XSTUDIO: TRANSFORMING STUDIO PEDAGOGY THROUGH POP-UP-LIVE LEARNING ENVIRONMENTS

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ABSTRACT

Contemporary architectural education increasingly faces the challenge of reconciling academic studio models with the complex realities of spatial practice, which require collaboration, adaptability, and direct engagement with diverse societal actors. Conventional design studios, typically centred on hypothetical briefs and representational outcomes, only partially address the social, material, ecological, and institutional conditions that shape the built environment.

This paper investigates how the architectural design studio can be transformed into a Pop-Up Live Learning Environment through the longitudinal development of xSTUDIO, an experimental teaching line established within APLE Lab Banja Luka. Drawing on a sequence of studio implementations conducted between 2022 and 2026, the study examines the gradual evolution of the pedagogical model across different spatial scales, thematic contexts, and forms of stakeholder collaboration. The analysis is based on a qualitative examination of successive studio iterations, focusing on their organisational structure, learning processes, implementation strategies, and educational outcomes.

The findings reveal a progressive shift from conventional design-based teaching towards an experiential and constructivist model that integrates research, collaborative design, material experimentation, full-scale implementation, and critical reflection within real spatial contexts. Across successive iterations, the studio expanded from experimental interior interventions and small-scale urban actions to institutional environments, territorial landscapes, and living ecological systems, while simultaneously strengthening collaboration with public institutions, cultural organisations, local communities, and private-sector partners.

Rather than proposing a fixed teaching methodology, the paper identifies a set of transferable pedagogical principles through which live learning environments can expand architectural studio education. These include process-oriented learning, collective authorship, stakeholder engagement, implementation literacy, embodied spatial experience, and socially responsible spatial action. The paper argues that such principles provide a robust framework for rethinking contemporary studio pedagogy and offer a transferable model for architectural schools seeking to strengthen the relationship between education, professional practice, and society.

Keywords: architectural education; studio pedagogy; live learning environments; constructivism; experiential learning; socially responsive practice.

INTRODUCTION: FROM DESIGN STUDIO TO LIVE LEARNING ENVIRONMENTS

Contemporary architectural practice increasingly unfolds through collaborative, interdisciplinary, ecological, and socially engaged processes that challenge conventional models of architectural education [1], [2]. While professional practice requires architects to negotiate complex relationships among multiple stakeholders, institutions, material systems, and environmental conditions, architectural education continues to rely predominantly on studio models centred on hypothetical briefs, individual authorship, and representational outcomes. Although the architectural design studio remains the pedagogical core of architectural education, its traditional format has been increasingly questioned regarding its capacity to prepare students for the complexity of contemporary practice [3], [4].

The architectural design studio nevertheless continues to represent a unique environment for learning through experimentation, dialogue, and reflective action. Throughout the twentieth century, particularly following the pedagogical reforms introduced by the Bauhaus ([5] Gropius, 1938), studio education developed around the integration of conceptual thinking, material exploration, and learning by doing [5], [6]. Later, Schön's concept of the *reflective practicum* further established the studio as a setting in which professional knowledge is constructed through iterative cycles of action, reflection, and critique rather than through the transmission of predefined solutions [3]. Recent pedagogical discourse has increasingly emphasized that the studio should be understood not merely as a physical space but as a distinctive pedagogical culture that enables collaborative knowledge construction through situated and practice-based learning [6], [7], [8], [4].

Building upon these foundations, contemporary pedagogical discourse has increasingly drawn on constructivist learning theory, experiential learning, and stakeholder engagement to reconceptualise architectural education. Rather than treating design as the production of architectural objects alone, these perspectives shift attention towards the design of learning processes in which knowledge emerges through collaboration, experimentation, implementation, and critical reflection [9], [3], [7]. Consequently, live studios, design-build programmes, community-based projects, and practice-oriented laboratories have emerged as educational formats that reconnect architectural learning with real contexts, real actors, and real consequences. Their educational value has been demonstrated through enhanced material understanding, collaborative competencies, and stronger links between academic learning and professional practice.

These developments also resonate with recent European initiatives seeking to redefine the relationship between education, sustainability, and society [10]. The New European Bauhaus (NEB) promotes an integrated approach that combines sustainability, inclusivity, aesthetics, and interdisciplinary collaboration through experimental spatial practices [10]. Within this broader framework, the Erasmus+ project *Architecture Pop-Up Lab Exchange (APLE)* ([11] introduced Architectural Pop-Up Laboratories as flexible educational infrastructures designed to connect universities with public institutions, local communities, cultural organisations, and professional practice through experimental, context-based learning.

Against this background, the paper analyses investigate how the architectural design studio can evolve into a Pop-Up Live Learning Environment through the longitudinal development of xSTUDIO, an experimental line established within APLE Lab Banja Luka. The study analyses a

sequence of studio implementations conducted between 2022 and 2026, analysing how successive experiments gradually expanded the pedagogical framework across different spatial scales, thematic contexts, implementation formats, and modes of stakeholder collaboration.

