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# AI and Its Role in Architectural Education

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**A b s t r a c t**

The developing technologies shape and lead various domains; they have started to be used in fields such as education and architecture. This issue presents the amalgamations of those two fields. Employing AI is significant since architecture is a profession that involves technology as its integrative part. The study directs attention to the importance of the developing digital technologies, which in this case underscores the potential and role of AI. The study highlights the critical relation between architectural education system and the integration of AI. There are multiple studies focused on the usage of AI in architectural education. Comparative literature analysis based on those studies is limited; therefore, a shared analysis framework is used for comparison. The findings reveal the shared characteristics and differences among them, which can act as a guidance for future studies. Accordingly, the study aims to contribute to the architecture students and lecturers in architectural education.

**K e y w o r d s :** Architectural education; Artificial Intelligence (AI); Learning; Integration; Design.

## 1. Introduction

Architectural education has been a constantly developing field under the pressure of various technological waves. This process extends from hand drawing to computer-aided design (CAD), parametric tools and to digital production infrastructures (Oxman, 2017; Kolarevic, 2009). This issue has brought not only a technical transition but also a fundamental pedagogical restructure regarding the production, transmission and evaluation of the architectural knowledge (Oxman, 2017; Jenny, et al., 2022). Today, with the rapid integration of generative artificial intelligence (GenAI) models into academic and professional fields, architectural education is facing a new and undefined threshold.

This transformation has been distinguished from the prior ones by the non-instrumental integration of AI into the learning process. Parametric software or a BIM platform responds to students' design decisions with particular inputs; on the other hand, GenAI has the capacity to directly shape the students' thought process and discourse. This locates AI into an active pedagogical subject, therefore, necessitating a theoretical inquiry beyond mere discussions of technology in the field of education (Knox, 2020; Li et al., 2025). There is a significant increase in studies on the role of AI in education over recent years (Cope et al., 2021; Zawacki-Richter, et al., 2019; Kasneci, et al., 2023). The majority of these studies do not specifically address discipline-specific contexts; they overlook the studio-centred, open-ended problem structure of architectural education and its structure of subjective, judgement-based evaluation. Studies focusing on architectural education are still limited in number and are mostly individual case analyses conducted through a single tool or context. A comprehensive analysis that systematically compares the effects produced by different types of AI in different pedagogical contexts and reveals their patterns and gaps has still not been presented in the literature.

To address these gaps, studies included in the comparative analysis were collected through a structured search conducted in the Scopus database, which was selected due to its broad coverage of peer-reviewed and internationally visible publications. The study is guided by the following research questions: What types of AI tools are being used in architectural education, and for what purposes? What common patterns, relationships, and gaps emerge across recent studies investigating AI-supported learning environments?

This study aims to contribute to the literature on two levels. Firstly, it provides a comparative synthesis of recent research on AI integration in architectural education by identifying recurring themes, trends and gaps across different educational contexts. While existing studies often focus on individual tools or isolated case studies, a broader comparative perspective remains limited. Second, the study positions the integration of AI within the framework of digital pedagogy and discusses its implications for both educators and students. Students' experiences, perceptions and learning processes in AI-supported environments remain insufficiently explored, while educators often lack clear pedagogical guidance regarding the appropriate use of the technologies. In addition, their experiences and perceptions regarding AI tools have not been

sufficiently explored in the literature. Educators also lack guidance on how to position these tools. This study aims to provide an understanding for both groups based on the findings.
By examining multiple studies, this research aims to contribute to a more comprehensive understanding of how AI is reshaping architectural learning environments and what this transformation may imply for future educational practices.
The remainder of this paper is arranged as follows. Section 2 reviews the literature on digital transformation and AI-supported architectural learning environments. Section 3 explains the research design and comparative analysis methodology. Section 4 presents the findings, followed by a discussion of their pedagogical implications in Section 5. Finally, the study concludes by outlining its contributions, limitations and directions for future research.

