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Artificial Intelligence in Undergraduate Architecture Education: Opportunities and Challenges in Pakistan

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Abstract

Artificial Intelligence (AI) has influenced academia by offering tools that are effective for design learning, curriculum, research, and assessment. This research explores the development of existing teaching methods and emphasizes the responsibilities of the instructor. It discusses effective usage of artificial intelligence (AI) in architecture education and the drawbacks associated with it, especially in the context of Pakistan. Although there is an increasing global interest, there is a scarcity of research about the effects of this phenomenon on undergraduate architecture education in Pakistan. A descriptive research design draws on global literature to explain the potential role and use of AI and synthesises key themes related to creativity, ethics, infrastructure, and curriculum for future research directions. In summary, the research proves that a conscious and balanced approach to integration is important in ensuring that AI works to complement the creative processes of humans and preserves the values of design education.

Keywords: AI in education, artificial intelligence, architecture education, Artificial Intelligence, Generative AI, Higher Education

Introduction

Architecture education is going through a phase of transformation with the increased use of artificial intelligence. For the educational industry, AI is perceived as an unusual but effective agent that assists in positive adjustments to traditional teaching and learning.

There are considerable concerns regarding its implementation in pedagogy. The primary concern is the integrity of the design process, considering its origin and intent. There is a lack of comprehensive understanding of how to integrate AI effectively while preserving core discipline parameters. Additionally, there remains a lack of literature pertaining to disciplines that involve creativity, like architecture. This makes it important to explore possibilities of adopting AI in architecture education, especially in the context of developing countries like Pakistan.

This research reviews strengths of AI models in architecture education, assesses trends, and analyzes challenges and opportunities of using AI in education.

Methodology

Table 1 - Literature Search Strategy

Author(s)	Year	Focus Area	Key Relevance to This Study
Holmes et al.	2019	AI in Education	Ethical and pedagogical implications
Cheng & Jones	2021	AI in Architectural Education	Opportunities and challenges of AI integration
McCormack et al.	2020	AI and Creativity	Authorship and design ethics
Eastman et al.	2018	BIM and Digital Design	Digital tools in architectural practice
Fathoni	2023	Generative AI in Design Education	Creativity and academic integrity
Niemi et al.	2023	AI and Future Learning	Emerging educational applications

Literature Selection Criteria

This study adopts a narrative literature review approach, whereby relevant literature was identified through Google Scholar, Scopus, and ScienceDirect. The search focused on publications from 2018 to 2025. The selected literature was evaluated for relevance and categorized based on major themes such as AI application in design studio, ideation, ethics, limitations, and faculty preparedness. Generative AI tools were used to assist with preliminary organization of literature, formatting tables, and general editing. Sources were independently verified, and analysis and interpretations were developed and reviewed by the authors. The selected research approach ensures the presence of extensive knowledge from across the globe, acknowledgement and reflection of diversity, as this research becomes a foundational step for academia in identifying gaps in the current literature and areas for future investigation.

Research Objectives

1. Examine applications of AI in architecture education for efficient workflow and as a teaching aid.
2. Explore challenges and impact of AI integration in design pedagogy in Pakistan.

Research Questions

1. What functional roles can artificial intelligence assume to support learning, inquiry, and practice within architecture education?
2. What barriers and enablers affect the adoption and integration of AI in architectural education within Pakistan?

Background

One core objective of an undergraduate degree in design is to encourage critical thinking, understand principles of the domain, develop context awareness, and appreciate human values. In the process, the student develops their passion and motivations for future ventures. Despite the growing use of generative AI in design education globally, limited literature exists on its implications for undergraduate architecture programs in Pakistan, particularly in relation to studio culture, creativity, infrastructure readiness, faculty preparedness,

and ethical governance.

Architecture pedagogy focuses on experiential learning with the inclusion of studios and collaborative projects. The studio emulates aspects of real-life scenarios, e.g., teamwork, client and designer roles, and categorisation of design stages. The construction industry is multifarious, and these inclusions in pedagogy help in breaking down experiences for the student before they step into practice. Architecture as a discipline is ever-changing; this too is an essential lesson that becomes part of the undergraduate experience. The art and science of designing, building, and using them will continue to evolve, and therefore students are equipped with the understanding of this characteristic as a strength. In that way, they are more likely to embrace new tools, methodologies, and trends, and are also highly valued contributors in industry.

