Redefining Architectural Pedagogy: Navigating the Integration of Midjourney AI in Design Education

NESRINE MANSOUR
South Dakota State University

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This paper examines the integration of Midjourney AI in architectural education, aimed at navigating digital pedagogy. By reviewing a case study from an Architecture studio, the paper seeks to understand the benefits, challenges, and ethical implications of embedding AI technologies in architectural learning. Traditional architectural education has primarily focused on design principles, technical skills, and historical context. However, introducing AI presents an opportunity to expand the pedagogical scope, enabling students to engage with emerging concepts and techniques. A Design/Research studio, titled "The Sacred in Between: Architectural Explorations of Sacred Spaces," enabled students in exploring the concept of "the sacred" through digital and physical artifacts, employing AI as a novel tool. Utilizing Midjourney AI, students synthesized relevant readings and discussions to create imagined scenes, with an extensive array of images aiding the initial design process. Additionally, reflections on encounters with AI spurred a class debate on AI's influence on architectural education and the profession.

A core discussion emerged around the potential decrease in human agency and creativity due to an overreliance on AI, which may lead to a standardized design approach, thus inhibiting individual expression and innovation. The ethical dimension of integrating AI into the curriculum was also explored, with concerns regarding authorship. Advocacy for a critical understanding of AI's social and ethical implications was emphasized. The incorporation of AI in architectural education opens avenues for curriculum diversification, design exploration, and interdisciplinary collaboration, especially in a digital-centric society propelled towards the Metaverse. However, preserving human agency, addressing ethical issues, and equipping students for a dynamic professional landscape are imperative. This integration encourages architectural institutions to empower students in navigating complex design challenges amid rapid technological changes, urging a re-evaluation of architecture's manifestation in digital realms as discourse increases in this domain.

INTRODUCTION

The integration of Artificial Intelligence (AI) diffusion models, exemplified in this paper by Midjourney AI, into architectural education and practice marks a significant shift in design pedagogy. Midjourney AI refers to a specific application of AI that aids in bridging initial design ideas to final architectural concepts by translating abstract ideas into visual representations. This is part of the broader framework of diffusion models, which describe the mechanisms of how innovative technologies like AI are adopted and integrated within a community, in this case, the architectural design studio.

This exploration is anchored in the necessity to cultivate a resilient, adaptable learning environment that can evolve in tandem with the fast technological advancements emblematic of the contemporary digital era. As educators across various disciplines navigate the integration of AI tools in the classroom, it is crucial to examine its impact from several vantage points: pedagogically, as a supplement to traditional design tools, the motivations driving its adoption, and the ensuing recommendations for design studios. This paper endeavors to delve into the application of an image-generating AI tool in architectural education, aiming to elucidate the prospective benefits, challenges, and broader implications of this technological integration.

HISTORICAL CONTEXT AND CURRENT DIRECTIONS

Historically, architectural education has been a field where design principles, technical skills, and historical knowledge merged. The advent of Artificial Intelligence (AI) incites an even broader pedagogical scope, inviting an exploration into innovative design methodologies. While the literature on diffusion models within architectural education is still burgeoning, architects, designers, educators, and students continue to explore the capabilities of the diverse tools evolving daily.

The convergence of Artificial Intelligence with art and architectural design has unfolded as a rich field for exploration, enabling new horizons in computational creativity and design methodologies. The connection between art and computation dates back to the 1960s, setting the stage for modern-day intersections of AI, art, and architecture (Mazzone and Elgammal 2019). A pivotal juncture was reached with the emergence of Generative

Figure 1. Digital Collages: 'The Sacred and Profane' Series, Crafted by Students Using Segments of Midjourney AI-Generated Images Combined with Photo Manipulations By Shylo Hilbert, Matthew Woldt, and Anna Hamling.

Adversarial Networks (GANs) around 2017, marking a new era in generative art and extending the bounds of AI-powered image generation in both artistic and architectural realms (Leach 2022; del Campo and Leach 2022). Scholarly dialogues around GANs highlight their potential in generating novel images, inclusive of architectural conceptual designs, thereby augmenting the design process with AI-driven creativity (As, Pal, and Basu 2018). The year 2022 witnessed a surge in AI platforms able to translate textual prompts into visually engaging images, presenting a fresh avenue for conceptualizing architectural ideas through textual inputs (Ploennigs and Berger 2022).

