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Entry

Where Critical Inquiry, Empirical Making, and Experiential Learning Shape Architectural Pedagogy

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Definition

This entry is based on the premise that pressing issues of climate change, social injustice, and post-COVID practices appear to have superseded some essential values of architectural and design pedagogy, leading to improvements in content that may be offset by a loss of focus on the core curriculum. The entry reimagines architectural pedagogy by arguing for a transformative shift from traditional product-based education to a process-oriented, inquiry-driven approach that cultivates critical thinking and empirical making, predicated upon experiential learning. It aims to integrate rigorous critical inquiry into both studio-based and lecture-based settings, thus critiquing assumed limitations of conventional approaches that prioritise final outcomes over iterative design processes, dialogue, and active engagement. Employing a comprehensive qualitative approach that incorporates diverse case studies and critical reviews, the analysis is divided into two main threads: one that places emphasis on the studio environment and another that focuses on lecture-based courses. Within these threads, the analysis is structured around a series of key themes central to experiential learning, each of which concludes with a key message that synthesises the core insights derived from case studies. The two threads instigate the identification of aligned areas of emphasis which articulate the need for active engagements and reflection, for bridging theory and practice, and for adopting interdisciplinary and experiential approaches. Conclusions are drawn to establish guidance for a future direction of a strengthened and pedagogically enriched architectural education.

Keywords: studio-based teaching; experiential learning; active learning; architectural theory; design education; dialogical learning; learning from reality

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1. Introduction: Back to Basics Beyond Climate Change and Post-COVID Discourse

Architectural education has long been situated at the intersection of artistic enterprise and technical rigour. Over the past decades, concerns about the effectiveness of traditional pedagogical models have given rise to a renewed interest in alternative, process-based and inquiry-oriented approaches to design learning. This entry echoes the French philosopher and sociologist, Edgar Morin, known for his work on interdisciplinary thought and complexity, who argued that "by sacrificing the essential for the urgent, one ends up forgetting the urgency of the essential" [1]. Morin's observation is a perceptive cue that the architectural education community may seek to address pressing demands such as climate science, wellbeing and pandemics, and social inclusivity within architectural pedagogy

and design studio teaching practices, at the expense of deeper, long-term skills, knowledge and behaviours that underpin architectural education and practice.

Reacting immediately and constantly to emergent issues risks ignoring fundamental disciplinary premises. Progressive architectural pedagogy requires a judicious balance of immediacy with significance, ensuring that foundational principles that underpin the core aims of educators and students are critically reinforced.

Weaving two threads of pedagogical discourse in architecture, this entry places emphasis on ways in which knowledge content is delivered effectively within the learning process, rather than focusing on the type of content itself. While the two threads place emphasis on experiential learning, the first concerns critical inquiry and process-oriented studio pedagogy. The second thread highlights impactful learning approaches in lecture-based courses and modules. Collectively, these approaches offer working examples of evolving methods of architectural pedagogy.

These educational initiatives are not necessarily new in many other disciplines and contexts beyond architecture and design; all such alternatives require continuous and progressive institutional commitment. Curriculum restructuring should explicitly promote constructive alignment between theoretical and practical courses, ensuring that students experience a cohesive learning trajectory. Academic development programmes can support educators in experimenting with active learning methods, digital platforms, and interdisciplinary collaborations. Educators themselves need space and time to develop, reflect upon, and refine their teaching practices, echoing the iterative design processes they advocate for their students. Partnerships with local communities, professional organisations, and industry leaders can offer students real-world contexts and opportunities that amplify the relevance of both studio and classroom learning. Such collaborations also serve as channels for future employment, networking, and continued professional growth, forming a bridge between academia and practice.

1.1. Rationale and Brief Argument

The growing complexity of social, environmental, and economic challenges and the role of architecture in addressing these issues necessitates a pedagogical shift towards more dynamic, integrative, and process-oriented approaches to learning [2]. Traditional design studios and lecture-based courses often fail to fully engage students in skills of critical inquiry and experiential learning [3]. Architectural education has historically relied on a dual structure of theoretical coursework and design studios. However, the rapid evolution of digital tools, changing socio-environmental challenges, and the need for interdisciplinary collaboration call for approaches that transcend this assumed dichotomy [4,5]. While several voices call for reconciling knowledge types by integrating the two, attempts at this synthesis often fail to recognise the spread and depth of knowledge required in lecture content and the ways in which such knowledge is incorporated into design studio projects. In response, process-oriented pedagogy has emerged as a convincing approach that fosters creativity, solution generation skills, and engagement in empirical making [6,7]. It emphasises the process of design rather than solely focusing on final outcomes, encouraging students to engage in reiterative experimentation and critical reflection. Research suggests that process-driven learning enhances adaptability and the ability to creatively synthesise diverse knowledge sources and types which are essential attributes for contemporary architects [8,9].

Various national and international reports, such as the UIA-UNESCO Charter of Architectural Education (1996—updated 2023) [10], the Carnegie Foundation's report 'A New Future for Architectural Education and Practice' (1996) [11], and the AIAS report 'The Re-design of Studio Culture' (2002) [12], highlight the limitations of traditional ar-

chitectural education. More recently, AACA of Australia, RIBA and ARB in the United Kingdom, and NAAB of the United States [13–18] have introduced new criteria for validating schools of architecture including calls for new knowledge contents. This is coupled with significant inquiries that emphasise benefits of integrating research processes into architectural education while advancing deeper connections between academia and professional practice [4,5,9,19–26]. Such commentaries often advocate for a radical knowledge-based reform in architectural pedagogy to prepare students for rapid changes in professional practice. Although these organisations appear to focus on the architecture student's acquisition of more professional knowledge, their aims can be translated as calls for a paradigm shift in teaching approaches, curriculum structures, and assessment metrics to better serve the lifelong learning needs of students, the profession, and society.

Central to the discussion in this entry, it is argued that architectural pedagogy should transition from a traditional output-based model to one that accentuates process, inquiry and experiential engagement. As architectural practice becomes increasingly complex and interdisciplinary, the traditional studio approach, characterised by linear sequencing, prescriptive instruction, and limited student agency, will prove inadequate [8,9]. An educational transformation that employs active learning, autonomous inquiry and self-reflection, as well as integrating innovative methods and technologies, may more effectively echo the dynamic nature of contemporary professional practice. In studio settings, this argument is supported by evidence that creative thinking and problem-solving skills are developed effectively through iterative cycles of experience and reflection [6]. Engaging in hands-on activities, dialogue and empirical making, students develop the capacity to translate abstract ideas into realistic responses to simulated client requirements, values and aspirations. Concomitantly, lecture-based courses can be reimagined as interactive learning settings where the built environment itself can be utilised as a learning opportunity and an applied source of knowledge. These corresponding approaches form two threads of an integrated pedagogical vision that aims to equip students with technical competencies through nurturing the adaptive, reflective mindset necessary for lifelong learning and professional success. While many of the practices discussed in this entry are evident across global schools of architecture, this paper analyses how these practices are being consciously restructured and reframed within evolving pedagogical perspectives.

1.2. Objectives

Considering these existing challenges, the increasing body of literature that calls for reforming architectural education, and our focus on the essential rather than the urgent, this entry aims to achieve the following:

- Examine the role of critical inquiry, empirical making, and process-oriented approaches in architectural pedagogy.
- Demonstrate how experiential learning and digital technologies can enhance studio teaching.
- Explore approaches to encourage active engagement in lecture-based courses or taught modules.
- Develop recommendations for cultivating a culture of inquiry and collaboration within the student body, and between students and staff.

On a broader level, this entry seeks to contribute to the ongoing discourse on architectural pedagogy and offers strategies for educators seeking to encourage more effective teaching approaches. The study also aims to provide insights into how knowledge delivery can be reconceptualised to prepare students better for the demands placed on the profession and its education by society.

1.3. Approach to Analysis

An extensive qualitative and multi-perspective approach is employed to integrate case studies and critical reviews of pedagogical experiments and address the premise and objectives of this entry. This approach is predicated on an existing body of knowledge, which has developed over several decades, including pedagogical theories and situated experiments conducted by educators in architecture. The selection of examples is identified to cover the range of themes this entry aims to capture and convey, including creative thinking, critical inquiry, experiential (active-inquiry-based) learning, empirical making, and process-oriented pedagogy. The selection of cases draws from a range of schools of architecture in Asia, Europe, North America, and Europe to demonstrate and validate the identified themes, as well as to identify fundamental drivers of architectural pedagogy in a cross-cultural milieu.

The analysis is divided into two threads: one that focuses upon the studio environment and another that concentrates upon lecture-based courses and modules. Within these threads, the analysis is structured around key themes such as creative thinking, experiential learning, critical inquiry, process-based teaching, digital pedagogy, the built environment as an open textbook, and the continuing relevance of history. Each subsection concludes with a synopsis that synthesises key insights for educators and practitioners teaching architecture (Figure 1). The entry draws on seminal works by educational theorists as well as empirical studies, generating a robust, evidence-based framework for reimagining design pedagogy. The two threads instigate identification of shared emphases and links, challenges and opportunities, and limitations and possibilities associated with these theories and approaches, postulating guidance for strengthening future pedagogical practices in architecture and design.