Evolution of Architecture Education

Architecture Education was historically based on the master and apprentice model, whereby a master was the source of learning and inspiration and, through hands-on practice, transferred their skill and wisdom to the apprentice over the course of a year. This approach coincides with the context of early years, whereby repetition and imitation were the primary tools leading to perfection. During the late 19th and 20th centuries, the approach towards architecture education shifted. Architecture schools like the Bauhaus in Germany and Vkhutemas in Russia institutionalized architecture education and promoted a systematic approach to pedagogy. This new pedagogy integrated craft, art, technology, and science into architecture education, forming a comprehensive degree that was a marriage of the arts and the sciences (Droste, 2006). Notably, influential theorists such as John Dewey and educators associated with the Bauhaus school underlined the importance of experiential learning and interdisciplinary approaches within architectural education (Dewey, 1938; Kolb, 1984).

This evolutionary process involves two fundamental aspects of architectural education: the capacity of architectural education to synthesize various disciplines and its focus on technological advancement. The profession of architectural education has been able to achieve a distinct identity as it relates not only to the discipline of arts and design but also to that of science and technology. Through history, the learning process of architecture has proven to be highly dynamic and sensitive to changes taking place in society, technology, and the environment. It all comes down to context, which is the key term here because architecture education is essentially context-sensitive learning.

After the Industrial Revolution, architecture education witnessed the establishment of the Bauhaus in 1919 by Walter Gropius. The school originated from the concept of unity of art, craft, and technology, a holistic approach to design that resolved both form and function. This established the basis for modern architecture (Gropius, 1965). The 20th century saw a worldwide shift towards human-centered design; once more, architecture education responded by including user-centered design principles in education and practice. Architecture education adopted prototyping and usability testing strategies that are now mainstream in user research methods that previously were not in the curriculum at all (Norman, 1988).

Evolution in Curriculum Development

Traditionally, architecture education was based on linear processes and categorised problem solving. However, the influence of technological developments, societal dynamics, and increased complexity resulted in the inclusion of collaborative frameworks, iterative design processes, and layered parameters. This adoption in curricula across architecture schools recognised that students needed to be trained with a proactive approach to navigate contemporary dynamics of the discipline (Cross, 2007).

This era also marks the inclusion of multi- and interdisciplinary courses that offered flexibility along with innovation. Domains such as sustainability, digital representation, structural

engineering, environmental systems, history, and theory, and later, virtual and augmented reality and parametric design (Kolarevic, 2015). All these supporting domains aimed to help students develop a stronger worldview and prepare them for a rapidly changing world, specifically in the architecture industry. Among the most drastic of the additions to the curriculum was the shift from manual representation of design, e.g., drafting and sketching, to digitally produced drawings, e.g., digital sketches and computer-aided design applications, a move driven by technological advances and the industry's requirements. The biggest advantage of this shift was increased efficiency in production and increased accuracy in overall design drawings, especially when working with complex concepts. Whereas originally there existed an apprehension that CAD may possibly have the potential to replace originality and restrict creativity, in the long run it has been successful in accomplishing great achievements (Schön, 1983). The reason for this has been mainly because CAD is not envisioned to replace traditional methods of work; rather, it is meant to add to them. Further advancements, such as parametric design and Building Information Modeling (BIM), have stretched architectural education to train students to meet modern challenges with technical skill and creative instinct (Kolarevic, 2015).

Evolution in Teaching Methodology & Pedagogy

Customarily, architecture education was based on the didactic approach to learning. Design thinking has been the basis of this selection of methodology because it emphasizes empathy, sensitivity, ideation, and prototyping (Brown, 2009). This links directly to the role of the architect as an intelligent problem solver, finding simple solutions to complex problems. The studio remains at the heart of this methodology, contributing significantly to the development of critical thinking and reflection in an immersive environment for students (Schön, 1983).

Unlike traditional teaching, based on a master- apprentice structure, pedagogy in the 19th century was student-centric. It was adopted by architecture and was based on interaction, debate, and the learning styles of the students. Specifically in creative fields, a mixed media approach was adopted to help students represent multidimensional aspects of the design process and solutions. The methodology did not remove traditional representations; it added to them a series of new hands-on methods such as form finding, volumetric studies, and study models. This overview of the evolution of teaching methodology portrays flexibility and adaptability as vital aspects of architecture education. Pedagogical tools in virtual and augmented reality have supported this by providing necessary tools to develop immersive learning experiences for the students. (Pantelidis, 2010). Development in curriculum design, methodology, and pedagogy is a result of the changing nature of the field. These are necessary to prepare students for the complexities of contemporary architectural practice.