Through the xSTUDIO case study, the paper identifies the transferable pedagogical principles that emerged through its continuous evolution. By analysing this process through the perspectives of contemporary studio pedagogy, constructivist learning, and experiential education, the paper argues that Pop-Up Live Learning Environments provide an adaptable framework for reconnecting architectural education with reflective practice, embodied spatial experience, collaborative knowledge production, and socially responsible spatial action.

THEORETICAL BACKGROUND: FROM STUDIO PEDAGOGY TO LIVE LEARNING ENVIRONMENTS

The Architectural Design Studio as a Learning Environment

The architectural design studio has long occupied a distinctive position within higher education, functioning simultaneously as a site of creative inquiry, technical instruction, critical reflection, and professional socialisation. Since the pedagogical reforms introduced by the Bauhaus, architectural education has increasingly recognised the studio as more than a place for design production, establishing it as a workshop in which knowledge is generated through experimentation, making, and collaboration [5]. This conception fundamentally transformed architectural education by integrating art, craft, and technology within a unified learning environment.

Despite its central role, the contemporary design studio has increasingly been criticised for its limited capacity to address the complexity of present-day architectural practice. Traditional studio formats often remain centred on hypothetical briefs, individual authorship, and representational outputs, while professional practice increasingly demands collaboration across disciplines, engagement with multiple stakeholders, negotiation of institutional frameworks, and responsiveness to ecological and social challenges. As Till [1] argues, architecture is inherently contingent upon external forces that extend beyond disciplinary autonomy, requiring architects to operate within conditions of uncertainty rather than predetermined design problems.

Schön's concept of the *reflective practitioner* further reframed studio education by understanding professional knowledge as emerging through iterative cycles of action, reflection, and adaptation rather than through the application of fixed disciplinary knowledge [3]. From this perspective, the architectural studio becomes not simply a place where projects are produced, but a pedagogical environment in which learning develops through engagement with uncertain situations, critical dialogue, and reflective experimentation.

Constructivist and Experiential Learning in Architectural Education

Contemporary discussions on studio pedagogy increasingly draw upon constructivist and experiential theories of learning, which regard knowledge as actively constructed through experience, social interaction, and critical reflection. Dewey [6] argued that meaningful learning emerges from inquiry situated within authentic situations, while Kolb [9] conceptualised learning as a continuous cycle of concrete experience, reflective observation, conceptualisation, and active experimentation. Together, these perspectives shift educational emphasis from knowledge transmission towards knowledge construction through action.

The social dimension of learning has been further elaborated through Vygotsky's [7] constructivist theory, which positions learning as an inherently collaborative process mediated through dialogue, interaction, and shared problem solving. Building upon these foundations, Jonassen [8] proposed constructivist learning environments characterised by authentic tasks, contextual learning, multiple perspectives, and collaborative knowledge construction. These theoretical positions closely align with architectural education, where design knowledge emerges through continuous interaction between spatial context, material conditions, users, institutions, and environmental systems.

Within architectural education, such perspectives have increasingly encouraged a shift beyond speculative design exercises towards situated, practice-oriented learning environments. Salama [4] argues that contemporary architectural education should extend beyond conventional studio culture by integrating experiential learning, real-world engagement, and interdisciplinary collaboration into the educational process. Rather than treating architecture primarily as the production of formal solutions, these approaches emphasize learning as an evolving process of inquiry, negotiation, implementation, and reflection.

Live Learning Environments and Pop-Up Pedagogies

These theoretical developments have contributed to the emergence of live studios, design-build programmes, community-engaged projects, and practice-based laboratories as alternative models of architectural education. Although differing in format and institutional organisation, these approaches share a common pedagogical premise: architectural knowledge develops most effectively through direct engagement with real places, real actors, and real consequences. Learning therefore becomes inseparable from implementation, collaboration, material experimentation, and societal engagement [2].

Recent European initiatives have further reinforced this educational direction. The New European Bauhaus [10] advocates experimental spatial practices that integrate sustainability, inclusivity, aesthetics, and interdisciplinarity through collaboration between academia, professional practice, public institutions, and civil society. Within this broader framework, the Erasmus+ project *Architecture Pop-Up Lab Exchange (APLE)* [11] introduced Architectural Pop-Up Laboratories as flexible pedagogical infrastructures capable of connecting architectural education with diverse spatial contexts and societal actors through temporary, adaptive, and collaborative learning environments.

Together, these theoretical perspectives suggest that architectural learning is most effective when knowledge is constructed through authentic action, collaborative inquiry, critical reflection, and engagement with real spatial conditions. This conceptual synthesis provides the theoretical foundation for analysing the evolution of xSTUDIO as a Pop-Up Live Learning Environment and for identifying transferable pedagogical principles relevant to contemporary architectural education.

METHODOLOGY

This research investigates how an architectural design studio can evolve into a Pop-Up Live Learning Environment through the longitudinal development of xSTUDIO, an experimental teaching line established within APLE Lab Banja Luka. Rather than documenting individual educational projects, the study examines the gradual transformation of a pedagogical model implemented through successive studio iterations between 2022 and 2026. The primary objective is to identify the pedagogical principles that emerged throughout this evolutionary process and to evaluate their transferability to broader contexts of architectural education.