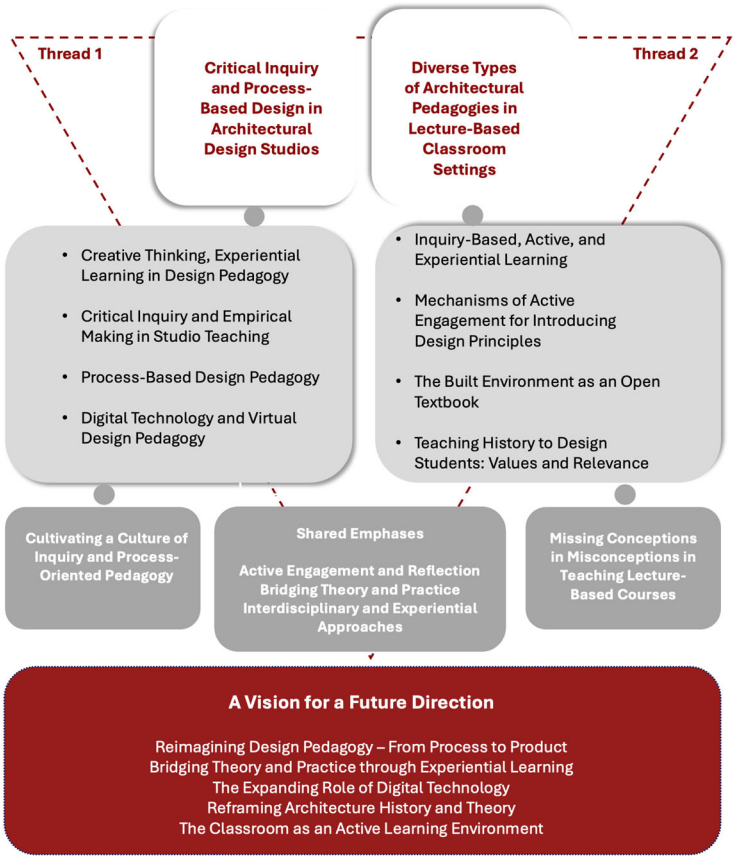


Figure 1. Approach to analysis involving two main threads: one that places emphasis on the studio environment and another that focuses on lecture-based courses.

2. Critical Inquiry and Process-Based Design in Architectural Design Studios

The first thread on critical inquiry and process-based design learning is conceptualised in four key areas that include creative thinking and experiential learning in the architectural design studio; process-based design learning; critical inquiry and empirical making in studio teaching practices; and digital technology and virtual design pedagogy (Figure 2).

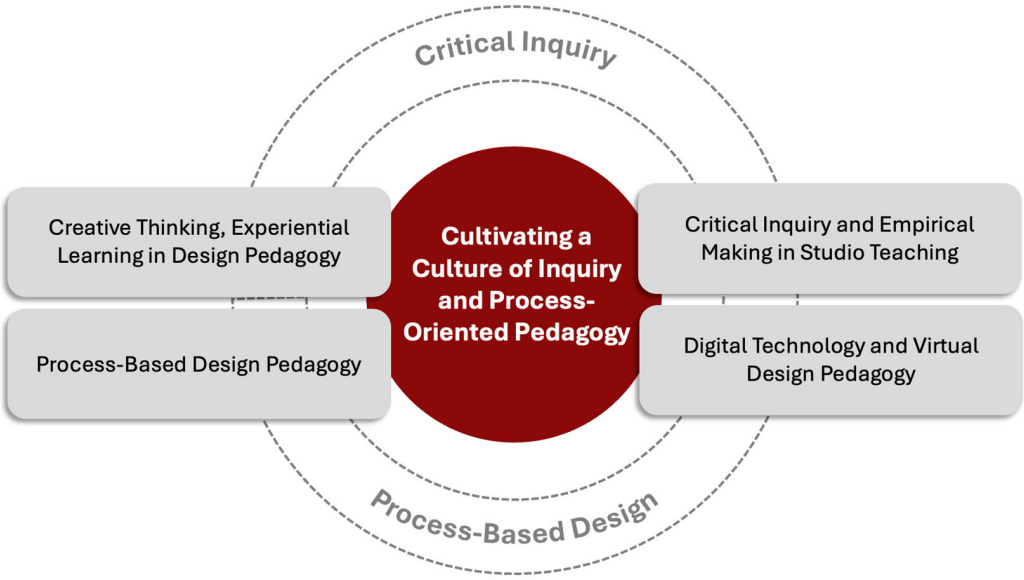


Figure 2. The first thread: critical inquiry and process-based design in architectural design studios.

2.1. Creative Thinking, Experiential Learning, and Learning Styles in Design Pedagogy

Creative thinking has long been, and continues to be, the keystone of architectural and design education. Theories by Kolb, Dewey, and Piaget [6,27,28] emphasise the significance of experiential learning in fostering creativity and innovation. Adopting a process-oriented approach supports students in engaging with hands-on problem-solving, thus enhancing their ability to debate complex design challenges. Experiential learning can be conceptualised into four types of thinking: convergent, divergent, assimilative, and accommodative. Understanding these types, and their associated learning styles allows educators to adopt pedagogical strategies that can enhance learning outcomes. This section explores creativity in architecture and design, and the role of experiential learning in shaping design education.

2.1.1. Evolution of Creativity in Design

Creativity in architecture has evolved from being considered an individual act of generating ideas and creative concepts towards the critically evidenced integration of intrinsic and extrinsic influences. Historically, the Renaissance era attributed creativity to artistic genius, implying divine intervention and the sovereignty of the individual. However, contemporary thinking emphasise creativity as a structured process involving discipline, self-perception, and knowledge application [29,30]. The architectural profession has since expanded architectural production to encompass contributions from co-professionals, researchers, project managers, and other specialists in the creative and construction industries. In this context, creativity requires the critical skills of integrating multiple sources of knowledge–often conflicting–to synthesise complex and original designs. It follows that assessing creativity in design should not be limited to formal products or outcomes but should also examine and critique the procedural rigour employed in the generation of designs [29]. It may also be argued that creativity encompasses problem definition as well

as problem solving [31,32], suggesting that architectural creativity extends beyond formal responses to include problem-identification and problem-solving. Key cognitive abilities associated with creativity include reformulating design problems, generating original and alternative ideas, strategic problem-solving, and risk-taking [28]. Notably, the integration of creativity and social responsibility is crucial to ensure that architectural design is pertinent and contextual. Architects must engage in socially engaged creativity, balancing artistic endeavours with societal and environmental needs. Therefore, architectural education should continuously seek to frame contextual complexity and evaluative synthesis within the creative act of design.

Sternberg's theory of successful intelligence [33,34] is germane to conceptualising creativity in architecture. It identifies three constituents: practical intelligence, focusing upon problem-solving in complex real-world contexts rather than hypothetical abstractions; analytical intelligence, which emphasises deductive reasoning where conclusions are drawn based upon critically validated premises; and creative intelligence, which involves synthesis and problem-solving. In design pedagogy, fostering these three aspects of intelligence can cultivate the abilities of future architects to address diverse social and environmental challenges [35]. An example of successful intelligence application is a studio experiment at Kuwait University which exemplifies promotion of creative thinking [36]. Students were challenged to design mosques that would reflect contemporary Muslim lifestyles, challenging the normative aesthetics and ornamentation of traditional mosques. The studio encouraged the critique of conventional typologies, incorporating elements such social spaces, interactive environments, and modern technologies. The outcomes demonstrated how applied concepts of creativity, utilising successful intelligence protocols can foster meaningful and innovative architectural responses to a complex brief.

2.1.2. Experiential Learning Theory and Design Pedagogy

Experiential learning, as expounded by Kolb [6] is viewed as a process wherein knowledge is acquired through experience. This theory employs a four-stage learning cycle consisting of concrete experience, reflective observation, abstract conceptualisation, and active experimentation. These stages correspond to different learning styles, including divergent learning, which combines concrete experience and reflective observation; assimilative learning, which integrates abstract conceptualisation and reflective observation; convergent learning, which combines abstract conceptualisation and active experimentation; and accommodative learning, which incorporates concrete experience and active experimentation. In this sense, experiential learning is particularly relevant in design studios, where students learn through reiterative design processes. Reflection plays a critical role in transforming experiences into knowledge, as design education requires students to engage in real-world problem-solving [37]. Design problems are typically ill-defined, necessitating a combination of reflection-in-action and action-based learning [7,38,39]. An example study was conducted at Bahcesehir University, Istanbul, exploring how learning styles influence students design performance. The experiment tested students under constrained and unconstrained design conditions and found that, on the one hand, concrete experience learners performed better under constrained conditions, outperforming in structural innovation and ergonomics. On the other hand, reflective observation learners thrived in unconstrained conditions, demonstrating stronger conceptual development and spatial articulation. These findings recommend that design educators should tailor learning experiences to students' individual cognitive styles to support their performance.