Architecture Education in Pakistan

The first formal architecture program in Pakistan began at National College of Arts in Lahore and Dawood University of Engineering and Technology in Karachi. The program at National College of Arts was heavily influenced by art and craft, and the Dawood University of Engineering and Technology provided a technical, more engineering-inclined approach to architecture education. As formal degree-awarding architecture schools, these became a benchmark for the standard of architecture education in the country. Today, architecture is a thriving profession primarily due to rapid growth in the construction industry, and architecture is seen as a balanced program for those seeking both technical education and artistic expression.

The studio teaching model that emphasizes context-sensitivity through projects, combined with the application of theoretical knowledge in practice through workshops and cross-disciplinary efforts, has enabled architectural schools in Pakistan to remain relevant and in line with the current educational trends worldwide.

Technology is expected to enhance the scope of architectural education in Pakistan through the provision of cutting-edge means for design, simulation, and analysis. For instance, AI-based software for design may help students understand the complexities of architectural issues involving structure, environment, and space (Farooq & Khan, 2020). However, this would entail the need to develop an AI-based technology that will cater to the requirements of culture, environment, and society in Pakistan (Raza & Ali, 2021). However, the best technological advancements in architectural education need to be incorporated in the context of traditional design education principles for developing countries. According to studies conducted at Pakistani universities, students believe that the use of generative AI technologies can be advantageous for learning and information search purposes. Meanwhile, issues of academic integrity, over-reliance on such tools, and insufficient guidelines from the institution continue to exist (Shafqat & Amjad, 2024; Mehran & Farooq, 2025).

Thematic Synthesis of AI Integration in Architectural Education

AI Applications in Design Studio

The use of artificial intelligence (AI) in higher education provides platforms to boost efficiency within administrative processes as well as within the teaching processes while also accommodating learners by providing tools that allow configurable parameters (Luckin et al., 2016).

Learning management systems can be driven through artificial intelligence to conduct analyses of student performance. Such capability becomes an asset to institutions dealing with the problem of student retention and dropouts, and outcomes may help create intervention programs that eventually lead to improved well-being and success of students (Long, P., & Siemens, G., 2011). Academic researchers at institutions may also benefit from the use of artificial intelligence since it can automate literature review, data analysis, and work with big data sets (Aoun, 2017).

AI inclusion in education is not a 21st-century idea. In the 1970s and 80s, simple intelligent tutoring systems (ITS) were introduced that provided customised feedback, instructional design support, and tutoring. SCHOLAR was one application that simulated Human student interaction and provided discipline-specific knowledge (Woolf, 2010). In the 1990s, applications such as ANDES and AutoTutor used AI algorithms to improve learning systems, making them more adaptive and interactive and, most importantly, including real-time responses and enhancing learning outcomes (Graesser et al., 2001). Exponential growth in the application of AI has enabled the creation of adaptive learning platforms, intelligent content creation, and tools for data-driven decision-making processes for academia.

Adaptive learning systems, such as ALEKS and Dream Box, use AI algorithms to adjust learning pathways (Kulik & Fletcher, 2016). The system identifies gaps in knowledge and provides targeted intervention. Some platforms, such as Knewton and Smart Sparrow, have used AI to create learning experiences so that teachers will have more time to engage in higher-order teaching tasks.

AI technologies in architecture education offer innovative ways that can aid in enhancing creativity, streamlining work processes, and most importantly, customise learning experiences for both the instructor and the student. Repetitive tasks in the design process can be efficiently developed, and feedback can be instant. Since basic versions of design solutions can be provided instantly, learners will now have to use high levels of creative processes to achieve a higher level of design resolution and innovation (McCormack et al., 2020).

BIM and parametric design have proved to be vital in applying complex structures and systems by learners, primarily due to the availability of simulations that can imitate real-life scenarios. Additionally, virtual studios and platforms engage peer learning while maintaining the interactivity and experiential value of architecture education.

AI's real value lies in improving the process of idea generation and conceptual formulation, not just the production of visual effects. For example, it can help in generating several iterations of a design concept or carry out analysis of configurations and material efficiency. Recent studio-based research demonstrates that AI-assisted architectural design courses can improve student engagement with programming, design exploration, and iterative problem-solving when integrated into structured learning environments (Jin et al., 2024). Evidence from AI-assisted architectural design studios indicates that the educational value of AI depends heavily on how the technology is embedded within studio pedagogy and guided by instructors rather than on the technology itself (Özorhon et al., 2025).