The use of AI within architectural education has transitioned from rudimentary design tools to robust instruments, catalyzing notable advancements within the field. Various publications have elaborated on this evolution, offering both descriptive and analytical insights into AI's applications in architecture, bridging gaps in existing knowledge while fostering a nuanced understanding of AI's impact on architectural practices. The literature echoes a growing interest and significant headway in bringing together AI with architectural education. However, a vast scope remains for further research to comprehensively discern the long-term implications and to formulate frameworks guiding the effective assimilation of AI within architectural pedagogy as well as practice. The narrative suggests a paradigm shift where architectural design and education are becoming more accessible and instantaneous, thanks to AI technologies (Bölek, Tutal, and Özbaşaran 2023). This narrative underscores decades of advancements that have enticed both artistic and architectural communities, framing a vivid tableau of AI's role in reshaping creative expression and design paradigms (Nast 2023). The discourse should extend to encapsulate broader explorations in diffusion models like Midjourney AI, Stable Diffusion, Dall-E and others. This study uses Midjourney AI as a tool to visualize and understand sacred architectural connections in the architecture studio, two months after the tool became available to the public.

PEDAGOGICAL STRUCTURE

Informed by the data and insights harvested from the Architecture Design and Research studio, this section outlines the analytical framework utilized to examine the integration of AI in the architecture studio.

In the academic years of Fall 2021 and 2022, two Research/ Design Studios and Research labs were created as part of a new curriculum. The stacked studios encompassed a diverse student body ranging from third- and fourth-year undergraduates to first-year graduate architecture students. This educational setup provided a platform for students to immerse in a collaborative and systematic exploration of architecture, guided by topical investigations stemming from contemporary issues present in the assigned faculty research and creative endeavors. The primary focus in this case was on the exploration of sacred architecture, encapsulated in the studio titles "The Holy Light: A Spiritual Journey Through Sacred Architecture" and "The Sacred In Between: Architectural Exploration of Sacred Spaces."

These studios encouraged students to explote the concept of "the sacred" through the creation of digital and physical artifacts, thereby unraveling the intricacies of sacred spaces and their alignment with diverse spiritual practices. Emphasizing 'Light' as the essence of the studio's theoretical and practical approach, students delved into the interplay between space, place, architecture, and experience. The overarching question was: how can architecture evoke a spiritual or transcendent experience?

Through a combination of various readings, lectures, class discussions, digital collages, design, model making, and written documentation, students engaged in dialogues and debates unraveling the nature of 'the sacred.' They applied phenomenological, interpretive, and analytical lenses to architectural quandaries, further delving into architectural analyses and placemaking exercises spotlighting the role of light in evoking spirituality. This led to the design of inter-faith and meditation spaces, enhanced by guided meditation exercises in natural

Figure 2. Course Syllabus Cover Page Generated by Midjourney AI. By Author

contexts and a field trip to an Abbey—a tangible exploration of sacred architecture.

In the summer of 2022, the release of diffusion models opened up avenues for a wide audience to convert text into captivating visuals. Given this advancement, integrating such tools into the teaching of nuanced topics like the sacred became an intriguing proposition. "The Sacred in Between" design research studio was organized into three distinct units, each encompassing a variety of tasks and activities undertaken both individually and in groups. The introduction of Midjourney AI commenced in the first unit with the creation of digital collages, and its application was continued through subsequent studio tasks, as agreed upon collectively by the instructor and the students (Figure 2)

PROJECT BASED LEARNING

The three pivotal projects were devised to explore surreal transcendence through digital collages, analyze transcendence and light, and design a meditative/reflective space. In the first project, students looked into the dichotomy between the sacred and the profane using digital collages. Employing the back then new Midjourney AI tool, they generated imagery representing these dichotomies, in a process dubbed as "sketching with words." This innovative approach allowed students to leverage AI for a deeper understanding and articulation of their conceptual syntheses (Figure 1).

The subsequent group-oriented project propelled students to examine sacred and spiritual buildings, focusing on their interplay with nature and sacred characteristics. Through a case study methodology, they explored the realm of transcendence in architecture, guided by a matrix curated by a consortium of thirteen architects (Ardalan and et al 2014). The matrix, carried out from 26 case studies, delineated fourteen conditions potentially conducive to transcendent architecture, including Context, Cosmos/Nature, Hidden/Manifest Experience, Light, Luminous Program, Materiality/Tectonics, Mathematics (Geometry), Motion (Access, Ritual, Path), Axis, Scale, Sound, Space/Form, Time, and Unity. Students embarked on a journey of analyzing various sacred buildings across different faiths, exploring transcendence by examining the outlined fourteen conditions.

