

Integrating Artificial Intelligence in Architectural Education: Final-Year Graduation Project Case Study

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Abstract:

As artificial intelligence (AI) rapidly transforms creative and professional sectors, architectural education is increasingly engaging with AI technologies to reshape pedagogical models, especially within final-year graduation design studios. This paper explores the revolutionary potential of AI in architecture education, focusing on its ability to enhance design ideation, streamline critique processes, personalize feedback, and standardize evaluation measures. The paper assesses the incorporation of AI-assisted technologies, including Midjourney, DALL·E, ChatGPT, and parametric simulation platforms in graduating design studios through a case study at the Higher Institute of Engineering – Al Shorouk Academy during the 2024–2025 academic year.

The study compares traditional and AI-enhanced workflows across student groups, measuring outcomes in creativity, environmental performance, and clarity of communication. The results show that AI-enabled design projects demonstrated higher levels of innovation and improved environmental performance metrics, while accelerating iteration cycles. Beyond measurable metrics, AI integration enriched students' conceptual exploration and enabled faculty to focus more on high-level mentorship. Based on this institutional case and broader theoretical frameworks, the paper proposes a future model for integrating intelligent systems into architectural design studios. The findings suggest that AI can be an effective collaborator in shaping the studio's environment, encouraging equity, creativity, and preparedness for a future of digital architecture, provided that it is paired with ethical and pedagogical supervision.

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References:

- 1- Androniceanu, A., & Burlacu, C. (2017b). [Details not specified; related to AI promoting equity in design education].
- 2- Bostrom, N., & Yudkowsky, E. (2014). The ethics of artificial intelligence. In K. Frankish & W. Ramsey (Eds.), *The Cambridge Handbook of Artificial Intelligence* (pp. 316–334). Cambridge University Press.
- 3- Burry, M. (2016). *Scripting cultures: Architectural design and programming*. Wiley.
- 4- Celani, G., & Vaz, C. E. V. (2022). Artificial intelligence and architectural education: Challenges and opportunities. *International Journal of Architectural Computing*, 20(1), 55–68. <https://doi.org/10.1177/14780771221075118>
- 5- Clayton, M. J., Johnson, R., & Song, Y. (2020). Intelligent design interfaces for architectural education: Integrating AI in student feedback and assessment. *International Journal of Architectural Computing*, 18(4), 392–406. <https://doi.org/10.1177/1478077120970532>
- 6- Donath, D., & Seidel, J. (2019). Towards an AI-supported design process in architecture education. In *Proceedings of the 37th eCAADe Conference* (pp. 343–352).
- 7- Gao, T., Penzes, B., & Kensek, K. (2022). The future of artificial intelligence in architectural design: A review. *Automation in Construction*, 136, 104166. <https://doi.org/10.1016/j.autcon.2022.104166>
- 8- Garcia, M., & Lee, J. (2022). AI-mediated evaluation in design education: Toward objective and consistent assessment. *Journal of Architectural Education*, 76(1), 45–59.
- 9- Gomedé, S., et al. (2018). [Details not specified; relates to types of AI].
- 10- Gössling, S., Hall, C. M., & Scott, D. (2021). *The AI disruption in education: Balancing innovation and mentorship*. Springer.
- 11- Grosz, B., & Stone, P. (2018). *Autonomous robots in education: Integrating AI with student interaction*.

- 12- Haseski, E. (2019). Deep learning for architectural design: Extracting complex patterns from unstructured data. *International Journal of Architectural Computing*, 17(3), 212–229.
- 13- Hillier, B., et al. (2015). [AI in higher education: personalizing learning and supporting complex systems].
- 14- Hiran, A. (2021). Automation and productivity: Reducing human intervention in industry. *Industrial Engineering Journal*, 35(4), 103–115.
- 15- Holmes, A., Bialik, M., & Fadel, C. (2021). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign.
- 16- Jabi, W. (2013). *Parametric design for architecture*. Laurence King Publishing.
- 17- Lee, J., & Kim, J. (2022). Generative design using machine learning: A review of methods and applications in architecture. *Frontiers of Architectural Research*, 11(2), 278–292. <https://doi.org/10.1016/j.foar.2021.06.004>
- 18- Manika, D., et al. (2021). [On AI as a co-educator augmenting teacher roles].
- 19- Naboni, E., Paoletti, I., & Saxena, A. (2019). *Advanced environmental design: Global principles for sustainable architecture*. Springer.
- 20- Oxman, R. (2017). Thinking difference: Theories and models of parametric design thinking. *Design Studies*, 52, 4–39. <https://doi.org/10.1016/j.destud.2017.06.001>
- 21- Pedro, F., et al. (2020). [Describing dual-instructor model with AI and human educators].
- 22- Popenici, S. A. D., & Kerr, S. (2017). Exploring the potential of AI in higher education. *Research and Practice in Technology Enhanced Learning*, 12(1), 1–13.
- 23- Rodriguez-Hernandez, A., Garcia, J., & Perez, L. (2021). Robotics in architectural education: Bridging digital fabrication and construction automation. *Automation in Construction*, 127, 103691.
- 24- Smith, L., & Brown, T. (2022). AI-enabled feedback loops and constructivist learning in architectural studios. *Computers & Education*, 179, 104432.
- 25- Thompson, E. M. (2019). Artificial intelligence and machine learning in architecture: Emerging research trends and implications for education. *Architectural Science Review*, 62(3), 212–221. <https://doi.org/10.1080/00038628.2018.1535446>
- 26- Wang, Y., Li, X., & Chen, Z. (2023). Training educators for AI integration in design curricula: Challenges and strategies. *Journal of Design Education*, 11(2), 78–95.
- 27- Yu, R., Wang, Q., & Mao, Y. (2021). The integration of AI and VR in architecture design education: A framework for immersive and adaptive learning environments. *Journal of Architectural Education*, 75(1), 106–117. <https://doi.org/10.1080/10464883.2020.1848806>
- 28- Zhao, X., Yang, L., & Wu, J. (2021). Data-driven design optimization for sustainable architecture: AI applications and future directions. *Sustainable Cities and Society*, 69, 102833.
- 29- Zhou, H., Miller, K., & Johnson, M. (2023). Academic integrity and AI: Developing ethical guidelines for student use of AI tools. *Journal of Higher Education Policy*, 39(1), 89–104

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