Creativity and Ideation

By automating repetitive tasks, AI enables students to devote greater attention to critical thinking, creativity, and the development of ideas. Instructors must show the students that AI is a tool that cooperates with the design process but never replaces human creativity and decision-making.

Natural Language Processing (NLP) models are useful for formatting, summarising, or elaborating information. Generative design models are useful in conceptualising ideas, exploring form and visualisations. Simulation tools are useful for performance evaluation and structural integrity. As repeatedly concluded above, the instructor remains the main designer of the studio process and therefore will have to regularly assess student progress and understanding of the studio objectives and give feedback that helps students integrate AI wisely.

To ensure that AI is enhancing design capabilities, not replacing them, the instructor will continue to design a balanced learning environment (Smith & Lee, 2019). Studies examining prompt engineering suggest that creative outcomes are influenced by students' ability to develop effective prompts and critically evaluate generated outputs (Lee & Kang, 2025). While generative AI may expand idea generation and creative exploration, emerging evidence suggests that meaningful creativity continues to rely on human judgement, reflection, and contextual interpretation (Medel-Vera et al., 2025).

Ethical and Authorship Concerns

Among all the benefits, there exist serious concerns with reference to data privacy, algorithmic bias, and ethics. Unless AI provides a transparent, fair, and unbiased platform for information and data, its integration will be discouraged. (Williamson & Eynon, 2020). In addition to concerns within AI platforms, the socio-political aspect of the digital divide across the globe between the developed and the underdeveloped world is an overarching concern that halts open and free integration of AI. Limited resources and limited infrastructure, along with a lack of financial support, will continue to keep the developing world from moving forward efficiently and may add to the existing inequalities in education (Selwyn, 2019). This, however, can also be seen as an opportunity for reformation of these societies.

In pedagogy, it is perceived that integration of AI may have an adverse effect on the relationship between the learner and the instructor or may not allow for that relationship to build at all, which is a vital aspect of effective learning (Knox, 2020). In terms of ethics, the issues concern "hallucinations," a common characteristic of AI systems, the phenomenon of fabricating information.

Educators and institutions are supposed to develop policies and frameworks that will enable responsible and ethical use of AI in education (Williamson & Eynon, 2020). Empirical studies in higher education have reported both opportunities and challenges associated with generative AI. While AI can improve access to information and learning support, concerns persist regarding academic integrity, transparency, authorship, and the reliability of AI-generated outputs (Albadarin et al., 2024; Yusuf et al., 2024).

Infrastructure and Resource Constraints

The introduction of AI into education in the

developing world can result in high-quality educational content and resources regardless of location; this accessibility can transform learning experiences and the overall capacity of learners. It can aid in providing administrative support to faculty and staff to focus on the content and design of the education. However, these opportunities for innovation and efficiency are highly dependent on knowledge of its role and its limitations.

Most institutions in the developing region lack regular, high-speed internet connectivity, advanced computational resources, and finances to support AI software. The financial requirements of these are a heavy load on limited budgets and funds and therefore often get neglected (Awan & Khan, 2020). Additionally, although formalised integration of AI in higher education institutions is underway, most instructors remain sceptic to its use and are not aligned with learning and adopting the AI knowledge domain. Unorganized and sporadic use of AI will result in mediocre design outcomes rather than a nurtured, thorough understanding of AI's potential and use.

AI tools rely on datasets; since the sources of these datasets are primarily linked to certain regions of the world currently, the resulting interpretations of information carry bias and misconstrued facts. For most regions, AI tools are unable to comment on, review, add to, or translate data concerning numerous smaller regions, cities, towns, etc. Context-based research is a foundational aspect of architectural design, and with the absence of socio-cultural, environmental, and economic nuances of projects in the developing world, the basic objective of the learning will be diminished.

Artificial Intelligence and related technologies have surfaced in architecture schools within the past two years. It primarily came from individuals who felt students needed to be introduced to its potential so that its appropriate and ethical use can be ensured. The Higher Education Commission of Pakistan, the government regulatory body for undergraduate and above-level education in the country, published an AI Policy for all universities of Pakistan in 2025. This led to many schools formally integrating AI into their syllabus. These efforts provide evidence of a progressive approach in multiple phases of architecture education.