In the concluding project, students were tasked to design a meditative/reflective space, using all the information they have accumulted throught the previous tasks, emphasizing the essence of sacred architecture with light as the cardinal material to invoke contemplation and spiritual transcendence.

Across all projects, the utilization of the AI tool played a pivotal role in both the generation of ideas and visual implementation, showcasing a convergence of narratives and inspirations. The dynamic interaction between AI and the students' creative process demonstrated how technology can serve as a catalyst in not only conceptualizing but also visualizing complex themes such as the sacred. Through these projects, students didn't merely learn to use AI as a tool, but rather engaged with it as a collaborative entity, enriching their exploration and understanding of sacred architectural realms.

LEARNING OUTCOMES

Within the framework of the sacred architecture design and research studio, students embarked on both individual and collective explorations of the sacred, harnessing the capabilities of Midjourney AI. They employed established definitions as well as their unique interpretations and synthesis of related literature as prompts for the AI program to craft imaginative scenes. This endeavor yielded a variety of Midjourney images. From this exploration, students produced digital collages, integrating parts and pieces from hundreds of generated images (Figure 3). The process entailed training the machine by refining their textual prompts, which in turn, enhanced the expression of their ideas. Notably, the Midjourney AI was utilized to create insightful diagrams analyzing transcendence and light in various sacred buildings, significantly aiding in visualizing their matrices and research more effectively.

In the final task of designing a meditative space, AI emerged as a valuable ideation tool during the early design process. The ideation spanned beyond mere form and shape to encapsulate materiality, colors, light quality, sources of light or openings, and circulation among other strategies. The amalgam of generated images facilitated a convergence of collective ideas among
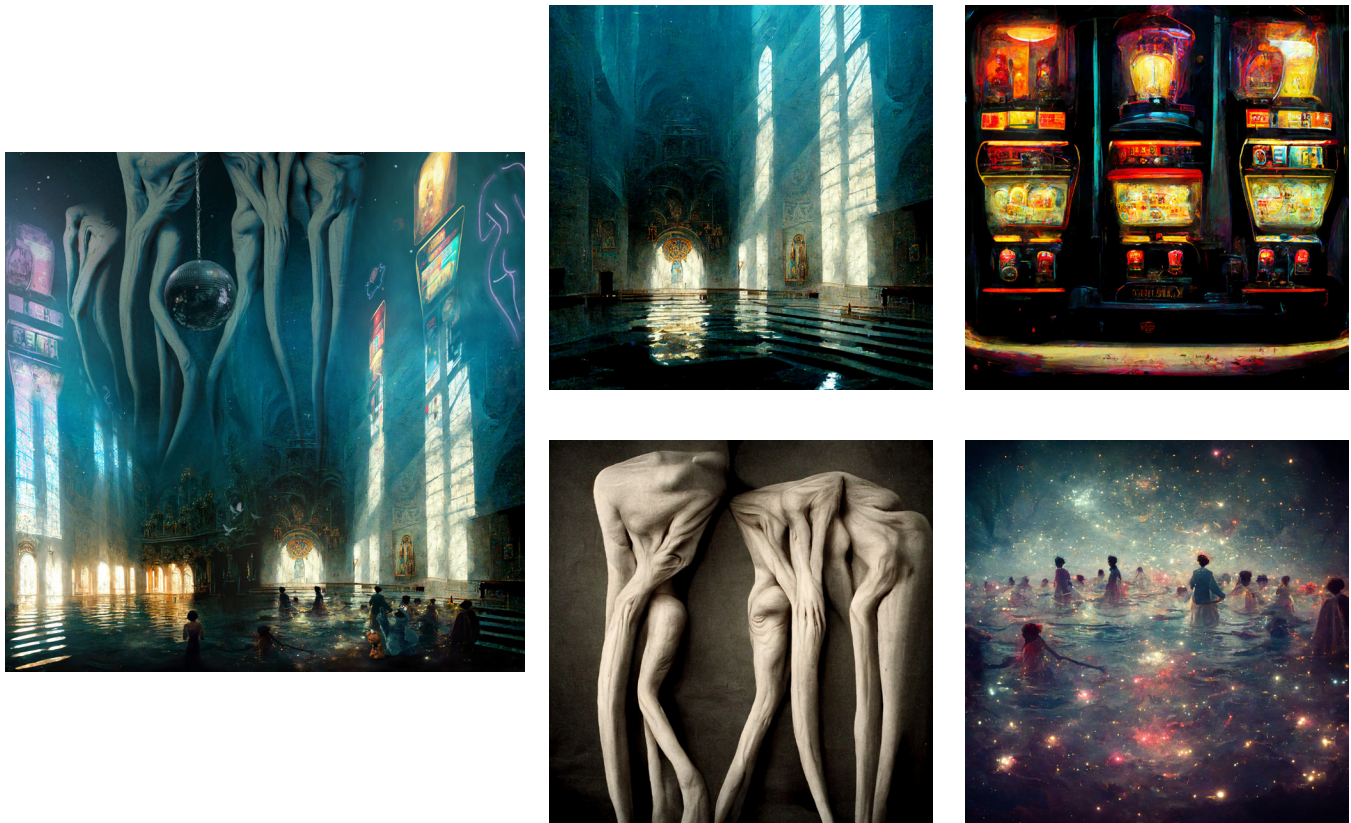
Figure 3. Neon Desecration Digital Collage. Composite Image on the Left Created from Multiple Midjourney AI-Generated Samples Displayed on the Right. By James Van Westen

