tools to the specific experiences of art and design students, nuanced differences emerge, offering insights into how various academic disciplines interact with technology in their learning processes. Among art and design students, 85.71% experimented with text-based AI generative content, such as ChatGPT3, closely aligning with the broader student body's engagement rate of 88.89%. This slight variance suggests a generally high level of curiosity and willingness to explore AI's capabilities across disciplines, with art and design students being slightly less engaged in text-based AI experimentation than their peers from other majors. The use of AI for creating image-based content saw a similar pattern, with 71.43% of art and design students utilizing such tools, reflecting the overall trend (72.22%) across all students. This demonstrates a consistent interest in leveraging AI for visual content creation, underscoring the technology's perceived utility in enhancing creative outputs, regardless of the student's field of study.

When incorporating AI applications into their final projects, art and design students reported a participation rate of 85.71%, mirroring their experimentation with text-based content. This rate is identical to the overall student body's engagement, indicating a uniform recognition of AI's value in academic projects across different disciplines. In terms of the specific uses of AI, art and design students displayed a balanced approach: 30% used text-based generative AI for content creation, 20% utilized image-based generative AI, another 20% employed both methods, and 30% used AI tools for inspiration. This distribution highlights the diverse applications of AI within the creative process, illustrating art and design students' versatility in employing technology to augment their creative endeavors.

Regarding the perceived improvement of final projects through the use of AI, 66.67% of art and design students felt that AI applications had a positive impact, with 33.33% remaining uncertain ("maybe"). This sentiment contrasts with the broader student feedback, where 82.35% acknowledged an improvement, suggesting that art and design students may be more contemplative or critical about the extent to which AI enhances their work.

When comparing the engagement and perceptions of computer science students with AI tools to the broader student body and specifically to art and design students, distinct patterns and attitudes emerge, illustrating the nuanced ways in which students across disciplines interact with AI technologies. Computer science students showed a high level of engagement with text-based AI generative content, such as ChatGPT3,

with 90.91% reporting usage during the class. This rate is slightly higher than the overall engagement (88.89%) and aligns closely with the participation rate among art and design students (85.71%). The marginally higher usage rate among computer science students may reflect a greater familiarity or comfort with AI technologies due to their field of study. The use of AI to assist in creating image-based content saw 72.73% of computer science students participating, which is nearly identical to the overall student engagement (72.22%) and closely mirrors the rate among art and design students (71.43%). This uniformity across disciplines suggests a broad recognition of the benefits AI tools offer in enhancing creative outputs, regardless of the students' primary focus on textual or visual content.

Similarly, a significant proportion (90.91%) of computer science students incorporated AI applications into their final projects, reflecting the general trend observed across all students and within the art and design cohort. This consistent high level of AI integration highlights its perceived relevance and utility in academic work across various disciplines Among computer science students who utilized AI, there was a diversified approach to its application: 27.78% focused on text-based generative AI, 16.67% on image-based generative AI, 33.33% used both, and 22.22% sought AI for inspiration. This distribution showcases a balanced engagement with both textual and visual AI tools, indicating a comprehensive exploration of AI's capabilities.

A notable 90.91% of computer science students believed that AI applications improved their final projects, with only 9.09% uncertain about its impact. This overwhelmingly positive response surpasses the satisfaction rate among art and design students (66.67% felt an improvement, with 33.33% maybe), suggesting computer science students might perceive a more definitive benefit from AI integration, possibly due to a more technical understanding of AI's capabilities. The comparison reveals that computer science students are slightly more inclined to engage with and recognize the benefits of AI in their coursework, compared to the overall student population and the art and design subgroup. This might be attributed to their technical background, which could facilitate a deeper appreciation for AI's potential in enhancing both the process and the outcomes of their academic projects.

In the realm of future use and prioritization of AI tool applications within the design process, students exhibit a strong inclination towards integrating AI into their future work, coupled with discerning perspectives on how these tools can best serve their creative endeavors. A significant majority of students, 88.89%, expressed a clear intention to use AI tools to enhance their future designs. This overwhelming consensus underscores a broad recognition of the value AI can bring to the creative process, signaling a shift towards more technologically integrated design practices.