Studies conducted in Pakistani universities present a positive response to the introduction of AI, especially from students in areas of learning support, information retrieval, and academic productivity. At the same time, concerns regarding academic integrity, overreliance, and the absence of clear guidance remain prominent (Shafqat & Amjad, 2024; Mehran & Farooq, 2025). Financial limitations affect access to resources, while insufficient faculty preparation may limit effective implementation. These challenges are further compounded by the limited availability of context-specific architectural datasets required for culturally responsive design education (Buriro et al., 2024; Mehran & Farooq, 2025).

The main prevailing concern is the loss of originality and individual creativity, very similar to concerns raised years ago when digital drawing first came into the discipline. Currently, a handful of architecture schools are making conscious efforts to integrate AI through training and courses within the curriculum; however, the integration is slow. Findings have been reported across Pakistani institutions, where educators recognise the potential of AI-enhanced learning but emphasise the need for training, institutional support, and structured strategies before large-scale adoption (Balqees et al., 2024; Buriro et al., 2024).

Research in Pakistan shows that readiness in technology, confidence of users, and understanding of AI tools directly affect the adoption of AI usage, confirming the fact that infrastructure is not valuable unless accompanied by improvements in users' digital literacy and preparation. (Shah et al., 2024). These limitations, combined with uneven levels of faculty preparedness and the scarcity of culturally specific architectural datasets, collectively slow the effective adoption of AI

within architectural education.

Faculty Readiness and Curriculum Development

In recent years, in the developed world, AI has been used to enrich course content, taking advantage of the vast informational data bank of large language models (LLMs). AI-driven models can reconfigure course content based on the learner's pace almost instantly. DreamBox and Knewton are platforms that change learning tracks for users based on their performance in real time and maintain engagement. (Holmes et al., 2022).

Including generative AI tools into the course content gives the instructor control over AI usage as an exploration tool. Dreamcatcher by Autodesk can create multiple design alternatives – these are not solutions; in fact, they are seeds that the learner can explore to reach a resolved design idea. It saves time and opens the learner's knowledge base to the extent of possibilities and allows them to make connections. Contrary to popular belief, AI tools exist that process social, environmental, and urban data at early design stages based on empathy and context analysis. This means design schemes can be reviewed faster and, therefore, effective and responsible solutions can be finalised rapidly (Pantelidis, 2010). Lastly, AI-driven applications support the multidisciplinary nature of the discipline; established BIM applications offer learners the ability to visualise and analyse building structures, systems, and environmental factors. (Eastman et al., 2018).

The policy environment in Pakistan is also evolving. The Higher Education Commission's Framework on the Use of Generative AI in Higher Education Institutions encourages responsible adoption while emphasising academic integrity, transparency, AI literacy, privacy, and institutional governance (Higher Education Commission, 2025).

Design thinking can be enhanced significantly through AI integration by enabling faster ideation, deeper exploration of design and form, and data-informed decision-making. The capacity to provide immediate feedback and performance analysis is useful for both the learner and the instructor. Instructors have access to immersive learning environments that can enhance student engagement and collaboration across institutions, regardless of geographical location. Google's Jamboard and MURAL are examples of collaborative platforms that bring learners and instructors together to work on problems, thereby eliminating physical limitations and providing the advantage of gaining knowledge from across the globe (Thompson et al., 2020).

The obvious disadvantage in this scenario is reduced human interaction. However, as is with any era of education, the responsibility lies with the instructor to design a teaching methodology that maintains the balance between technology dependency and individuality (Selwyn, 2019). Generative AI has also been associated with the development of digital literacy and broader professional competencies among architecture students, suggesting a role beyond simple productivity enhancement (Kee et al., 2024).