2.1.3. Empirical Examination of Learning Styles

The imposition of constrained design parameters and learning outcomes was utilised in an 'Integrated Design Studio' experiment at Qatar University. This initiative employed the Student Performance Criteria (SPCs) of the NAAB (National Architectural Accrediting Board). The studio project assignment brief involved designing proposals for the headquarters of Qatar Economic Zones Company (Q-EZC), emphasising the integration of specific sustainability considerations within a wider matrix of functional requirements [40]. Design objectives included integrating technical documentation, sustainability considerations, and historical traditions into a comprehensive design response. The project was systematically structured in multiple phases. The first phase required students to conduct project-specific research, analyse the site, and study programmatic requirements. This was followed by conceptual development, where each student developed three alternative designs before selecting one for refinement. The design development phase focused on producing preliminary drawings and models, leading to the final scheme, which was evaluated by a jury consisting of faculty members and client representatives. Historical and cultural analysis played a critical role, with students conducting comparative studies of global influences and local architectural traditions. The final stages required technical detailing, including sustainability strategies aligned with GSAS certification (Gulf Sustainability Assessment System). While constrained design conditions may appear to be limiting to creativity and limited in scope of inquiry, they can conversely enhance creative thinking through the provision of a structured and challenging context within which creative ideas take place. The involvement of clients and industry professionals provided students with authentic, real-world understandings of professional design processes, ensuring that design proposals would meet formal, functional, and contextual requirements.

2.1.4. Key Message

Architectural pedagogy should embrace experiential, process-oriented learning to nurture analytical, practical, and creative intelligences while adapting to individual learning styles. Kuwait's mosque studio showed that successful intelligence protocols fostered meaningful, innovative designs; Bahçeşehir's experiment demonstrated that concrete-experience learners excelled under constraints and reflective observation learners thrived in open briefs; and Qatar's constrained phased studio enhanced creative thinking through structured experiences and client engagement. These approaches ensure the development of socially responsible, contextually relevant solutions to complex design challenges. Personalised learning approaches can be employed to serve individual student needs and learning styles. Integrating real-world scenarios can offer students a deeper understanding of professional practice considerations. Encouraging reflective observation is key to helping students to critically articulate justifications for their design actions and decisions.

2.2. Critical Inquiry and Empirical Making in Studio Teaching

At best, studio-based learning integrates critical inquiry to enable students to successfully develop, critique, and refine their design and thought processes. Empirical making, whereby students engage in material experimentation and iterative prototyping, can enhance reasoning through tangible learning experiences. Critical inquiry relates to critical thinking, which has long been a fundamental goal in education, as exemplified in Dewey's theories which offer a solid foundation for its pedagogical significance. In contemporary educational discourse, critical inquiry has been increasingly recognised as a dynamic learning tool, mainly in the context of design pedagogy [3,41]. This section outlines three different studio-teaching models from various universities, each highlighting the role of critical thinking and heuristic, autodidactic strategies in design learning.

2.2.1. The Design Studio as a Site for Critical Inquiry

While critical thinking is commonly accepted as vital to education, its interpretation diverges. Bose (2007) [41] identifies critical thinking as a complex, context-specific problem-solving activity involving both abilities and dispositions. However, traditional studio instruction often fosters student dependency on professors for decision-making, which can impede the development of critical thinking [3,41]. In response to this conjecture, Bose et al. introduced the 'independent design decision-making' model at Pennsylvania State University, aiming to shift decision-making responsibility to students and enhance self-efficacy [42]. The study applied this model to a third-year design studio in collaboration with the Schreyer Institute for Teaching Excellence [3]. Over a period of two years, diverse strategies were implemented and assessed using two metrics to assess performance: the GEFT (Group Embedded Figures Test) and SALG (Student Assessment of Learning Gains). The findings showed that independent decision-making significantly improved students' confidence and critical thinking abilities which led to producing higher-quality design outcomes [3]. Through promoting autonomy and independent learning, this approach demonstrates that reducing reliance on design instructors' endorsements and approvals can foster more autonomous, reflective, critically engaged and active learning.

2.2.2. Critical Inquiry and Practice as a Teaching Tool

A debate over whether critical thinking is an independent attribute, or a discipline-specific skill continues. It can be argued that critical thinking is inherently connected to specific subjects [43,44], which instigates a focus on the signature pedagogies of architecture [45]. At the American University of Sharjah (AUS), A studio experiment implemented an inductive teaching model stressing self-directed investigation and proactive engagement [46,47]. This approach involved students analysing existing buildings to understand fundamental architectural principles. Redrawing architectural plans, students were able to reveal underlying design strategies, strengthening their analytical skills. This method allowed students to bridge academic learning with professional practice, enabling proficiency at aligning theoretical knowledge to real-world situations. A key aspect of the experiment was the authentic and fluid nature of design briefs. Students firstly designed a single-unit retreat then were later asked to adapt their designs to a 12-unit complex, replicating real-world design modifications that could normally emerge. Notably, this approach encouraged flexibility and critical reassessment of design ideas, essential skills for professional architects. Analytical diagrams were used extensively to scrutinise design strategies, enhancing students' abilities to critique, communicate and develop appropriate design solutions.

2.2.3. Heuristics and Learning by Making

A heuristic approach to studio teaching was introduced at the University of Utah [48], placing an emphasis on materiality and construction detailing. This approach reversed the conventional design process through starting with full-scale constructional models before advancing to general arrangement design drawings. Inspired by Zumthor's reflections on 'thinking architecture' [49], this approach rooted design thinking in an appreciation of physical materials, structural principles and constructional details rather than formal design principles or abstract concepts. Students initially built full-scale material models, directly investigating structural and material properties. This process allowed them to develop tectonic knowledge before interpreting their ideas into architectural drawings. One case study involved a student who developed a detailed masonry and timber connection, using it as a conceptual foundation towards generating a scheme for an entire building design [48]. This strategy accentuates the importance of physical making in de-

sign pedagogy, proving that hands-on experimentation can generate meaningful design responses. A second heuristic design exercise required students to analyse constructional interfaces, such as wall to roof junctions, towards developing appropriate construction details [48]. Through working directly with materials students gained a deeper awareness and appreciation of architectural components and their impacts on overall design. This heuristic approach supports the notion that making and conceptualisation are intertwined processes in reframing design solutions, resulting in more innovative and contextually aware design schemes.

2.2.4. Key Message

Studio teaching flourishes when critical inquiry and empirical making converge to build autonomy, analytical rigour, and material fluency. Pennsylvania State's independent decision-making model, measured by GEFT and SALG, demonstrated that shifting responsibility onto students boosted their confidence, critical thinking, and the design quality of their work. At the American University of Sharjah, inductive redrawing of real buildings and the challenge of scaling from single-unit retreats to twelve-unit complexes sharpened students' ability to link theory with practice, encouraging flexibility and reflective critique. The University of Utah's heuristic, full-scale prototyping addressed material properties and construction detailing, enabling students to translate tactile explorations into innovative schemes. Together, these cases reveal that empowering learners through autonomy, authentic analysis, and hands-on experimentation cultivates critically engaged, contextually aware designers. Fostering independent inquiry, reflective learning, and hands-on experimentation, these three approaches confirm that students can successfully acquire the critical skills necessary for solving complex design challenges.

2.3. Process-Based Design Pedagogy

The process-based design pedagogy stresses the need for a shift from passive learning to active engagement. This section examines case studies where iterative learning cycles, reflective practice, and integrative design mechanisms have meaningfully enhanced student performance and design thinking. The pedagogical literature [2,3,41,50–54] states that students engaging in inquiry-based learning develop a better understanding of spatial design, structural integrity, and social and environmental responsiveness.

2.3.1. Process-Based Design Studio Teaching Approach

Design education has traditionally been product-oriented, emphasising the final output rather than the design process itself. An 'analysis–synthesis' approach emerged in the late 1960s; however, its fragmented linear approach could often lead to inadequate integration of design elements [30,38,55]. Adopting this approach, many students struggled to translate initial investigations into coherent design solutions, in the uncritical belief that the process would invariably lead to a single optimal solution [9,56,57]. In response, a structured studio-teaching approach was developed to integrate process into design learning. This approach is predicated on three core assumptions: students have limited repositories of design ideas, they struggle to go beyond basic formal experimentation, and they have difficulties incorporating multiple criteria into design solutions [8]. This approach consists of two primary components, analytical understanding and creative decision-making, which are delivered via four key stages.

In the first stage, students receive a detailed assignment brief, covering project objectives and key design issues. They then engage in collective brainstorming and discussions, encouraging conceptual idea generation. Foundational lectures introduce relevant design principles and provide case study examples, followed by studio sessions that facilitate debate on contextual, programmatic, and functional aspects. The second stage engages

with information gathering, which consists of reviewing standards, analysing case studies, and conducting site analysis. Students diagnostically analyse project criteria and relate them to the case studies, while performing walkthroughs to assess constraints and opportunities onsite. This phase offers students opportunities to gather essential data towards establishing design imperatives which will influence their design decisions.

The interpretation stage follows, asking students to translate their understanding of design imperatives into a detailed programme. Students can then develop a framework that guides their design approach. This phase is essential as it enables students to organise their thoughts and refine their ideas. Finally, in the schematic design stage, students generate two alternative designs, evaluating their effectiveness before identifying one for final development. The quality of designs is assessed based on how well they apply processed information and address key design imperatives. Notably, through this process students enhance their problem-solving skills and learn to iterate effectively.

2.3.2. Teaching/Learning Methodology

The process-based design model incorporates Gardner's Multiple Intelligence Theory (MI Theory), recognising diverse learning styles, including bodily/kinaesthetic, visual, logical/mathematical and spatial preferences for individual learners [8,58–60]. It should be noted, however, that MI Theory remains debated and is not synonymous with learning styles. It also acknowledges psychological theories such as the Split-Brain Theory, which was historically influential but has been critiqued over recent years. The theory distinguishes between analytical-logical (left-brain) and imaginative-intuitive (right-brain) thinking [61–63]. The teaching process adopted accommodates diverse cognitive styles, fostering both deductive (information gathering) and inductive reasoning (creative synthesis). A key component of this model is peer feedback, which minimises traditional instructor/tutor intervention. Students engage in group critiques, evaluating their work through comparison to that of their peers to refine their designs concepts [64,65]. The studio process balances instruction, which includes exploration, information gathering, programme development, and responses, where students apply acquired knowledge to develop design schematics. This dynamic interaction between instruction and responses cultivates a deeper appreciation of design processes and the necessary skills development to enact these.