Students were tasked with ranking the utility of AI applications in improving their design process, revealing nuanced insights into their perceived value. The ability of AI to "Suggest creative solutions" emerged as the top-ranked utility, with 50% of students prioritizing this application. This preference highlights a desire for AI to contribute dynamically to the creative phase, underscoring the importance of innovation in design. In contrast, "Shore up deficiencies in aesthetic background" and "Assist with writing code" were ranked lower, receiving the least prioritization. This indicates that while students see value in capability to enhance their technical and aesthetic skills, they place greater emphasis on the role of technology in fostering

creativity and generating new ideas. Notably, "Assist in creating new ideas" and "Help in organizing existing ideas" also ranked highly, further emphasizing student interest in leveraging AI for its creative and organizational potential. The rankings reveal a nuanced understanding of the diverse applications possible, from enhancing creativity to providing structure and clarity in the design process.

When asked whether AI art tools should be considered comparable to established digital imaging tools like Adobe Photoshop, opinions were divided. While one-third of the respondents affirmed this comparison, a significant half remained uncertain, suggesting ongoing debates about the functionalities and unique advantages of these examples in relation to traditional software. There is a strong consensus that AI tools should be permitted in aiding ideation and the formative steps of the design process, with 83.33% in favor. This suggests a recognition of the potential to inspire and inform the early stages of creative work, where conceptualization and initial development play critical roles. Similarly, a majority of students (83.33%) support the use of AI tools for completing and submitting final works for classes. This reflects a confidence in the ability to contribute meaningfully to comprehensive project development and finalization, highlighting its perceived reliability and efficacy.

In their design projects, students utilized AI tools across various stages, highlighting their versatility and applicability throughout the creative process. The majority (33.33%) relied on AI during the intermediate stage to write copy for websites, indicating its role in content creation and generation. Additionally, 27.78% used AI at the formative stage for ideation, demonstrating its effectiveness in sparking initial concepts and ideas. Another 27.78% reported using AI in other aspects of their projects, indicating its diverse applications beyond specific stages outlined in the survey. When asked about the benefits of AI exercises in the design process, a significant portion (66.67%) acknowledged their positive impact on mastering design processes. This suggests that integrating AI tools into design education can enhance student skills and proficiency in navigating creative challenges. Furthermore, when reflecting on areas where AI helped overcome shortcomings in web design, students identified various aspects such as ideation (18.03%), written content creation (16.39%), and coding (13.11%). These responses underscore the contribution of AI to different facets of design projects, from conceptualization to execution, highlighting its multifaceted role in enhancing design outcomes.

The final section of the survey involved free responses on the impact AI will have on future employment and general perceptions of AI use in creative fields. Many expressed an overall positive outlook. Responses like, "I think it is a great tool for a course such as web design," highlight the perceived value of AI as a powerful aid, empowering those involved in website creation. Others saw it in a broader context: "I think it is important to view it as a tool such as the internet; it is going to help us improve and work better." This highlights a mindset where AI is viewed simply as another tool, much like the internet itself.

Some responses indicated a neutral sentiment. Individuals acknowledged AI's potential while recognizing its current limitations: "AI is a help, like Google. It can't do everything a professional can." Others pointed to specific areas where AI is impacting traditional roles: "As a graphic designer, I can see AI is taking my job of designing logos and images." This suggests a measured assessment acknowledging

AI's influence but not necessarily viewing it as an existential threat. A recurring theme was mixed sentiment, reflecting both the possibilities AI presents and the anxieties about job displacement. One participant noted that "AI will both make jobs easier and make it easier to replace people…" This illustrates the simultaneous excitement and concern about the ability to streamline work but potentially reduce the need for human designers. Others echoed this, stating, "AI is intelligent, but it can't do everything a human can. It just enhances what we can do."

Understandably, some expressed a predominantly negative sentiment. The fear of being replaced was particularly stark: "Because AI is replacing everyone, especially when it comes to technology and web design, I feel like today AI can create a fully functional website, and it scares me." Others expressed a worry that AI might lead to a loss of authenticity, lamenting that "it won't have a genuine touch." Thus, the feedback reveals that there is no single, unified perspective on AI in web design. The technology inspires excitement, measured acceptance, trepidation, and even outright fear. As AI continues to mature, it's imperative that educators proactively address the topic, as suggested by a respondent: "AI is something that should be taught in class, and how to use it effectively. Rather than using it as an answer key." This ensures that the next generation of web designers can harness AI responsibly, shaping its use in an ethical and creatively empowering way.