## 2. The Literature Review

### 2.1 Computational and digital transformation in architecture

The discipline of architecture has been transformed by the influence of technology. This ranges from computer-aided design (CAD) systems to parametric design and performance simulation tools. These also restructured architects' production methods, decision-making process and representation tools (Lee & Ostwald, 2020). These technological developments were accompanied by significant shifts in architectural theory and design thinking. One dimension focused on defining the methodological foundations of digital design, while another examined the changing nature of digital content, representation and design knowledge within computational environments (Oxman, 2006). Digital design, which has moved beyond being only a means of representation and has become the production of form, documented the radical transformation of parametric and algorithmic processes in architectural practice (Kolarevic, 2009).
The impact of this transformation on education has followed a slow and contradictory process. The introduction of CAD tools into the architecture curriculum was initially treated as a technical adaptation; its pedagogical implications were not sufficiently questioned in their work discussing the teaching of parametric design thinking. Oxman (2017) argues that digital does not only offer new production possibilities but also basically reshape the functioning of design cognition- the cycles of problem definition, discovery and evaluation.
Theoretical frameworks on the nature of the design process have discussed what it means to design (Cross, 2006; Lawson, 2005). These frameworks still offer valid reference points for digital pedagogy discussions. Furthermore, the Covid-19 pandemic elevated the adoption of digital technologies in architectural education and significantly expanded the use of online and hybrid learning environments (Geyer, 2024). Design studios are traditionally dependent on face-to-face interaction and design critique. This experience demonstrated both the opportunities and limitations of technology-mediated architectural learning and contributed to a broader acceptance of digital tools within architectural curricula (Ghonim et al., 2026; Özorhon et al., 2025). More recent studies addressing the intersection of AI with architectural practice are becoming a significant area of interest. The introduction of computational design, generative design and machine learning tools into architectural practice has led to concrete applications in areas such as form optimization, material usage and environmental performance analysis. These developments create a new curriculum agenda, necessitating a response in architecture education. The digital shift led to the appearance of new design strategies. Therefore, the shift in education underscores the need for a framework and guidelines in education (Schiff, 2021; Ceylan, 2021). While previous waves of digital transformation primarily focused on enhancing representation, simulation and computational design capabilities, the emergence of artificial intelligence introduces a fundamentally different challenge. Unlike earlier technologies, AI systems increasingly participate in knowledge production, decision support, and creative exploration. Consequently, the discussion has shifted from questions of technical adoption toward broader pedagogical concerns regarding learning, creativity and human-machine interaction.

### 2.2 AI and student learning: from the digital pedagogy perspective

The extensive literature on the role of AI in education has rapidly increased in recent years. A systematic review examining AI in higher education presented that existing research in multiple dimensions, while highlighting the need for ethical and educational approaches (Zawacki-Richter, et al., 2019). This indicates the research on the integration of AI into education has a technological perspective and reflects the general limitations of the pedagogical dimension.
Recent studies on AI in education show that they are reshaping educational processes via assessment practices, personalized learning environments, and AI should be understood not just as a tool but also as an active component of the learning environment (Crompton & Burke, 2023; Kasneci, et al., 2023; Labib et al., 2025; Huh et al., 2025). This viewpoint offers an important theoretical foundation for understanding the role of AI, especially in complex and multi-layered learning environments such as architecture studios. The introduction of GenAI, particularly image-generating systems which use LLMs (large language models) into education has given the debate a new dimension. From a digital pedagogy perspective, learning is not only determined by the transfer of information but by the interactions formed among learners, technologies and educational environments. AI systems may influence how students formulate problems, evaluate alternatives and reflect on their own learning processes. In education, examination of AI requires attention not only to its technological performance but its pedagogical implications for learning and evaluation (Krause et al., 2026).
In the context of architectural design studios, these features enable students to generate design options within a short period of time. AI-assisted image generation and text-based design tools can prompt early-phase ideation, visual exploration and conceptual development. At the same time, the abundance of the generated alternatives raises concerns about authorship, originality and the extent to which design reasoning is visible within the process.
Kasneci et al. (2023), in their studies, address the opportunities and risks of ChatGPT in education, documenting that these tools offer students remarkable opportunities for personalized feedback and access to information. However, they also raise concerns in terms of critical thinking, assessment of originality and academic integrity. Examination of AI-powered learning ecologies from the standpoint of knowledge and assessment, emphasizes that AI has the capacity to aid learning (Cope, Kalantzis, & Searsmith, 2021). Additionally, this fundamentally questions assessment practices. There

are implications of GenAI in educational settings, how these tools are integrated into students' creative production processes and under which conditions they support and weaken learning is crucial (Grassini, 2023). This discussion reflects a tension specifically evident in architectural education. AI tools can accelerate the design process, but the question of whether this acceleration leads to a genuine learning gain or to the externalization of the process remains unanswered.