teams, which were further explored through the creation of conceptual models and architectural drawings.

The use of AI, particularly Midjourney AI, in the architectural studio elucidated a rich, interactive learning environment where students could delve deeper into the abstract concept of the sacred in architecture. It became evident that AI served not merely as a tool, but as a collaborative partner in the learning journey. By interacting with AI, students refined their ideas, visualized complex concepts, and were able to manifest their understandings into tangible designs and models. The iterative process of training the AI, generating visuals, and refining ideas based on the visual output engendered a conducive learning space for exploring and understanding intricate architectural themes. The outcomes underscore the potential of AI as a powerful pedagogical asset in architectural education, fostering a dynamic interface between conceptual understanding and visual expression. Through this symbiotic engagement with AI, students were not only able to better visualize their ideas but also to broaden their analytical and creative horizons in understanding and interpreting sacred spaces within architectural realms.

DATA COLLECTION

The data collection was conducted through a multi-dimensional approach, aiming to gauge students' experiences and insights on the integration of AI in architectural education and practice. The initial phase involved a structured debate, wherein students articulated the impacts of AI on architecture, based on their ethical reflections following a 3-week hands-on engagement for the first time with the new AI tool. This debate catalyzed critical thinking and furnished qualitative data on varying perspectives regarding AI's role in architecture. Further, a methodological inquiry was executed through a questionnaire entailing 8 open-ended questions, providing a platform for students to reflect on their experiences, the utility, and the influence of AI tools on their design processes, and its potential application in their future academic and professional pursuits. This holistic data collection, leveraging debates, questionnaires, and ongoing class discussions, enriched the comprehension of AI's potential to augment architectural pedagogy, diversify the curriculum, and instigate critical discussions on ethical and professional implications.