Instructor observations

Throughout the course, a clear distinction emerged in student sentiments regarding AI, particularly among computer science majors. These students exhibited a heightened concern regarding the potential impact on future job prospects. International students also expressed a nuanced perspective, advocating for the parallel development of human skillsets alongside AI: "I think that since the 'cat is out of the bag' there isn't much point in trying to defeat or oppose it, but rather find opportunities to use it for creative and other purposes while emphasizing the need for continued development of human intelligence and skill."

Initially, a sense of apprehension towards AI tools was prevalent. However, hands-on experience led to a shift in perspectives. Students recognized the value of AI as a creative aid: "The applications I enjoyed using the most were the ones best used as a starting point for the creative process … helping me come up with ideas to start with whenever I would get stuck." This sentiment extended to art and design students, who came to view AI as an enhancement for their work: "I like to view AI as a tool that can enhance my creativity further. I see it as a guide, reference, and [source of] new creative ideas for future projects."

The instructor maintained a balanced approach throughout the course, emphasizing both embracing the potential and the continued cultivation of human intelligence. Throughout the course, the instructor implemented a multifaceted approach to emphasize the importance of both embracing the potential of AI and fostering the continued cultivation of human intelligence. This approach was manifested through various instructional strategies and learning activities designed to highlight the complementary roles of AI and human creativity in the field of web design and development.

Firstly, the instructor incorporated theoretical discussions and case studies that explored the capabilities and limitations of AI in creative endeavors. These sessions encouraged students to critically evaluate the role of AI as a tool for augmenting human creativity rather than replacing it entirely. By examining real-world examples and engaging in reflective discussions, students gained a nuanced understanding of how AI can enhance, rather than diminish, human intelligence and creative expression.

Moreover, practical assignments and projects were structured to promote a symbiotic relationship between AI-driven tools and human ingenuity. For instance, students were tasked with using AI-generated content or design suggestions as springboards for their own creative exploration, encouraging them to leverage AI as a source of inspiration while exercising their unique creative judgment and problem-solving skills. Additionally, collaborative activities such as group discussions and peer reviews provided opportunities for students to exchange ideas and perspectives, fostering a dynamic learning environment where human interaction and collaboration were paramount.

Furthermore, the instructor actively encouraged students to reflect on their own learning experiences and personal growth throughout the course, prompting them to consider how their interactions with AI tools had influenced their creative processes and professional development. By integrating self-reflection and metacognitive exercises into the curriculum, the instructor empowered students to take ownership of their learning journey and develop a deeper appreciation for the synergistic relationship between AI and human intelligence.

This balanced perspective seemed to assuage student fears, fostering a more constructive approach toward AI integration. Computer science students, in particular, recognized the practical utility of AI: "AI has been a huge help to me within my field of computer science … to come up with ideas for projects … AI is also a huge help with debugging code." Yet, this practicality is tempered with a call for better education on effective AI utilization: "more education on how technology works and how to use it is required."

Overall, the course provided a foundational understanding of the potential of the tools and the need for proactive adaptation. Lingering concerns about job displacement persist, particularly among CS students: "I'm scared of AI. I am a Comp Sci major, and a lot of entry-level jobs are being taken up by AI programs…" This highlights the need for continued dialogue on AI's impact within the field. Despite these concerns, the dominant sentiment shifted to one of informed acceptance and a willingness to adapt alongside AI: "[M]y current goal is to stay up to date on news so that I can be well-informed while also exploring the best application use cases." As such, the course succeeded in fostering a critical yet constructive understanding of AI amongst students. While anxieties persist, particularly within the sphere of computer science, the course served as a valuable introduction, helping students navigate the rapidly shifting technological landscape.