2.3.3. Implementation of a Process-Based Model

This model was applied at King Fahd University of Petroleum and Minerals (KFUPM) during a second-year sophomore studio in 2005. Students were required to design an international elementary school within a seven-week timeframe. Initial stages involved research on school design principles, with an emphasis on aspects related to creating a "sense of belonging" through the "school within a school" cluster typological concepts while integrating the school as a community space [8,19,20]. Facilitating rapid conceptualisation of design ideas, students participated in design games and role play aimed at studying different typologies, exploring school building identity, replicating stakeholder roles and developing room adjacency alternatives. Throughout the process, students recorded and analysed site constraints, functional requirements, and user needs (school students and teachers). The interpretation phase asked for development of a personalised design programme and prioritisation of design imperatives in advance of proposing two alternative designs. Peer evaluations helped refine these alternatives, leading to final proposals which were assessed based on compliance with the knowledge from earlier stages [8,66,67].

Two projects are selected to highlight the effectiveness of the process-based model. One project emphasised social interaction by creating a central communal space with

modular classroom clusters. Energy efficiency was enhanced through north-facing classrooms and skylight-based daylighting. Another project focused on cultural integration by incorporating traditional Saudi wind towers (Barajeel) for passive cooling, while the layout followed a mall-like typology that cross-programmed educational and communal spaces. In essence, these projects demonstrated an increased understanding of contextual, programmatic, and functional considerations.

In 2013–2014, the Senior Design Project Programming course at Qatar University implemented a feedback/feed-forward approach to pre-design thinking. This course aimed to teach students the effective skills to translate precedent studies into comprehensive architectural programmes [40,57]. The methodology involved diverse modes of knowledge delivery and learning settings including lectures, readings, group discussions, and structured assignments, concluding with a pre-design document [68,69]. The document aimed at defining a project typology, site analysis and selection, user profiles and requirements, and spatial adjacency diagrams. This iterative feedback process enhanced students' skill to conceive imperatives for realistic design alternatives.

2.3.4. Key Message

Process-oriented pedagogy presents a challenging and evidence-based alternative to product or output-based design approaches. Structuring studio work into stages, engaging students in interactive learning, and integrating multiple learning opportunities, this model encouraged deeper analytical and creative skills, nurturing critical thinking, structured problem-solving, and the selection and application of appropriate design imperatives. Student feedback reported that the structured approach provided clarity and organisation, allowing valuable intervals for reflection and critique. The peer review and self-assessment elements were particularly beneficial. Nonetheless, some students noted time constraints and the need for clearer assessment rubrics. These insights should inform future improvements in the delivery of similar courses. Henceforth, continued improvements in feedback mechanisms, assessment clarity, and judicious time allocation for different project phases will further reinforce the process-based design pedagogical model. Consideration of efficient process-oriented design processes may also counter the prevalent issue of poor student time management in architectural education [70,71]

2.4. Digital Technology and Virtual Design Pedagogy

Advancements in digital tools have transformed architectural education, enabling students to engage with virtual simulations, parametric modelling, and computational design. Electronic learning and digital pedagogies can facilitate collaborative and interactive learning experiences beyond traditional studio and classroom settings [72–74]. A number of cases follow to demonstrate the effectiveness and potential of virtual studio environments where students engage in real-time design problem-solving exercises using digital platforms. This development can also be seen to reflect current trends in architecture, whereby multi-national practices can offer 24 h architectural production through use of multiple time-zones.

Architectural education has traditionally revolved around the Beaux-Arts learning environment of physical design studios, emphasising learning by performing, promoting face-to-face and peer learning interactions, and holding critique and review sessions in person [75]. However, with globalisation and technological advancements being embedded in professional architectural practices, there is an imperative for students to collaborate in multicultural and international environments. The introduction of digital technologies, including Virtual Design Studios (VDS), has significantly transformed the learning process. Digital platforms such as Archnet, developed at MIT, have facilitated international

collaborative studios in various countries, including Bosnia, India, Japan, Lebanon, and Turkey [19]. Initiatives, such as the European project OIKONET, have evolved into virtual campuses that support multidisciplinary housing research across Europe [76].

The integration of digital learning environments has profoundly impacted both architectural research and studio teaching. Virtual design studios (VDS) operate as a networked studio across different locations allowing students to collaborate as if they were in a single physical space. VDS can impart professionally relevant design skills and foster cross-cultural learning. Unlike traditional studios, VDS can engage with new methods of reviewing design processes, assessing student work, and utilising collaborative tools [77]. Notably, shifts toward knowledge codification have been a focus, with researchers categorising architectural knowledge in VDS into three phases: initiation, realisation, and reflection with emphasis on the importance of well-codified knowledge for students, educators, and external stakeholders.

2.4.1. E-Learning Concepts, Benefits and Challenges in Virtual Learning Environments

The integration of e-learning concepts within design studios was explored by Devetakovic and colleagues at University of Belgrade. Their research focused on using MOODLE, an e-learning platform that supports design education through a virtual learning environment (VLE). Within a VLE, the studio process is adapted to a digital framework, where content is structured both thematically and chronologically. In this case study, a third-year urban design studio with 30 students used a MOODLE-based platform. The VLE allowed structured access to studio content, external information, and a virtual exhibition space to present student work at various design stages. Other functionalities included discussion forums, external resources, a glossary of technical terms, and project repositories. These digital tools enhanced student engagement, promoted knowledge sharing, and provided long-term accessibility to design projects [78]. However, challenges such as the additional time required for content management and the need for continuous technological updates should also be noted.

Using VLEs in design studios offers multiple benefits [72–78]. It facilitates the delivery of design studio information and documentation, allows collaboration with external institutions and government agencies relevant to the project, and promotes the external and authentic communication and transaction of knowledge between students, educators and stakeholders. Importantly, remote participants can successfully engage with studio projects and contribute to discussions and review sessions. VLEs can also preserve design knowledge beyond the teaching period. Despite these advantages, challenges such as the impacts of diminution of the social learning advantages of physical studios, increasing reports of student loneliness, the rise of bad actors and behaviours in cyberspace, adapting digital platforms to tutors' and students' evolving delivery and communication habits, developing a reliable repository, and maintaining a digital exhibition space remain functional challenges.

2.4.2. Collaborative Virtual Design Studios and Dialogic Learning

The pedagogical dynamics of collaborative VDS have been explored in many experiments around the world. For example, Hou and Kang (2006) examined how cultural, methodological, and spatial differences influence the design process and outcomes [79]. Basing this work on a premise of dialogic learning, their study involved students and educators from the University of Washington (USA) and Tamkang University (Taiwan). The digital learning platform facilitated interactions through virtual pin-up boards, archives, and work-in-progress folders, supplemented by video conferences for interim and final critiques. Cross-cultural student pairs were formed to support each other's design develop-

ment, with communication facilitated in both Chinese and English. A key feature of this collaborative studio was the adoption of 'landscape narratives' where students analysed two urban waterfront sites, one in Seattle and one in Taipei, to unveil untold cultural and historical narratives [80]. Through techniques such as photo collages, two-dimensional mapping, and digital storytelling, students explored the vigorous characteristics of these spaces. Their design proposals, termed 'ARTivism,' aimed to communicate these narratives through individual and collaborative efforts. These exercises helped students develop critical thinking, articulate cultural differences and commonalities, and negotiate diverse design conceptualisations through the development of a common architectural language.

2.4.3. Key Message

Digital technologies and virtual studios extend architectural pedagogy beyond the physical studio setting, fostering global collaboration, knowledge codification, and long-term project accessibility. At the University of Belgrade, a MOODLE-based VLE structured course content, discussion forums, and virtual exhibitions for 30 urban design students, enhanced engagement, peer sharing, and archival continuity, albeit at the cost of extra content management and potential social isolation. Likewise, the Hou & Kang experiment between the University of Washington and Tamkang University leveraged dialogic learning in a cross-cultural Virtual Design Studio where bilingual teams co-created "landscape narratives" of Seattle and Taipei waterfronts using digital pin-ups, video critiques, and storytelling tools. This collaborative VDS sharpened critical thinking and intercultural fluency and demonstrated that virtual platforms can enhance a shared architectural language across different geographies. Clearly, these cases show that, while e-learning demands ongoing technical upkeep and strategies to mitigate student isolation, well-designed digital studios can democratise expertise, sustain design discourse, and prepare students for globally networked practices.

3. Diverse Types of Architectural Pedagogies in Lecture-Based Classroom Settings

The second thread is centred on diverse types of architectural pedagogies in lecture-based classroom settings. The thread articulates four key areas that include engaging with inquiry-based, active and experiential learning; utilising the built environment as an open laboratory or textbook; examples of active engagement in beginning studios that focus on introducing design principles; and the teaching of history to design students (Figure 3).