### 2.3 AI in architectural education: opportunities, risks and pedagogical Strains

Architectural education creates a different context from general higher education discussions due to the unique dynamics of the design studio environment. The studio is a pedagogical approach that centres on production under uncertainty, learning without trying and developing judgment through a critical dialogue. Positioning AI in this environment is not a matter of technical preference. It includes deep-rooted questions about how the design student will think, what he/she will problematize and on what basis the decisions will be justified. The literature discusses this tension along several axes. The first axis is the issue of creative autonomy and dependence. AI tools have the capacity to produce speculative and visual alternatives, which can provide enrichment for the student in the early stages of the design process. Besides this, it has the risk of blunting critical decision-making skills in the later stages of the process. The second axis is a new skill area called prompt literacy. Researchers point out that working effectively with AI requires a design and thought practice of its own. It questions how this skill will be integrated into the architecture curriculum (Medel-Vera et al., 2025; Yaşar, et al., 2025; Jin, et al., 2024; Kee & King, 2024). The third axis is the issue of academic honesty and originality. The difficulty of determining the limits of student work, especially with the contribution of AI in visual generation processes, threatens to invalidate existing evaluation practices.

Amidst these debates, it is becoming increasingly important for architectural education researchers to consider AI not as a matter of pure instrumental efficiency but as a structural transformation that re-questions the pedagogical identity of the discipline. The main gap in the current literature is the absence of studies that comparatively reveal how this transformation manifests itself in different educational contexts.

Although recent studies have documented experiences regarding the integration of AI into architectural education, the evidence remains fragmented across different tools and courses. In consequence, it is difficult to identify broader patterns regarding how AI affects the learning process, experiences and educational outcomes. This addresses the gap which requires comparative analysis; it is capable of analysing and synthesizing findings across diverse studies and educational settings. The study answers this by examining the recent research through a common analytical framework.

## 3. Materials and Methods

This study adopts a qualitative comparative literature analysis approach to examine how artificial intelligence (AI) is being integrated into architectural education and how this integration influences student learning experiences. Comparative literature analysis enables researchers to identify recurring patterns, differences, and conceptual relationships across multiple studies addressing a common phenomenon. Rather than producing a statistical synthesis, the objective is to develop a broader understanding of emerging educational trends and pedagogical implications through systematic comparison. The approach is particularly suitable for rapidly evolving research areas such as AI in education, where empirical evidence remains fragmented across different contexts and technological applications. In the late 1980s, comparative literature analysis developed (Ragin, 1987) and comparative analysis has been recognized as an effective strategy for generating conceptual coherence from diverse sources.

In this context, the study is based on a comparison of selected studies using a predefined shared analysis framework, designed to facilitate comparisons across common educational dimensions (Figure 1). Consistent with review typologies proposed by Grant and Booth (2009), the aim of this study is not to conduct a quantitative analysis of findings but to identify common themes and compare current research.

Scopus was selected as the primary database because of its broad coverage of peer-reviewed international journals and its extensive use in interdisciplinary research. Limiting the search to a single database ensured consistency in source selection and reduced potential variations resulting from differences across databases. Given the rapidly evolving nature of AI-related research, the selected works' timeframe is from 2023 to 2026. The time frame limitation was intended to capture the most recent use of AI technologies following the widespread use of generative AI in the field of higher education within the field of architecture. The papers analysed were selected from academic studies addressing the relationship between architectural education and AI. The literature search was finalized on 18 April 2026; therefore, the publications indexed after this date are out of the scope of the analysis.