DISCUSSION

The narrative summarized in the data collected presents a multifaceted tableau, unveiling the dynamic impact of Artificial Intelligence (AI) integration within the architectural studio, marking a nuanced shift in design pedagogy. This discussion draws upon the feedback from students participating in the Fall 2022 Research Studio, shedding light on the experiential outcomes induced by the incorporation of AI image generation
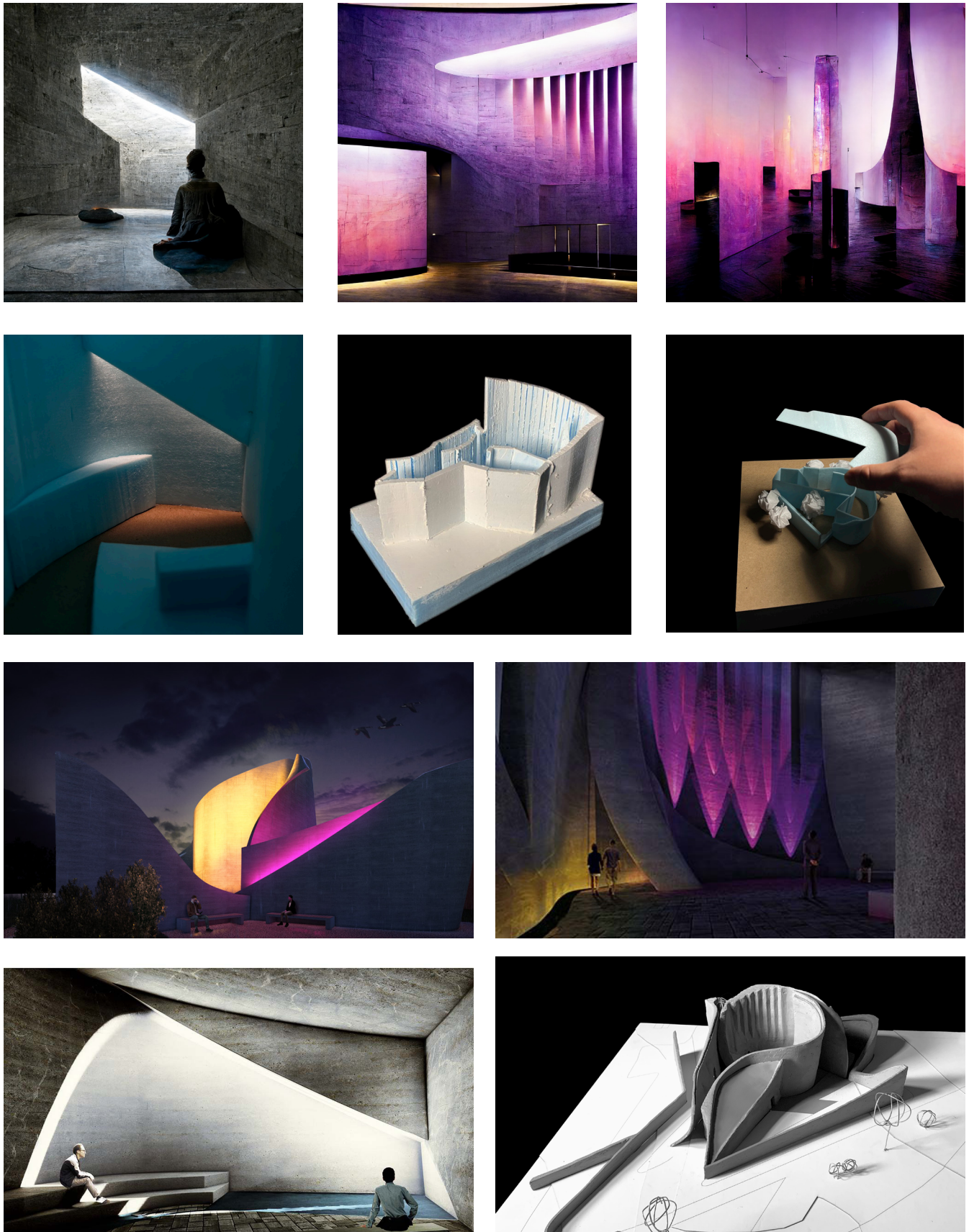
Figure 4. Meditative Space: An Architectural Journey from AI-Assisted Ideation through Conceptual Models to Final Exterior and Interior Renderings. By James Van Westen, Matthew Woldt, and Tylan Bear.

tools within the curriculum. The results delineate the strengths and challenges of AI, the pedagogical implications, and the ethical concerns that emerge from the digital symbiosis between AI and architectural pedagogy. The results are presented as follow.

Amplifying creative perspectives: a major strength of AI, as echoed by students' feedback, is its capacity in expediting the creation of design ideas. Students highlighted the remarkable efficiency of AI in spawning a multitude of design conceptualizations. This swift ideation not only propels the design process forward but also broadens the spectrum of design explorations during the early phases of a project. Furthermore, AI surfaced as a reservoir of inspiration, especially during moments of creative block. It was perceived not as a replacement for human creativity but as a catalyst, driving students into uncharted design realms and fostering a mindset of creative ingenuity.

Navigating the learning curve: despite AI's robust capabilities, its integration into the classroom brought forth challenges. A prominent theme that emerged from the feedback was the steep learning curve associated with mastering the tool. This underscores the exigency for an early and thorough orientation to effectively harness the potential of AI. An adjacent concern was striking a balance between dependency on AI and nurturing independent creative flair. The tendency for over-reliance on AI, due to its efficiency, raised concerns regarding the possible eclipse of students' intrinsic creativity.

This combination of challenges delves into the pedagogical narrative, the imperative to craft a learning environment where AI serves as a facilitative tool rather than a crutch. The pedagogical design should motivate students to be active agents in the design dialogue, rather than passive recipients of AI-generated outputs.