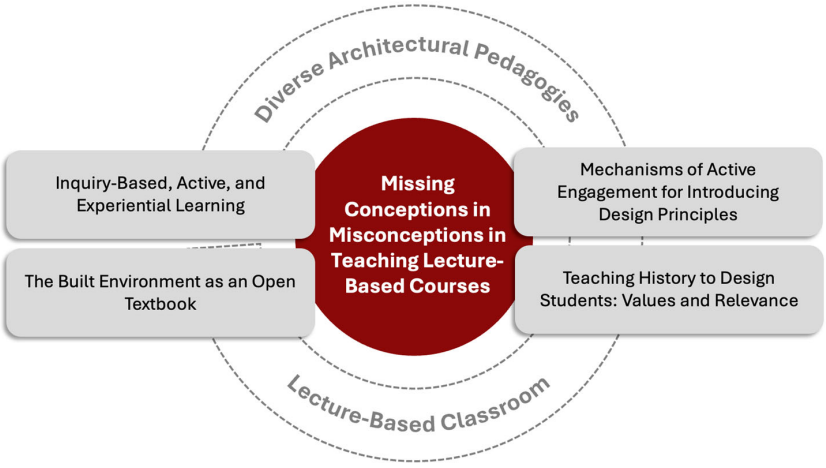


Figure 3. The second thread: diverse types of architectural pedagogies in lecture-based classroom settings.

3.1. Inquiry-Based, Active, and Experiential Learning

Inquiry-based learning (IBL) challenges students to actively engage in the learning process rather than passively absorb knowledge delivered to them. It is an instructional method popularised in the1960s as a response to the limitations of traditional rote learning, which emphasised memorization and the uncritical reproduction of instructional materials. Unlike conventional pedagogies, IBL assesses student progress based on the development of critical thinking, analytical skills, and experiential learning rather than the supine acquisition of knowledge [5,23]. This approach led educators to experiment with teaching approaches that transform students from passive recipients into active learners, considering the incorporation of active learning strategies essential in contemporary education. This section highlights how educators have incorporated IBL strategies to enhance cognitive engagement and problem-solving skills. A series of examples is identified to demonstrate the integration of student-led learning towards enhancing their analytical and intellectual competencies.

3.1.1. Characteristics and Role of Active and Experiential Learning

The core principle of active learning is student engagement, whereby learners participate in individual or group activities such as reading, discussion, evaluation, and exploration of ideas and actions. In active learning educators act as facilitators rather than traditional lecturers and knowledge providers, offering constructive feedback while encouraging students to engage in higher-order thinking through analysis, synthesis, and evaluation [81,82]. Unlike passive learning environments, active learning inspires students to reflect on their actions and thought processes, thus developing comprehension. Pedagogical research over the past decades maintains the importance of active learning [19,20,83–86]. Studies have demonstrated that student retention of information diminishes significantly after ten minutes in traditional lecture settings [82]. Comparisons between traditional lecturing and discussion-based methods reveal that students perform better through interactive discussion rather than unidirectional knowledge transmission. Active learning fosters better understanding as it enables students to discuss, write, and relate new knowledge to prior experiences.

Experiential learning, on the other hand, is rooted in the works of John Dewey, Jean Piaget, and David Kolb [6,27,28]. It emphasises hands-on experiences as an integral part of the learning process. It argues that students learn best when actively engaged in the practical application of new knowledge, echoing the ancient of wisdom of the Chinese philosopher Confucius: "Tell me and I will forget. Show me and I may remember. Involve me and I will understand." Experiential learning ensures that students directly interact with the subject matter rather than passively reading or hearing about it [6,19].

While some educators associate experiential learning exclusively with off-campus or fieldwork activities, it can also be effectively employed within classroom settings. For example, rather than passively absorbing architectural theories through lectures, students can participate in practical and empirical exercises, such as analysing design principles or human-environment interactions. Field visits to architectural sites can further enhance experiential learning by immersing students in authentic, real-world environments, enabling them to observe cultural diversity and human behaviours as they relate to the built environment [7,20,87]. Extending beyond unreflective observation, experiential learning requires students to engage actively with themes and subjects, testing theories, evaluating outputs, and applying appropriate concepts in real-world scenarios. This approach aligns with Habraken's argument for legitimising built-environment professions through experiential knowledge of the everyday environment [88]. In this sense, experiential learning fosters

autonomy, allowing students to assimilate and apply knowledge towards employment in future experiences, ultimately augmenting their academic and professional competencies.

3.1.2. Active and Experiential Learning: Two Sides of the Same Coin

Active and experiential learning are interconnected strategies that underline inquiry-based learning (IBL). While the terminology varies, both approaches share similar purposes, enhancing student motivation by emphasising experience, value creation, and critical thinking over passive knowledge transfer. These approaches shift the educational focus from simple information retention to deeper, critical engagement with learning materials [88]. In architectural pedagogy, interactive learning mechanisms must also include structured evaluation research. Traditional evaluation methods, such as casual interviews and descriptive observations, often fail to capture what students have authentically learned. Effective assessment research must be objective and structured, ensuring that students comprehend and internalise knowledge rather than solely recall it [19,89,90]. Through experiential learning, students actively engage in problem-solving, evaluating real-world environments to assess their functionality, user-friendliness, and ability to foster desirable behaviours [91,92]. Nonetheless, despite attempts to incorporate evaluation research into architectural education, efforts have mostly remained limited to individual initiatives where traditional teaching practices continue to lack interactive learning mechanisms that bridge in-class and off-campus activities and experiential learning methodologies.

IBL, reinforced by active and experiential approaches, is essential for modern education. While traditional methods of information transfer remain dominant in many schools, the growing assimilation of interactive learning strategies indicates a positive shift. The pedagogical value of student engagement, hands-on experiences, and reflective learning stresses the necessity of moving beyond rote memorisation toward a transformative educational experience.

3.2. Mechanisms of Active Engagement for Introducing Design Principles

Traditional methodologies of design training, emphasising acontextual learning of standards, principles, and rules are increasingly being viewed as unfit for purpose [20]. There is a growing demand for a more effective, student-centred approaches that promote creative thinking and exploration, aligning with broader championing of 'education-as-process' and 'education-as-experience' approaches that advocate for active and experiential learning in design pedagogy. Active engagement mechanisms offer imaginative ways to introduce design principles. These can involve a wide range of practices that include collaborative exercises, case-based learning, and participatory assessments. Evidence from educational research suggests that student-centred pedagogies nurture deeper understanding and improved retention of knowledge and skills. Authentic exercises such as real-time sketching and peer critique sessions have proven effective in grounding and reinforcing theoretical knowledge through practice [19,46,47].

3.2.1. Introducing Architecture to First-Year Students

Empowering first-year students through careful curriculum and content design is essential [93,94]. An approach for engaging first-year architecture students was implemented at Qatar University through the 'Introduction to Architecture and Allied Arts' course. To support an active learning environment, a series of experiential exercises was developed that complemented lecture content and encouraged student participation [95].

The first exercise addressed the relationship between cultural identity and architectural form. Students were introduced to the dialectic relationship between culture and the built environment, focusing on how architecture can embody human values and choices. Students were paired and asked to describe three building images that represented different

cultural contexts. They identified the culture that they believed each building belonged to and determined three visual attributes that had influenced their judgements. The second exercise aimed to enhance students' ability to recognise different building typologies. Through lectures, students learned that buildings communicate their functions and activities through visual cues. In pairs, they examined twelve images of buildings from diverse environments and categorised them based on type, function, and users. This exercise lasted 45 min and provided students with a deeper understanding of how architectural design can convey meaning and purpose [19,95].

The third exercise focused on developing judgement skills by encouraging students to express their views on different environmental settings. They analysed six images of buildings, using adjective pairs to describe their perceptions. This task encouraged students to reflect on how physical features can influence both user experiences and psychological responses. This exercise also highlighted the differences between architectural terminology and the typical vocabulary that a lay person would use to describe architectural features.

Engaging first-year students in these exercises enabled them to develop a critical awareness of the built environment and its impact on human experiences [95]. Students' feedback reported that active learning allowed them to make better informed judgments about the buildings and environments in question. They appreciated the structured analysis of buildings and found that discussing concepts with peers improved their grasp of the exercise contents. Overall, these methods were effective in promoting engagement, reflection, and critical thinking despite challenges with some students who struggled to complete the exercises on time.

3.2.2. Rethinking the Delivery of Architectural Principles

Another active learning approach was implemented in an 'Architectural Principles' course at the American University of Sharjah. Students were introduced to fundamental architectural concepts, including spatial composition, organisational strategies, and the impact of environmental conditions on architectural forms [46,47]. Unlike traditional approaches, which may rely on passive learning with students absorbing information from lectures and textbooks without critically engaging in meaningful discussion, this approach integrated modern technology to create a more active and interactive learning environment. Digital tools, such as smart boards, allowed instructors to demonstrate design concepts dynamically. For example, instead of presenting static diagrams, instructors used animated digital drawing techniques to illustrate the thought process underpinning architectural design concepts. This approach enabled students to follow the logical and consecutive progression of design decisions, fostering deeper comprehension [46].

Interactive media played an important role in enhancing the student experience through visualising architectural concepts where sequential illustrations and videos were presented. For example, the impact of circulation and movement within a building was revealed through animated communications, helping students realise the potential user experience of specific spatial organisations. This approach encouraged students to ask questions and to engage in discussions wherein the learning process became more participatory, supportive, and rewarding.