A structured search strategy was employed to ensure transparency and replicability. During the screening process, a Boolean search strategy was used in order to support the transparency (Gough et al., 2017; Bramer, et al., 2018). The keywords were chosen based on the concepts of the study. Therefore, architectural education, artificial intelligence and learning-related words are used. Boolean operators were employed to combine these concepts and narrow the search to studies relevant to the research objectives.

The Boolean search combinations are given below:

("architectural education" OR "design studio") AND ("artificial intelligence" OR "generative AI" OR "generative design") AND ("learning" OR "student perception" OR "educational impact").

The inclusion and exclusion criteria are considered a fundamental requirement for minimizing selection bias. Accordingly, the criteria were fixed before the screening.

Inclusion criteria:

- Publication in a peer-reviewed academic journal
- Directly addressing the use of AI in the context of architecture or design education
- Publication date 2023-2026

- Exclusion criteria:
- Being a conference paper, a book, a review or a book chapter
- Not related to architectural education

As a result of the initial search, a large literature pool was reached, followed by a multi-stage elimination process.
At first, 47 results were found through the application of the exclusion criteria, then the results were reduced to fourteen. Through the in-depth analysis of the studies, 4 were excluded. Since it was an observation and survey-based approach, it did not include the direct application of AI tools. Furthermore, there were studies which did not focus on the context of architecture education as well. 10 articles remained for the comparative analysis.
The studies were analysed in-depth through five analytical dimensions:

- Educational context: the teaching environment in which the study took place (design studio, course implementation, etc.)
- AI Tools: the AI class used or studied
- Learning Process: the dimension the study focuses on in the learning process
- Student Experience: student attitudes and experiences reported in the study
- Educational Impact: main outcomes of the study.

This framework is designed to make data from different studies comparable on a common categorical plane.
The final sample was considered sufficiently focused for qualitative comparison while maintaining diversity in terms of educational settings and AI technologies. The chosen studies represented a range of pedagogical contexts, including design studios, architectural courses and AI-supported learning environments, thereby allowing broader patterns to emerge across diverse implementations.
The analytical dimensions were developed through recurring themes identified during the preliminary review of the literature, as well as the concepts discussed in digital pedagogy and architectural education research. These dimensions provide a structured framework for examining not only the technological characteristics of AI applications, also their educational implications.