AI Technologies Supporting Architectural Education

Table 2- AI models and their relevance to Architecture Education

AI Category	Educational Applications	Example Tools	Benefits	Limitations
Generative AI	Concept generation, visualization, design exploration	MidJourney, DALL-E, Stable Diffusion	Rapid ideation and Limited contextual accuracy, prompt dependency Visualization	Limited contextual accuracy, prompt dependency
Large Language Models (LLMs)	Writing support, research assistance, precedent studies	ChatGPT, Claude, Gemini	Fast information retrieval and content support	Hallucinations, factual inaccuracies
Computer Vision	Site analysis, image interpretation,	Open CV, Google Vision	Visual data analysis	

	building recognition			
Predictive and Simulation AI	Environmental and performance analysis	Autodesk Forma, Cove Tool	Data-driven decision-making	Requires high-quality datasets
AI-Enhanced BIM Systems	Building lifecycle management and collaboration	Revit, ArchiCAD	Integrated project information	Computational requirements

The above table summarises major AI technologies and their potential applications within architectural education. Generative AI technologies like MidJourney, DALL-E, and Stable Diffusion foster ideation, image-making, and rapid design exploration, which allows students to investigate many design alternatives in a short time. Large Language Models (LLMs) such as ChatGPT, Claude, or Gemini help with research and writing assistance as well as precedent studies. Computer Vision technologies enable site analysis, interpretation of images, and processing of visual data. Predictive and simulation AI systems aid in environmental analysis and performance assessment during design work.

The use of AI in BIM technology enhances collaboration across the project lifecycle by digitally unifying aspects of design. Although these technologies have benefits, adaptive AI systems and LLMs are prone to providing incorrect or biased output in instances of limited local information. Computer vision or simulation tools usually require accurate datasets as well as high computational power. The use of BIM systems requires extensive training and significant software investment. Therefore, AI technologies should be regarded merely as processes that enable learning and exploration in design rather than as replacements for critical thinking and creativity of the learner.

It is essential to comprehend the importance of these technologies from five major aspects discussed in the next paragraphs: uses within design studios, creation and new ideas, ethical issues, limitations in resources, and the readiness of the professors. It is necessary to make a distinction between generative AI and predictive or adaptive AI. Generative AI tools like MidJourney and DALL-E have been mainly applied for design ideas and visuals. Meanwhile, predictive and simulation-related AI systems are used for analysis, improving performance, and making decisions. Thus, their roles in education are different and will need to be integrated based on the desired educational outcomes.

Proposed Framework for Responsible AI Integration in Pakistani Architecture Schools

Table 3 - AI Integration in Pakistan

Stage	Focus Area	Proposed Action
Stage 1	Awareness and Capacity Building	Faculty and student training on AI literacy and responsible use
Stage 2	Curriculum Integration	Introduction of AI-assisted learning activities within design studios and related courses
Stage 3	Infrastructure Development	Improvement of internet connectivity, software access, and computing resources
Stage 4	Assessment Guidelines	Development of assessment criteria for AI-assisted academic and design work
Stage 5	Ethical Governance	Establishment of policies addressing transparency, academic integrity, privacy, and authorship
Stage 6	Continuous Evaluation	Periodic review of AI integration outcomes and curriculum refinement

Conclusion

Key Findings

The paper reveals that AI has great potential for improving architecture education through supporting design ideation, visualization, and learning processes. At the same time, the research indicates the possibilities of increasing the efficiency of the process using AI in educational tasks. However, there are still many difficulties in implementation, which involve the availability of infrastructure, funding, and

context-dependent data. In addition, successful incorporation of AI in architecture education highly depends on the readiness of professors.

The field of architectural education has undergone change throughout the ages, owing to its primary goal of design thinking. As part of their teaching and curriculum, architectural education has assimilated developments and innovations that are important for its development and continuing relevance. AI can take this process to the next level with improved precision and efficiency in developing concepts. Generative and language-processing algorithms can be used to generate various environments and scenarios, which would form the basis of a pedagogical approach.

However, the effective integration of AI into education comes with economic, financial, and infrastructural constraints, along with a fear of losing traditional methodologies. These challenges necessitate a nuanced approach that balances technological advancement with the preservation of traditional educational values. For Pakistan, a phased implementation of AI may be most suitable, which includes training of instructors and academic staff, updating infrastructure, and developing policies.

Recommendations for Pakistani Architecture Schools

1. Faculty training and professional development in AI-assisted workflows.
2. Gradual curriculum integration.
3. Improvement of institutional infrastructure,
4. Development of assessment guidelines for AI-assisted work.
5. Establishment of policies addressing academic integrity, transparency, authorship, and ethical use.

Future Research

The integration of AI will allow students to face the challenges of the 21st century, whereby students are not only aware of the technological side of the discipline but also have cherished values of creativity and critical thinking that reflect its nature. Future research can be directed towards empirical studies conducted in architectural schools in Pakistan through the survey of students and instructors, studio experimentation, and the creation and evaluation of AI-based curricula.