Diverging from traditional approaches. students were required to critically analyse architectural designs and to demonstrate their understanding through written and visual responses in another exercise. Students were asked to analyse Marcel Breuer's Reed House by examining its approach, entry sequence, and internal circulation. This format allowed students to demonstrate their ability to think critically about built environments rather than unreflectively repeat facts [47]. Student feedback on this approach was positive stating that it reinforced their ability to critically evaluate design concepts.

3.2.3. Key Message

The shift from passive learning to active and experiential learning has significantly enhanced teaching and content delivery processes. Inquiry-based, active, and experiential learning transforms architecture students into autonomous thinkers by embedding hands-on exercises, peer dialogue, and reflective tasks into foundational courses. At Qatar University's "Introduction to Architecture," pairing students to identify cultural markers, typologies, and emotional responses in building images deepened their critical awareness, and, according to student feedback, enhanced their judgement skills and engagement despite time management challenges. Similarly, at the American University of Sharjah, integrating smart-board animations and interactive media in an "Architectural Principles" course enabled learners to trace design reasoning in real time and to critically dissect Marcel Breuer's Reed House; students reported that this participatory format strengthened their ability to evaluate spatial concepts over rote recall. As alternatives to traditional approaches, such mechanisms align with contemporary pedagogical thinking that emphasise active learning and problem-solving skills. Methods employed highlight the importance of student-centred learning environments that encourage exploration, discussion, reflection, and analysis.

3.3. The Built Environment as an Open Textbook

The notion of learning beyond traditional classroom environments has gained momentum, emphasising inquiry-based, active, and experiential learning to promote engagement with real-world situations thereby enhancing students' learning experiences. However, structured integration of the built environment into theoretical and lecture-based courses remains underexplored, typically limited to casual site visits. Adopting real-world settings as learning environments can improve student skills and abilities. For example, architecture students at Queen's University Belfast and the University of Strathclyde conducted structured environmental assessments as part of lecture-based courses, fostering deeper connections between design theory and practice. Initiating structured learning by employing the built environment as an open textbook, a study was conducted in the Master of Architecture programmes at both universities. Two exercises were conducted, 'Contemplating Settings' and 'Procedural Evaluation.' These exercises sought to foster an understanding of socio-behavioural factors and spatial awareness.

In 'Contemplating Settings,' students documented and analysed socio-cultural and behavioural phenomena such as privacy, personal space, and territoriality. They were required to covertly photograph and chronicle these phenomena in real-life settings. Evaluation criteria included accuracy in depicting socio-behavioural terms, photographic quality, and interpretive and reflective depth. The findings revealed that while students could observe and document behaviour as it relates to observations of the spatial environment, many struggled with articulating concise descriptions. However, group discussions facilitated deeper comprehension of environmental behaviours [19].

The 'Procedural Evaluation' exercise involved assessing spatial and sustainable design characteristics through self-directed tours of selected buildings. Students used structured checklists to analyse planning, zoning, landscaping, design, energy, and waste management. This process promoted spatial awareness, helping students identify critical elements and challenges within buildings. Although most students successfully assessed fundamental building attributes, some struggled with providing insightful follow-up commentaries [96]. Nonetheless, the use of checklists in a structured evaluation process enhanced students' ability to systematically evaluate key aspects of the built environment.

3.3.1. Bringing the Built Environment into the Classroom

Active, inquiry-based, and experiential learning were further explored in a series of classes that addressed community and neighbourhood design issues. These classes integrated participatory design, community involvement, and neighbourhood planning theories into practical exercises. The primary learning objective was to instil a critical understanding of the role of community design in shaping responsive environments [97–101]. Characteristically, objectives of these courses included understanding community design as an interactive process beyond conventional architectural approaches; examining socio-cultural and economic variables influencing design; and enhancing critical thinking regarding community participation in co-design processes.

In these classes students engaged in diverse activities, including critical reflection exercises and research projects. One notable exercise required students to watch video clips on community design, debate ideas and concepts collectively, and to write collaborative and critical essays, analysing key issues related to local communities and spatial practices. This task encouraged students to articulate their perspectives and to recognise the significance of community involvement in addressing their own challenges. The consistent feedback evidenced that while most students valued the need for collaborative engagement with communities, several students acknowledged this ethos but regarded co-design as a complementary rather than an alternative or primary approach to design methodology [20].

3.3.2. Design Games as a Learning Mechanism

Another approach for integrating experiential learning in a classroom setting is the use of design games, initially developed for client-user interactions in community design and planning [51,97–102]. Design games can provide an engaging, collaborative platform for students to explore architectural concepts and decision-making processes. One such game, conducted at Qatar University (2011–2014), focused on school building design, and comprised the following four activities:

- Classroom Cluster Typologies: Students analysed different classroom layouts, evaluating their impact on interaction and learning efficacy.
- Building Beauty Contest: Students assessed school building aesthetics, reflecting on how architecture can successfully convey identity and function.
- Objective and Activity Definition: Students identified key learning environment objectives and related activities, towards structuring spaces, fixtures and furniture appropriately.
- Spatial Layout Design: Students created adjacency diagrams and graphic symbols to represent different functional areas within a specified learning environment.

Following their participation in the game, students presented their designs and reflections [19,20]. Many students noted that the activity enhanced their analytical skills and decision-making abilities. This was coupled with collaborative and group discussions which fostered diverse perspectives, leading to refined concluding narratives. This design game also reinforced the importance of balancing functionality with aesthetic and social considerations.

3.3.3. Key Message

Integrating the notion of the built environment as an open textbook into architectural pedagogy through structured experiential learning can significantly enhance spatial awareness, logical skills, and critical thinking. At Queen's University Belfast and the University of Strathclyde, the "Contemplating Settings" exercise encouraged students to covertly photograph and analyse socio-behavioural phenomena such as privacy, personal space, territoriality, revealing that while many could accurately observe behaviours, they ini-

tially struggled to articulate concise interpretations; group discussions, however, deepened their reflective insights. In the "Procedural Evaluation" exercise, checklists guided on-site assessments of planning, zoning, and sustainability features; most students identified key attributes effectively, though some found it challenging to generate insightful follow-up commentary. Community-design classes further highlighted that structured debates fostered critical awareness of collaborative processes, even as some learners still viewed co-design as an isolated activity rather than an integral design process. Finally, design games at Qatar University, ranging from classroom-cluster analysis to "building beauty" contests, demonstrated significant gains in analytical reasoning and decision-making. In essence, these cases confirm that structured, experiential engagement with real environments cultivates contextually focused design thinking. Future educational initiatives and research should explore ways in which these methodologies can be refined further, ensuring effective learning outcomes and broader application across diverse pedagogical contexts.

3.4. Teaching History to Design Students

The incorporation of historical analysis into architectural pedagogy can provide students with a contextual understanding of the evolution of design concepts and solutions. This section critiques conventional approaches to teaching history and offers alternative approaches that incorporate experiential learning, digital communications, and comparative analysis. The cases discussed reveal how interactive history modules can improve students' ability to critically engage with architectural precedents.

History remains an indispensable constituent of architecture curricula despite evolving attitudes toward its teaching [103]. Notably, even during the Modernist era when historical studies were viewed as obstacles to progress, history was never entirely removed from architectural curricula [104–106]. Questioning the role of history in architectural education, particularly regarding its integration into design teaching [107], it has been argued that history should be approached as a multi-layered knowledge space, examining its intellectual, ontological, and epistemological aspects. A key distinction is made between learning 'about' history and learning 'from' history, a perspective that can impact diverse pedagogical strategies. It is also expounded that the study of architectural history should extend beyond a chronological knowledge of physical structures and the cultural narratives behind them.

3.4.1. Model Making as an Experiential Learning Tool

While many institutions incorporate interdisciplinary learning that blend literature, art, geography, economics, and politics, a distinctive integrative approach is employed in the 'Foundation of Europe' course at the University of Waterloo School of Architecture [108]. This course surveyed the interactions of people, beliefs, and worship spaces from the fall of the Roman Empire to the European Renaissance. It included critical readings, film analyses, and physical modelmaking to engage students actively. Students explored mediaeval religious architecture, constructing detailed replicas of temples, synagogues, churches, and mosques. This hands-on experience engaged students with both tangible details and intangible narratives of historical architecture. Unlike traditional chronological approaches, this approach encouraged phenomenological and hermeneutical readings, offering students opportunities to investigate historical spaces within their cultural and experiential contexts. This pluralistic ethos enabled students to develop a deeper appreciation for materiality and construction techniques in different historical periods [19,108].

Such approaches assert that model-making can nurture an interactive and multivalent understanding of historical architecture by linking non-physical aspects, such as cultural influences, with physical construction methods. Students utilised both traditional and

digital fabrication tools, such as laser cutters and CNC routers, to produce physical models, thereby combining 'low' and 'high' technologies, encouraging students to explore historical structural and construction processes while applying contemporary techniques. In this respect, model-making allowed students to investigate structural systems and spatial organisation in ways that surpass typical doctrinal history lectures. Students interrogated and examined the impact of proportional and modular systems, the spatial organisation of sacred spaces, and the religious influences on architectural form towards refinement of their analytical skills through iterative modelling, redrawing and reconstruction. Through these processes, students developed a deeper and broader intellectual engagement with architectural history, developing the ability to interpret historical building technologies within modern contexts and perspectives.