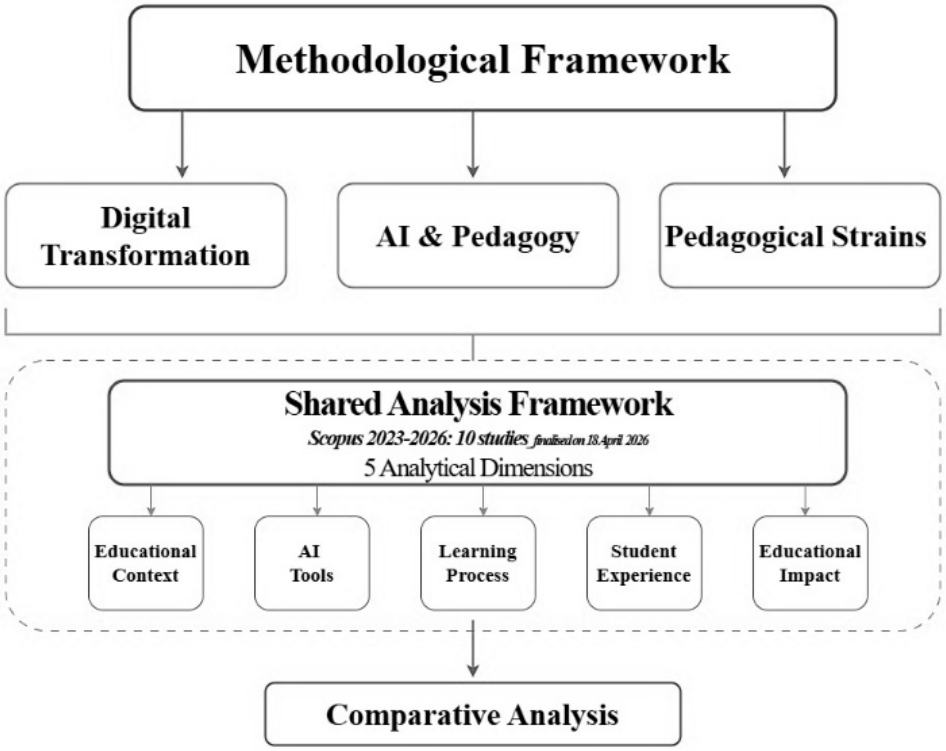


**Figure 1.** Structure of the Study (Source: authors).

Figure 1 illustrates the methodological workflow adopted in this study. The process includes four main stages, which are literature identification, screening, assessment, and selection of studies according to the predefined criteria. In addition, a comparative analysis is conducted through the established analytical framework. The graphical illustration of methodology was prepared to support methodological transparency and improve the understanding of the research process.

**4. Findings of the Comparative Analysis**

The findings presented in this section are obtained from a comparative examination of 10 selected studies within the framework of a shared analysis (Table 1 and 2). During the analysis, the studies were evaluated in terms of the types of AI tools, their educational aspects as mentioned in section 3, and the outcomes. Table 1 and Table 2 present the overall categorization of the analysed studies

**Table 1:** Comparative analysis of the studies (Source: authors).

| Study | Year | Educational Context | AI Tools | Learning Process | Student Experience | Educational Impact |
|---|---|---|---|---|---|---|
| **An approach to AI-supported learning in architectural education: Case of speculative space design (Lekesiz & Müezzinoğlu, 2025)** | 2025 | Design studio, applied through workshop | AI-aided design | Design process | Positive | AI supported the speculative design generation |
| **Stable Diffusion in architectural design: Closing doors or opening new horizons?** (Cao et al., 2025) | 2025 | Design education | Generative AI | Visual production | Mixed | AI as facilitator and has the risk of overreliance, recommends integrating AI into curricula |
| **Enhancing Architectural Education through Artificial Intelligence: A Case Study of an AI-Assisted Architectural Programming and Design Course** (Jin, et al., 2024) | 2024 | Course application | AI-aided tool | Design stage and architectural programming | Positive | AI-powered course has been found to improve the learning process |
| **Reimagining Tradition: A Comparative Study of Artificial Intelligence and Virtual Reality in Sustainable Architecture Education** (Ying, et al., 2024) | 2024 | Architectural design education | AI+VR | Sustainable education | Positive | Different learning effects of digital technologies compared |
| **Use of Artificial Intelligence and Prompt Literacy in Architectural Education** (Yaşar et al., 2025) | 2025 | Master level course in architectural design education | Generative AI | Digital skill | Positive with certain limitations highlighted | Prompt literacy is important, having fast visuals and draft images |
| **Students' perceptions of Generative AI Image Tools in Design Education: Insights from Architectural Education** (Huh et al., 2025) | 2025 | Architectural design education& Interior architecture | Generative AI | Student perception | Mixed | Students see AI as beneficial but a limited tool |
| **The impact of generative AI on architectural design education: insights from hands-on experience with architecture students** (Alamasi, et al., 2025) | 2025 | Architectural design education | Generative AI | Design process | Positive with certain challenges highlighted/Mixed | Framework recommendation, different levels of design stages |

**Table 2:** Continuation of comparative analysis of the studies (Source: authors).

| Study | Year | Educational Context | AI Tools | Learning Process | Student Experience | Educational Impact |
|---|---|---|---|---|---|---|
| **An exploration of the role of generative AI in fostering creativity in architectural learning environments** (Medel-Vera et al., 2025) | 2025 | Architectural design education | Generative AI | Design process | Positive | Discussions on AI tools integration into design education, Prompt literacy is important |
| **Exploring the Potentials of Artificial Intelligence Image Generators for Educating the History of Architecture** (Fareed et al., 2024) | 2024 | Application on theoretical courses (history of architecture, via workshops) | Generative AI | Architectural history | Positive | Introduction of a new approach to conventional architectural history education |
| **Pedagogy Explorations into Alternative Use of Generative AI in Design Studios** (Rhee & Oh, 2025) | 2025 | Architectural design education | Generative AI | Design process | Positive | Generative AI as a collaborator and a pedagogical partner |

The comparative analysis revealed recurring patterns across the selected studies. Several common themes emerged regarding the role of AI in architectural education contexts, while the AI tools and research objectives varied. These themes relate to the increasing prevalence of generative AI tool differentiations in design processes; student perceptions of AI-supported learning, and the emergence of new competencies associated with human-AI interaction.