The success of integrating AI in architectural education depends heavily on institutional readiness, instructors' preparedness, ethics, and contextual implementation, and responsible implementation should be performed through reforms of the curricula, faculty development, and institutional regulations on maintaining creativity and critical thinking at the design studio.

References

Albadarin, Y., Saqr, M., Pope, N., & Tukiainen, M. (2024). A systematic literature review of empirical research on ChatGPT in education. Discover Education, 3, Article 60. https://doi.org/10.1007/s44217-024-00138-2

Awan, M., & Khan, H. (2020). Infrastructure challenges in the adoption of AI in developing countries. International Journal of Educational Development, 40(2), 113-125.

Balqees, A., Syed, A., & Ullah, S. (2024). Utilizing ChatGPT to elevate teaching and learning in Pakistani universities. Pakistan Social Sciences Review, 8(3), 862–874. https://doi.org/10.35484/pssr.2024(8-III)69

Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., Negretti, R., & others. (2024). A meta-systematic review of artificial intelligence in higher education: A call for increased ethics, collaboration, and rigour. International Journal of Educational Technology in Higher Education, 21, Article 4. https://doi.org/10.1186/s41239-023-00436-z

Brown, T. (2009). Change by Design: How Design Thinking Creates New Alternatives for Business and Society. Harper Business.

Buriro, M., Sethar, W. A., & Parhyar, A. (2024). The future of learning: Integrating ChatGPT in Pakistan's higher education. Annals of Human and Social Sciences, 5(2). https://doi.org/10.35484/ahss.2024(5-II)64

Castillo-Martínez, I. M., Flores-Bueno, D., Gómez-Puente, S. M., & Vite-León, V. O. (2024, August). AI in higher education: A systematic literature review. In Frontiers in Education (Vol. 9, p. 1391485). Frontiers Media SA.

Cheng, N. F., & Jones, M. J. (2021). Integrating AI into architectural education: Opportunities and challenges. Journal of Architectural Education, 75(1), 57-67.

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. International Journal of Educational Technology in Higher Education, 20, Article 22. https://doi.org/10.1186/s41239-023-00392-8

Cross, N. (2007). Designerly Ways of Knowing. Birkhäuser.