A significant aspect of this course was the study of surface ornamentation in historical buildings. The study of Mediaeval buildings emphasised complex finishes, techniques and patterns [108]. Students were required to investigate these surfaces, exploring geometric, iconographic, and allegorical motifs that were integrated into the craftsmanship of historical buildings. The students' engagement with ornamentation emphasised that decorative elements were not simply aesthetic but also functional, symbolic, and contextually pertinent [109].

3.4.2. Digital Games, Sketching, and Collaboration

Another initiative employs an approach intending to make historical studies more engaging and relevant, raising questions of student engagement, architectural history's relationship to contemporary issues, and how to encourage passion for historical study. This approach is founded on the conceptualisation of history as a dynamic phenomenon that should be analysed critically, rather than being perceived as an invariable and static body of knowledge [110]. Innovative teaching techniques for teaching history to design students were introduced at the University of Minnesota. These incorporated strategies such as the use of digital tools, sketching, and collaborative projects. Interactive games, such as matching exercises, reinforced design concepts by linking historical motifs to their respective historical periods. These activities made the learning of history more engaging while fostering perceptive connections between past and present design principles.

Sketching was a key method employed to enhance student engagement in these classes, operating as a form of active visual notetaking and enabling students to grasp design elements more effectively. Unlike passive learning through lectures, sketching encouraged students to scrutinise and record details of architectural structures and furniture [111]. By visually and haptically interacting with historical forms and artefacts, students internalised design principles and theories to inform their own future practices.

A central component of the class was the semester-long 'Making a Difference' project, which challenged students to connect historical precedents with contemporary design solutions. Students were required to research a historical design problem and to propose contemporary solutions for a modern context. Projects included the design of public art installations and digital furniture solutions that sought to address social issues such as body image and health awareness. In this respect, one example, 'Scream for Social Change,' juxtaposed media-promoted aesthetic ideals with representations of real women to challenge societal attitudes. Another example involved a technologically advanced vanity table designed to promote holistic wellbeing. Linking the historical and the contemporaneous, these projects encouraged students to consider ethical and societal implications of design, reinforcing the relevance of historical study in contemporary practice [111].

3.4.3. Key Message

Teaching history to design students requires innovative approaches that can integrate interdisciplinary learning, experiential methods, and active engagement. Integrating architectural history through hands-on and interactive methods turns static precedents into dynamic learning experiences. At Waterloo's "Foundations of Europe," students designed and built laser-cut and CNC-routed models of mediaeval temples, synagogues, churches, and mosques—discovering that iterative model-making deepened their grasp of proportional systems, construction techniques, and ornamentation, and fostered phenomenological readings of sacred spaces. In Minnesota's history studios, digital games matching motifs to periods and sketch-based "visual notetaking" sharpened students' analytical skills: learners reported greater engagement and stronger connections between historic design concepts and contemporary practice. The semester-long "Making a Difference" project further demonstrated that researching a historical design problem and proposing a modern intervention, such as socially conscious art installations or wellness-focused furniture, encouraged ethical reflection and reinforced history's relevance to today's challenges. These cases show that coupling experiential model-making with digital collaboration, sketching, and creative assignments invigorates critical thinking, material literacy, and a practice-ready understanding of architectural history far beyond what lectures alone can achieve. Adopting such pedagogical techniques, educators can transform history from a static body of information into a dynamic, interactive and relevant realm that can inform and inspire future professionals.

4. Discussion and Outlook

4.1. Cultivating a Culture of Inquiry and Process-Oriented Pedagogy

Critical evolution of design education can lay the foundation for a more knowledge-centred approach to architectural pedagogy, with a breadth of theoretical perspectives capable of inspiring innovative teaching methodologies to shape contemporary practices. In recent decades, educators have expanded this shift by integrating creative thinking, experiential learning, heuristics, and empirical decision-making into curricula, thus strengthening the design studio as the primary locus for knowledge acquisition, production, reproduction and creative exploration. This studio-centric realm, physical or virtual, provides an immersive environment in which students can conceptualise spatial solutions, aligning with arguments and theories postulating that education is a dynamic process rather than a rigid procedure [6,7,27,28,34,112–115]. A decisive development in this context is the rise of process-oriented pedagogy, emphasising structured decision-making, iterative reflection, and critical inquiry to challenge traditional outcome-focused curricula [5,9,19,22,55]. Employing the design process as a professionally authentic basis for any pedagogical endeavour, educators can encourage deeper engagement with the complexities of architectural practice, while ensuring that professional skills are complemented by curiosity, judgement, and adaptability [6,116].

There is a critical need to teach students "how" to design rather than simply "what" to design, noting that an exclusive focus on final outputs can diminish essential reflective practices [7–9]. Critiques have long argued that conventional studios continue to prioritise polished final solutions at the expense of iterative and critical thinking, urging for a reconstitution of studio design processes as a continuous cycle of testing and refinement [19,20,29,30]. Such strategies seek to assess student projects on the judicious employment of decision-making mechanisms, explicit articulation of the design process, and ongoing critical dialogue, in seeking to develop rigorous and comprehensive solutions. Valuing the design journey, adapting it to individual learning styles, and stressing its

process-driven nature, can lead to enhanced creative endeavours and better comprehension of inherent design challenges.

Linking critical inquiry to process-based pedagogy requires a mindset that can recognise and assimilate knowledge and methods developed by other disciplines and fields of inquiry, and that can integrate environment-behaviour studies, socio-cultural perspectives, and political frameworks into the curriculum [50,51,54,98]. Approaches that merge research with design learning, moving from passive lectures to active learning, encouraging students to gather and apply information in creative processes are critical activities for students' learning experience. Embracing social science research methods, through literature reviews, interviews, surveys, and quantitative analyses [19–22,96] can help to extend students' awareness of socio-cultural and environmental factors, as well as prepare them for the multi-disciplinary context of authentic professional practices. In essence, a robust, research-informed approach enables learners to address contextual, multilayered real-world issues.

Effective implementation depends on committed and innovative educators who can blend theoretical knowledge with practical application, making it a fundamental necessity for architectural schools to recruit, or develop and support educators who are skilled and trained at fusing rigorous knowledge management with structured design processes. Teaching staff should possess wide-ranging academic and professional experiences so that they can guide students towards synthesising conceptual frameworks and developing practical skills. Embedding systematic decision-making and reflective practices in studio work shifts the focus from production of singular final outputs to the iterative, exploratory learning journey that underpins authentic design methodologies. This reimagined pedagogy endows students with the skills to address complex societal and environmental challenges, as they learn to produce justified and multivalent projects, as well as to critique, adapt, and refine their ideas in response to diverse constraints.

Cultivating cultures of inquiry within a process-oriented pedagogy enhances architectural education by making the design journey itself a source of learning, dialogue, and discovery. The cases presented herein demonstrate how structured methodologies and interdisciplinary research can foster critical thinking, collaboration, and social responsibility. In this way, the design studio remains a transformative backbone for shaping future architects and design professionals, while reflective, iterative, and contextually adaptable approaches to design education can enable graduates to navigate complexities and changes in modern practices with agility and critical insight.

4.2. Missing Conceptions in Misconceptions in Teaching Lecture-Based Courses

The constrained focus of some lecture-based courses in architecture can often lead to significant gaps in knowledge integration, student engagement, and meaningful assessment [6,18,38,86,95,96]. Although they are intended to furnish learners with essential theoretical frameworks, traditional lecture-based approaches may create cognitive dissonances between the learning of conceptual content and its practical application to studio design [86]. This incongruity emerges when architectural theories are taught retrospectively, emphasising the work of renowned designers (often the 'starchitects' uncritically lauded by sections of academia and the architectural press) without enabling students to grasp fundamental concepts of buildings and built environment phenomena. Consequently, rote memorisation of theoretical knowledge can limit profound conception and hinder the meaningful internalisation and expression of architectural phenomena [6,20,21,50,95,96,116]. Many educators still employ context-free hypothetical design projects that ignore real-world socio-cultural and environmental contexts, inhibiting students' abilities to investigate how buildings interact with diverse communities and settings [11]. While site visits and off-

campus experiential exercises may be potentially transformative, large class sizes and logistical challenges can discourage their incorporation into lecture-based modules.

Adopting new pedagogical strategies in lecture settings can overcome some of the preceding challenges. For example, structured experiential learning can encourage students to transform from passive observers to active participants in their learning journeys [11,19]. Activities such as modelling historical buildings or reconstructing artefacts can create immersive experiences that elucidate how architecture may have evolved under diverse cultural, environmental, and functional demands [108]. These exercises can also enhance discussion and negotiation skills, through the introduction of digital or analogue gaming platforms [97,108,111]. In similar fashion, reframing verbal information into visual or tactile representations can assist students in testing concepts in real time, inspiring collaborations with peers to refine their understanding [46,47,79,99].

A significant part of architectural pedagogy is centred on making, exploring, and evaluating built environments through historical or theoretical lenses. However, implicit assumptions about users and contexts can emasculate the learning process if they remain unexamined. Integrating site-based or community-centred tasks helps learners to forge stronger links between theory and application, nurturing accurate insights into how people inhabit and adapt spaces [19–21,51,79,97,98]. Engaging with residents, professionals, and stakeholders, either as observers or preferably as active contributors, can further deepen students' perspectives. Even in large classes, technologies can facilitate virtual or simulated site visits, group discussions and interactions, ensuring that scale of provision does not necessarily impede the implementation of experiential learning mechanisms.