5. Conclusion

The integration of generative artificial intelligence (GAI) into the teaching and learning of web design and user experience (UX) presents both opportunities and

challenges for students and instructors alike. This study aimed to explore student perceptions and experiences regarding the use of AI tools in a web design course, with a particular focus on the different experiences of art and design and computer science majors. By employing a mixed-methods approach, combining quantitative survey data with qualitative instructor observations and student quotes, a comprehensive understanding of student attitudes towards GAI in web design education was obtained. The survey results revealed that the majority of students, especially computer science majors, had experimented with text-based AI generative content and utilized AI applications to aid in image-based content creation during the course. Furthermore, students expressed a high level of interest in incorporating AI tools into their future design processes, particularly for suggesting creative solutions and providing a scientific approach to design.

Instructor observations highlighted a shift in student attitudes towards AI tools over the duration of the course. Initial apprehension gave way to appreciation as students gained hands-on experience and recognized the practical benefits of AI in enhancing their creative process and problem-solving abilities. However, concerns about AI's potential impact on job prospects persisted, indicating the need for ongoing education and dialogue surrounding AI integration in design education. Moving forward, future research should focus on further investigating the pedagogical approaches to effectively incorporate AI tools into web design curricula, considering the diverse needs and perspectives of students across different disciplines. Additionally, longitudinal studies tracking students' career trajectories post-graduation could provide valuable insights into the long-term impact of AI education on professional development and industry adaptation. Moreover, exploring strategies to address ethical considerations and mitigate potential biases in AI tools used for design education is essential for promoting responsible AI usage in the field.

This study contributes valuable insights into the integration of AI tools in higher education, particularly within the realms of web design and UX. By examining student attitudes, experiences, and learning outcomes in response to AI integration, this research sheds light on the potential benefits and challenges of incorporating AI into creative coursework. For educators, the findings underscore the importance of adopting a balanced approach that combines the innovative potential of AI with the continued cultivation of human intelligence. This necessitates designing curricula that not only leverage AI tools to enhance learning and creativity but also foster critical thinking, problem-solving skills, and ethical awareness among students. Additionally, educators can draw upon the practical strategies and pedagogical frameworks identified in this study to effectively integrate AI into their own teaching practices, thereby preparing students for the evolving demands of the digital age.

For researchers, this study offers a foundation for further exploration into the intersection of AI and education, highlighting avenues for future inquiry. By delving deeper into the long-term impacts of AI integration on student learning outcomes, career trajectories, and ethical considerations, researchers can advance our understanding of how best to harness AI technologies in educational settings. Moreover, there is a need for interdisciplinary collaboration between educators, technologists, and social scientists to address the complex challenges and opportunities posed by AI in education comprehensively. By engaging in collaborative

research endeavors, researchers can develop innovative solutions and evidence-based recommendations to inform policy, practice, and pedagogy in the rapidly evolving landscape of AI-enhanced education. In essence, this study underscores the transformative potential of AI in higher education while emphasizing the enduring value of human intelligence in driving creative innovation and ethical decision-making. By embracing a holistic approach that integrates AI tools with human-centric pedagogy, educators and researchers can collectively pave the way towards a more adaptive, inclusive, and ethically grounded educational landscape in the digital age.

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Appendix

Survey instrument

- Did you have fears about AI before the class started?
- Did you like the AI exercises being part of the design process in class?
- Did you find the AI exercises being part of the design process beneficial to your success in the course?
- Did you experiment with text-based AI generative content (automated essay generators) such as ChatGPT3 during the class?
- Did you utilize any AI applications to aid in the creation of image-based content during class? (e.g., Midjourney, Jasper, Crayion, DALLE-2)
- Did you use AI applications in your final project?
- If you used AI applications in your final work, do you feel that it improved the final project?
- After using the AI tool, can you see yourself using something like this to improve your designs in the future?
- Please rank from most to least the ways in which you feel AI applications may be used to improve your design process.
- Do you feel AI art tools should be considered comparable to Adobe Photoshop and other digital imaging tools?
- Do you feel students should be able to use AI tools to assist in ideation and formative steps in the design process?
- Do you feel students should be able to use AI tools to complete and submit final works for classes?
- Where did you rely on AI as part of your design process?
- Did you find the AI exercises being part of the design process beneficial to your mastery of the design process?
- If AI helped you to overcome any shortcomings that you might have had in the process of designing and developing web pages, select the areas below that benefitted from its use.
- Why did you use AI for certain tasks and not others?
- After using AI tools in this class, has your perception and/or fear of AI in general changed?
- Do you have fears that AI will take your job in the future?