Crysler, C. G. (2012). The SAGE Handbook of Architectural

Theory. SAGE Publications.
Dewey, J. (1938). Experience and Education. New York: Macmillan.
Droste, M. (2006). Bauhaus, 1919-1933. Taschen.
Eastman, C., Teicholz, P., Sacks, R., & Liston, K. (2018). BIM handbook: A guide to building information modeling for owners, designers, engineers, contractors, and facility managers. Wiley.
Farooq, M., & Khan, A. (2020). Enhancing architectural education in Pakistan through AI integration. Pakistan Journal of Engineering and Applied Sciences, 20(3), 101-110.
Fathoni, A. F. C. A. (2023). Leveraging generative AI solutions in art and design education: Bridging sustainable creativity and fostering academic integrity for innovative society. E3S Web of Conferences, 426, 01102. https://doi.org/10.1051/e3sconf/202342601102
Graesser, A. C., VanLehn, K., Rosé, C. P., Jordan, P. W., & Harter, D. (2001). Intelligent tutoring systems with conversational dialogue. AI Magazine, 22(4), 39-39.
Gropius, W. (1965). The New Architecture and the Bauhaus. MIT Press.
Higher Education Commission. (2025). Framework on use of generative AI (GenAI) tools in higher education institutes (HEIs). Higher Education Commission, Pakistan. https://www.hec.gov.pk/english/services/faculty/Plagiarism/Documents/Final_Framework%20for%20Ethical%20use%20of%20Generative%20AI%20in%20HEI%27s-%2023April2025.pdf
Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., ... & Koedinger, K. R. (2022). Ethics of AI in education: Towards a community-wide framework. International journal of artificial intelligence in education, 32(3), 504-526.
Jamil, F., & Zahra, S. (2020). Trends and challenges in architectural education in Pakistan. Contemporary Design Journal, 5(1), 77-89.
Jin, S., Tu, H., Li, J., Fang, Y., Qu, Z., Xu, F., Liu, K., & Lin, Y. (2024). Enhancing architectural education through artificial intelligence: A case study of an AI-assisted architectural programming and design course. Buildings, 14(6), 1613. https://doi.org/10.3390/buildings14061613
Jung, D., & Suh, S. (2024). Enhancing soft skills through generative AI in sustainable fashion textile design education. Sustainability, 16(6973). https://doi.org/10.3390/su16166973
Kee, Y. C. T., Kuys, B., & King, R. (2024). Generative artificial intelligence to enhance architecture education to develop digital literacy and holistic competency. Journal of Artificial Intelligence in Architecture, 2(1), 24–41. https://doi.org/10.1007/s10798-023-09855-5
Kolarevic, B. (2015). Architecture in the Digital Age: Design and Manufacturing. Taylor & Francis.
Kolb, D. A. (1984). Experiential Learning: Experience as the Source of Learning and Development. Prentice-Hall.
Kulik, James A., and John D. Fletcher. "Effectiveness of intelligent tutoring systems: A meta-analytic review." Review of Educational Research 86.1 (2016): 42-78.
Lee, S., & Kang, S. (2025). The influence of generative AI with prompt engineering on creative design in architectural education. Journal of Asian Architecture and Building Engineering. https://doi.org/10.1080/13467581.2025.2552446
Long, P., & Siemens, G. (2011). Penetrating the fog: Analytics in learning and education. EDUCAUSE Review (Online).
Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: An Argument for AI in Education. Pearson Education.
McCormack, J., Gifford, T., & Hutchings, P. (2020). Autonomy, authenticity, authorship: The ethics of artificial intelligence in creative design. AI & Society, 35(2), 343-355.
Medel-Vera, C., Britton, S., & Gates, W. F. (2025). An exploration of the role of generative AI in fostering creativity in architectural learning environments. Computers and Education: Artificial Intelligence, 9, 100501. https://doi.org/10.1016/j.caeai.2025.100501
Mehran, M., & Farooq, A. (2025). Role of ChatGPT in undergraduate education: Benefits, challenges, and ethical considerations. Journal of Development and Social Sciences, 6(2). https://doi.org/10.47205/jdss.2025(6-II)01
Niemi, H., Pea, R. D., & Lu, Y. (2023). AI in Learning: Designing the Future. Springer. https://doi.org/10.1007/978-3-031-09687-7
Norman, D. A. (1988). The Design of Everyday Things. Basic Books.
Özorhon, G., Nitelik Gelirli, D., Lekesiz, G., & Müezzinoğlu, C. (2025). AI-assisted architectural design studio (AI-a-ADS): How artificial intelligence joins the architectural design studio? International Journal of Technology and Design Education, 35, 1999–2023. https://doi.org/10.1007/s10798-025-09975-0
Pantelidis, V. S. (2010). Reasons to use virtual reality in education and training courses and a model to determine when to use virtual reality. Themes in Science and Technology Education, 2(1-2), 59-70.
Raza, M., & Ali, S. (2021). Developing localized AI applications for architectural education in Pakistan. Journal of Localized AI Development, 3(2), 67-80.
Schön, D. A. (1983). The Reflective Practitioner: How Professionals Think in Action. Basic Books.
Selwyn, N. (2019). Should robots replace teachers? AI and the future of education. Social Sciences, 8(9), 241.
Shafqat, F., & Amjad, A. I. (2024). Examining students' perceptions, experiences, and ethical concerns about using ChatGPT for academic support: A phenomenological study. Pakistan Social Sciences Review, 8(2), 443–455. https://doi.org/10.35484/pssr.2024(8-II)36
Shah, M. H. A., Ali, Z., & Shah, A. (2024). Challenging factors towards the effective use of ChatGPT in education in Province Sindh, Pakistan: Application of TAM model. International Journal of Academic Research for Humanities, 4(2), 86–94.
Smith, R., & Lee, C. (2019). Balancing tradition and technology in design education. Design Studies, 40(3), 45-60.
Thompson, K., White, N., & Horne, M. (2020). Virtual studios: Enhancing collaborative learning in design education. Journal of Learning Design, 13(2), 75-88.
Williamson, B., & Eynon, R. (2020). Big data in education: The digital future of learning, policy and practice. Policy Futures in Education, 18(5), 622-637.
Woolf, B. P. (2010). Building Intelligent Interactive Tutors: Student-Centered Strategies for Revolutionizing e-Learning. Morgan Kaufmann.
Yusuf, A., Pervin, N., & Román-González, M. (2024). Generative AI in education and research: A systematic mapping review. Review of Education, 12(2), Article e3489. https://doi.org/10.1002/rev3.3489