While utilising the built environment as an "open textbook" cannot solve every pedagogical challenge, it can significantly reduce the gap between theoretical knowledge and real-world outcomes. Embedding discussions, reflections, and problem-solving within lecture-based courses allows students to transition from information consumers to co-creators of ideas and knowledge about the discipline, enhancing skills of reasoning, decision-making, and critical-thinking, all of which are essential to professional preparedness. The built environment profession is inherently dynamic, encompassing design, procurement, representation, construction, and occupancy. Effective teaching approaches should constructively align with these factors, recognising that architecture involves both tangible and intangible dimensions. Progressive educators therefore integrate the poles of the speculative and the real world, processes and products, as well as subjective and objective perspectives, consequently nurturing holistic learning outcomes.

When lecture-based courses adopt active, experiential, and context-specific strategies, architectural pedagogy can become socially relevant. By emphasising deeper exploration of the built environment, and by linking conceptual theories with lived experience students can develop the competencies to analyse, critique, negotiate, and propose solutions that respond to the complexities of contemporary society. Through purposeful engagement with diverse teaching tools, architectural educators can nurture critical thinkers, active learners, and responsible professionals who are well equipped to address the evolving, often unforeseen demands of real-world professional practice.

5. Conclusions: A Vision for a Future Direction

Architectural pedagogy stands at a precarious stage, being impacted by continuous changes in policies and regulatory demands, advancements in technology, and evolving socio-political factors, expectations and perceptions. As outlined previously, the imperative to integrate critical inquiry, experiential learning, digital innovation, and historical awareness effectively is increasingly pressing. A synthesis of key insights from the study offers a forward-thinking standpoint, a vision on how educators, institutions, and students

can collectively foster a more dynamic, responsive, and holistic system of architectural pedagogy (Figure 4).

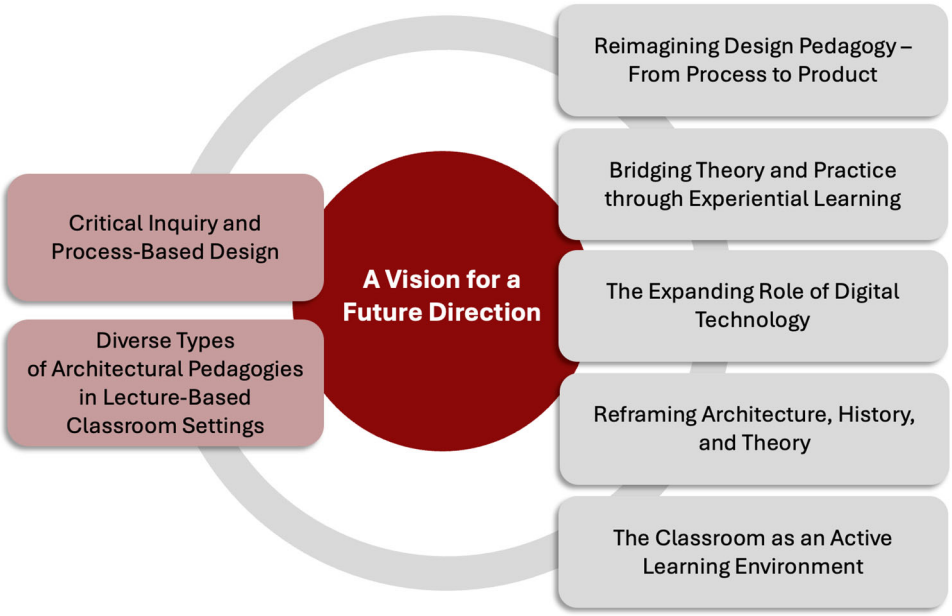


Figure 4. Synthesising the two threads into a vision for a future direction for architectural design pedagogy.

5.1. From Product to Process: Reimagining Design Pedagogy

A dominant thread throughout this study is the transition from a product-focused approach, where final deliverables dominate assessment and learning aims, to a process-oriented exemplar that values iterative thinking, reflection, experimentation, criticality and justification. The case study examples demonstrate that when students engage reflectively with experimentation, they can develop stronger analytical and problem-solving skills.

Framing design studio teaching as an evolving dialogue with 'wicked problems', rather than a linear and predetermined pathway, enables students to become more flexible, adaptive, and self-critical. This flexible mindset acknowledges that design in architecture never arrives at a single, perfect solution. Rather, it is shaped by multiple environmental, cultural and technological factors, and client requirements that should result in various design options embedding multiple learning opportunities. Through reflective practice and structured feedback loops, students learn to interrogate their assumptions, explore alternative design routes, and refine their ideas. Such a shift ultimately cultivates intellectual agility which is vital for responding to complex real-world challenges.

5.2. Bridging Theory and Practice Through Experiential Learning

Of similar importance is the role of experiential learning in strengthening the link between theory and application. While lecture-based courses are often successful at conveying foundational epistemologies, they risk restricting the students' roles to passive recipients of ubiquitous information. Site visits, design games, and empirical making exercises can transform learning settings into active laboratories for thinking and experimenting. Cases from universities stress how hands-on projects, such as constructing full-scale prototypes or demonstration projects, analysing building use and performance, or reimagining historical precedents, can invigorate theoretical content. Students should 'learn by doing' but must also 'learn by reflecting on what they are doing,' thereby enhancing their functional knowledge and their integration of spatiality, materiality, and cultural influences. Experiential projects can foster collaboration and communication skills, where students must be

able to negotiate design ideas individually, within teams, and with stakeholders. Consequently, this experiential factor deepens both the student's cognitive ability and their awareness of social responsibility, as well as developing professional soft skills of negotiation and collaboration.

5.3. The Expanding Role of Digital Technologies

Contemporary architectural pedagogy must also adapt to the digital transformation which is currently and rapidly changing professional practices. Virtual Design Studios (VDS), and e-learning platforms can widen educational prospects and participation, as well as facilitate cross-cultural opportunities, collaboration and feedback. The study presented cases where students from geographically different institutions could work together on shared design briefs, develop relevant new software skills, and learn experientially about cultural sensitivities, alternative paradigms and collaborative thinking. While these digital tools can unlock stimulating learning tools, such as rapid prototyping, full scale models, data-driven simulations, and global teamwork, they need to be framed carefully through thoughtful pedagogical frameworks that respect and include students of different interests and abilities. Educators need to ensure that technology serves as a medium for creative thinking and critical inquiry, not only as tools for formal shape-making, communications and visualisation. Virtual environments need careful introduction, curation and administration to prevent them from becoming repositories of stagnant information, rather than dynamic learning environments to support dialogic learning. The educational aims, outcomes, and outputs of architecture pedagogy must be prioritised over the instrumental implementation of standardised digital technologies.

5.4. Reframing Architectural History and Theory

An important dimension of progressive architectural pedagogy involves strengthening the study of history and theory. Rather than treating history as static timelines of styles and typologies, confined by a narrow adherence to 'great works' by 'starchitects', responsive educators are beginning to adopt integrative approaches that invite students to learn from history instead of merely learning about it. Learning tools and approaches such as model-making, digital reconstructions, and thematic explorations of historical precedents heighten students' appreciation of cultural and socio-political contexts within which buildings were created. Reconstructing historical buildings or analysing ornamentation in detail, students garner fundamental understandings of material properties, structural systems, and the cultural, spiritual, or religious narratives embedded in past and current locales. This level of engagement converts the study of history into a living dialogue, enabling students to recognise that contemporary design challenges often echo centuries-old interrogations about 'commodity, firmness, and de-light'. In essence, this promotes a sense of both continuity and continual change, encouraging students to see themselves as participants in an ongoing architectural discourse that establishes links between time, culture, and geography.

5.5. The Classroom as an Active Learning Environment

One of the prevalent challenges addressed in this study is the transformation of didactic, lecture-based courses and modules into interactive, participatory and student-centred experiences. While traditional lectures can be undoubtedly efficient in delivering basic information, they can unconsciously position students as passive recipients of data rather than active learners. However, strategies such as peer critiques, rapid in-class exercises, team challenges and digital platforms for group collaboration show potential in making learning in the classroom more dynamic. Short quizzes, reflective writing prompts, and interactive polls can be integrated into lectures to assess students grasp of content

delivered. Similarly, structured design games or case study-based scenario discussions can encourage students to connect theory with practice within the classroom setting. Creatively restructuring the delivery and assessment of content in the lecture theatre can exemplify the best practices of inquiry and exploration that are found in design studio learning settings.

As the title of this article suggests, the visions, intuitions, and experiments presented herein illustrate the imperative of cultivating a fluid, reflective, and contextually aware approach to architectural pedagogy. Constructively aligning key threads of a progressive architecture curriculum, including critical inquiry, process-based learning, collaborative engagement, digital exploration, and historical sensitivity, this entry argues that educators can empower future architects to navigate an increasingly multifaceted and rapidly changing profession. The design studio can become a live learning environment, and the design process that takes place within it can become an educational and intellectual dialogue. Bridging theory and application supports learners to develop flexible mindsets to cope with evolving design challenges and contexts. Enacting this vision requires institutional support, educator training and staff development, coupled with a commitment to embedding making, testing, and reflection in every facet of the curriculum. In this fashion, architectural education can cultivate professional learners, equipped with robust technical skills, conceptual proficiencies, creative and ethical sensibilities, and flexible mindsets capable of lifelong learning, all fundamental attributes for effectively shaping future built environments. Future iterations of this research could benefit from comparative critiques of conventional and emerging practices, which would assist in highlighting transformative pedagogical shifts.

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