Four main pattens were identified according to the analysis. A noteworthy finding is the dominance of generative AI applications in the literature. Most studies focused on image-generation systems, LLM (large language model) supported environments or hybrid AI-assisted design workflows. This suggests that current research in architectural education is concerned with the creative and exploratory capacities of AI rather than its analytical or evaluative functions.

The rise of GenAI, the transformation of the design process and the positive acceptance of those tools by the students.

Additionally, there is a certain cautious acceptance among the students as well. Moreover, prompt literacy is presented as a new skill. The emergence of prompt literacy indicates that effective interaction with AI systems is turning into an educational competence. Beyond technical proficiency, students are required to formulate intentions clearly, evaluate generated outputs in a critical manner and engage in iterative refinement processes. Consequently, AI literacy may be understood as an extension of broader digital literacy competencies within contemporary architectural education. The literature shows that technological adaptation of architectural education is focused more on visual generation and rapid ideation. Evaluation of AI mainly, by output production capacity, involves the risk of neglecting reasoning. This pattern reveals the need to reposition technology in a manner which enriches the learning process.

Although students mostly reported positive experiences with AI-supported learning environments, acceptance was rarely unconditional. Most of the studies documented concerns regarding overreliance on AI-generated outputs, potential decrease in creative autonomy, and uncertainties related to originality. These findings suggest that students view AI as a support mechanism while, in the meantime, they recognize its limitations within design education.

It demonstrates that AI is not adopted without questioning. These show that the students are not passive technology users but active learners who evaluate the limitations. Skills such as effective prompt writing, clear expression, iterative feedback and critical evaluation create learning areas for students. From the viewpoint of educators, the curriculum needs to be updated not just for the adoption of the tools but for digital literacy and human-machine communication skills. A particular amount of the literature concentrates on short-term applications; thus, long-term impact should be considered.

Overall, the studies indicate that AI is gradually becoming embedded within architectural learning environments. However, the literature is predominantly concentrated on short-term educational interventions and exploratory applications. Evidence regarding long-term outcomes, design reasoning processes and curriculum-level integration remains comparatively limited, which accentuates the important directions for future research.

## 5. Discussions

When the findings are evaluated together, it can be seen that the studies examined come to a common conclusion. The encounter of AI with architectural education is no longer a matter of choice but a reality that must be managed. The majority of studies approach this integration not with scepticism but with the question of how to frame it. However, this ‘how’ question cannot be deepened sufficiently in the studies analysed. Ouyang and Jiao (2021) classify the role of AI in

education through three paradigms. Most of the existing research positions it as an assistant or an instructor, whereas its true transformation potential lies in the third paradigm, where it is conceptualized as a partner aiming for cooperation.
The findings further suggest that AI should not be viewed only as a technological innovation but as a pedagogical partner for influencing how students approach to problem framing, idea generation and reflective learning. This point of view aligns well with the contemporary digital pedagogy literature, which emphasizes the reciprocal shaping of learning processes by human and technological developments.
For the design of educational technology in the age of AI aligned emphasizing structuring technology integration on the basis of technological possibilities rather than pedagogical principles is a structural error (Luckin & Cukurova, 2019). This can be aligned with the recommendations for integration with the curriculum. It remains at the level of general guidance rather than concrete pedagogical principles. It remains unclear which tools and with which assessment practices. At this point, the framework provided by digital pedagogy literature provides a functional basis.
The acceleration of the design process, should it be interpreted as a direct gain or a tension to be discussed? Design practice is a way of thinking based on the act of framing, mentioning that it can only be improved by direct contact with complexity (Dorst, 2015). The rapid alternative generation capacity offered by AI carries the risk of shortening the moment of experience for the student. The ethical dimension of AI in education, especially in the field of architectural education, is critical. From this perspective, educational value should not be just measured by efficiency or output quantity. Architectural learning has conventionally underscored reflection, iteration and the gradual development of design judgement. Thus, the challenge for educators is not whether AI should be or should not be integrated into architectural education, but how such an integration can preserve possibilities for critical inquiry and independent reasoning.
Concurrently, the examined studies demonstrate that the future of AI in architectural education is not much dependent on technological capability, but rather on pedagogical design. The central question is not whether students should use AI; the main inquiry becomes under which conditions AI can support meaningful learning. Future educational frameworks may need to balance technological innovation with critical reflection, ethical awareness and human-cantered design thinking.