Ethical considerations: The fusion of AI within architectural education also kindles ethical consideration. A main concern is the potential overshadowing of personal design input by AI-generated designs. The allure of AI might seduce students into a path of least resistance, where it becomes the primary design agent, relegating students to mere curators which in return questions authorship. This scenario not only undermines the educational essence of the design process but also evokes questions concerning the originality and authenticity of the design outcomes.

The growing integration of AI in architectural studios signifies a pivotal moment in design pedagogy. While the strengths of AI—rapid ideation and inspirational creativity—cement its value, the key to its fruitful integration lies in judicious utilization and efficient regulations. As we venture into this technological juncture, the responsibility is on educators to thoughtfully embed AI within the curriculum, ensuring it augments rather than usurps the foundational ethos of architectural education.

Pedagogical resonance of AI: the digital integration heralded by AI has undoubtedly altered the educational landscape, pushing students into a dual realm of traditional design methodologies and AI-augmented design exploration. The discourse underlines the importance of early immersion and adept orientation to smoothen the learning curve. Nonetheless, the advent of AI also foregrounds a nuanced pedagogical conundrum: fostering a balance between dependency on AI and nurturing independent creativity. The feedback articulates this sentiment, accentuating the necessity for structured activities that promulgate autonomous design thinking amidst the appeal of AI.

The bigger narrative of AI portrays it as a complement rather than a replacement for traditional design methodologies. Its capability for rapid idea generation proves its potential as a formidable tool for expansive design exploration. The incentive for digital integration emanates from AI's promise to stretch design range, acting as a stimulus towards uncharted design realms and novel conceptualizations. The efficiency it permeates within the design process liberates valuable time, affording students the luxury to delve deeper into specific design nuances.

Figure 5. Comparative Visualization: Left - AI-Generated Geometry, Color, and Light Analysis of a Mosque; Right - Inspired Light Box Model By Samuel Kruger.

This paper encapsulates the essence of AI's role in not only broadening design horizons but also in enriching the pedagogical landscape of architectural education.

CONCLUSION
The study of an AI-enhanced architectural studio unveils a nuanced transition in design pedagogy, reflecting a progressive stride towards merging further digital tools within education. The extensive capabilities of AI harbor the potential to enrich

the architectural learning paradigm significantly. However, the responsibility directly falls on the shoulders of educators to orchestrate an integration that accentuates, rather than eclipses, the pedagogical approach. By leveraging the strengths of AI and confronting the challenges it presents, architectural education can embark with assurance into this realm, fostering future architects adeptly primed for the forthcoming challenges.

This venture into the world of AI and diffusion models within architectural education inaugurates an innovative epoch of design exploration and interdisciplinary dialogue. It elicits a prudent critique of ethical dilemmas and the imperativeness of preserving human-centricity in the design process. The discourse also points towards substantial avenues for future research, accentuating the necessity to investigate harmonizing technological ingenuity with human intuition and focusing on the ethical implications of AI within the architectural education and profession.

As architectural education stands at the cusp of this technological juncture, the goal is for educators to craft a judicious blueprint for AI integration. Emanating from the feedback, a few pivotal recommendations crystallize, each carrying a potential method to enhance the synergy between AI and architectural pedagogy:

1.Early Acclimatization: Initiating an early familiarity with AI tools right at the beginning of the course could pave the way for a productive interaction throughout the academic term. Practical steps could include introductory workshops or tutorials that demystify AI tools, thereby laying a robust foundation for forthcoming engagements.

2.Engagement-centric Activities: Curating a curriculum filled with activities that compel students to remain in charge of the design dialogue is important. This could encompass projects that mandate a collaborative design approach, intertwining AI-generated insights with independent creative thinking. For instance, a project could require students to generate initial design concepts independently, then refine or expand upon these ideas utilizing AI tools, ensuring a balanced fusion of human creativity and AI-generated insights.

3.Ethical Discourses: Infusing the curriculum with dialogues that analyze the ethical facets of AI is vital. Regular discussions or debate sessions could be instituted, where students could scrutinize topics like design originality, authenticity, authorship, intellectual property, and the ethical ramifications of AI-assisted design. Furthermore, case study analyses of real-world scenarios where AI's ethical dimensions come in play could provide practical insights and foster a robust ethical understanding. By adhering to these recommendations, architectural education can navigate through this digital transition with a balanced approach, ensuring that the AI-augmented studio serves as a catalyst for enriched learning and innovative design exploration, whilst retaining the core ethos of architectural education.

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