## 6. Limitations

The number of studies included in the review is relatively limited. The narrowing of the sample is a result of applying strict inclusion and exclusion criteria. The study was limited to Scopus and the literature search finalized on 18 April 2026. This choice ensured methodological consistency in terms of quality assurance, peer review and international visibility. Some relevant studies in Web of Science, Google Scholar or regional indexes may have been excluded. The findings should not be interpreted as an absolute representation of the entire literature.

## 7. Conclusions

This study examined recent research on the use of AI in architectural education by a comparative analysis of the selected studies published between 2023 and 2026. Through the analysis of educational contexts, AI tools, learning processes, student experiences and educational impacts, the study attempted to identify shared patterns, opportunities linked with AI-supported learning environments. The findings show that AI is increasingly becoming an integral component of architectural education, specifically via the widespread adoption of generative AI tools that aid ideation, visualization and design exploration.
The study contributes to the existing literature in multiple ways. It provides a comparative synthesis of recent evidence in a field that remains fragmented across individual case studies, courses and technological applications. Rather than concentrating on a single AI tool or educational setting. The analysis highlights trends that extend across different architectural learning environments. The findings reveal the discussions surrounding AI in architectural educational contexts, which go beyond technological efficiency and consider pedagogical and ethical dimensions. It adds to ongoing debates within digital pedagogy by emphasizing the significance of understanding AI as a contributing element in architectural education.
In line with the stated objective from the outset of the study, the findings speak directly to architecture educators and students. For educators, the comparative analysis shows that incorporating AI tools into the studio environment requires a pedagogical positioning beyond a vague integration decision. When the tool and the phase of the design process it needs to be used are not defined, the speed gain offered by the tools has the risk of overshadowing the depth of learning.
For students, the findings offer three concrete conclusions. One is the acceleration of the design process via the AI tools, prompt literacy, which can be consciously developed.
Finally, maintain a critical distance from the tools, for instance, questioning the outcome, generating alternatives and explaining the reasoning behind a decision remain the expectations of architectural education, regardless of the presence of AI in the studio. From a practical view, the findings have implications for both educators and students. For educators, the results suggest that the successful integration of AI needs more than simple access to technological tools. Effective implementation requires the development of pedagogical strategies that define how and for what purposes AI should be used within the design process. The discussed competencies may become essential components of future architectural education.
Despite the discussed factors, several areas are in need of further investigation. The majority of the studies examined had a focus on the short-term educational interventions, whereas the long-term effects of AI on design thinking, creativity and, critical reasoning should be researched. Furthermore, future research may explore assessment practices and curriculum developments which can respond to increasing human-AI collaboration within design education. In the future, it is foreseen that the value of AI in architectural education will be dependent on the pedagogical frameworks.

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No new data were created or analysed in this study; all sources are cited within the article.

**Institutional Review Board Statement**
The research involved publicly available datasets and thus did not require ethical approval.

**CRediT Author Statement**
Conceptualisation; Ş. H., N. Ö.; Methodology; Ş. H., N. Ö. Writing – original draft; Ş. H.; Writing – review & editing: Ş. H., N. Ö.; Conceptualisation; Ş.H.; Supervision: N.Ö. *All authors have read and approved the final manuscript.*

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