The study adopts a qualitative longitudinal case-study approach grounded in constructivist and experiential educational theory. A longitudinal perspective was selected because the research focuses not on isolated studio projects but on the continuous evolution of a single pedagogical framework across multiple implementations. This approach enables the identification of recurring patterns, gradual transformations, and emerging educational principles that would remain less visible through the analysis of individual studio projects.

Methodologically, the research combines comparative case-study analysis, reflective pedagogical inquiry, research-through-design, and qualitative process evaluation. Rather than evaluating architectural proposals primarily through formal or aesthetic criteria, the analysis focuses on learning processes, organisational structures, stakeholder relationships, implementation strategies, and competency development.

The empirical basis of the research consists of four successive xSTUDIO implementations realised between 2022 and 2026 within APLE Lab Banja Luka. These studio iterations are

interpreted not as independent educational projects but as consecutive developmental phases of a single pedagogical model.

The analysis draws upon multiple sources of qualitative evidence, including studio briefs, project documentation, design outputs, implementation records, workshop documentation, public exhibitions, photographic archives, pedagogical observations, participant reflection forms, stakeholder feedback, and documentation of realised spatial interventions. The triangulation of these materials enables a comprehensive interpretation of both the pedagogical process and its evolving organisational structure.

To ensure systematic comparison across successive studio iterations, the research applies a common analytical framework organised around four interrelated dimensions:

1. Learning environment – organisation of the studio process, educational methods, learning activities, and the relationship between academic and real-world contexts;
2. Spatial and material engagement – interaction with real sites, material experimentation, prototyping, construction processes, and full-scale implementation;
3. Stakeholder integration – forms of collaboration among students, educators, public institutions, cultural organisations, local communities, and private-sector partners;
4. Learning outcomes – development of competencies related to collaborative practice, implementation literacy, communication, reflective thinking, embodied spatial understanding, and socially responsible spatial action.

Applying this analytical framework across all four studio iterations enables the study to interpret pedagogical development as an evolutionary process rather than as a collection of isolated educational activities. Consequently, the research shifts attention from individual projects towards the identification of transferable pedagogical principles that characterise Pop-Up Live Learning Environments as an emerging model of contemporary architectural education.

XSTUDIO AS A POP-UP LIVE LEARNING ENVIRONMENT

The pedagogical model examined in this study did not emerge as a predefined educational methodology. Rather, it evolved progressively through a sequence of experimental studio implementations that gradually expanded the relationship between architectural education, spatial practice, and societal engagement. Instead of being designed according to a fixed pedagogical framework, the model developed iteratively, with each studio implementation introducing new forms of collaboration, spatial engagement, material experimentation, and public interaction. Consequently, the evolution of xSTUDIO is understood not as a succession of independent educational projects but as the continuous development of a single pedagogical framework.

This evolution accelerated within the Erasmus+ Architecture Pop-Up Lab Exchange (APLE) project, where Architectural Pop-Up Laboratories were conceived as flexible educational infrastructures capable of operating across institutional, disciplinary, and spatial boundaries [11]. Within this broader framework, xSTUDIO became the pedagogical platform through which Live Learning Environments were systematically explored and tested at the University of Banja Luka. Rather than functioning as a conventional design studio, it positioned architectural education within authentic spatial situations where research, design, implementation, collaboration, and reflection formed an integrated learning process.

Although formally established through APLE, several methodological principles that later became characteristic of xSTUDIO had already emerged in earlier experimental studio teaching at the Faculty of Architecture, Civil Engineering and Geodesy [12]. A particularly important precursor was the *Studio Project 6* course (2022/23), developed in collaboration with the Museum of Contemporary Art of Republika Srpska. Structured around the concepts of architectural elements, atmosphere, and embodied spatial experience, the course encouraged students to investigate architecture not primarily as the production of form but as the orchestration of material presence, sensory perception, and spatial relationships. Drawing upon Rem Koolhaas' *Elements of Architecture* and Peter Zumthor's *Atmospheres* [13], students explored thresholds, light, sound,

tactility, intimacy, and embodied spatial experience [14] as operative design instruments within an existing institutional setting.

Beyond its thematic focus, this studio introduced several pedagogical characteristics that would later become fundamental components of xSTUDIO. Collaboration with a cultural institution replaced the conventional hypothetical design brief; external experts participated throughout the design process; projects were publicly presented and discussed beyond the academic environment; and architectural proposals were understood as open processes rather than closed design products. Although implementation at full scale had not yet become a central educational objective, the studio established an important methodological transition from autonomous design towards context-based, collaborative, and experience-oriented learning.

Subsequent studio iterations progressively expanded this pedagogical foundation. Rather than concentrating exclusively on interior space, later implementations extended towards public space, institutional environments, territorial landscapes, and living ecological systems. At the same time, the scope of learning evolved from conceptual design towards material experimentation, prototyping, construction, and full-scale implementation. The role of external stakeholders also gradually changed, shifting from occasional reviewers to active collaborators involved in defining problems, co-developing projects, facilitating implementation, and evaluating outcomes.

This gradual transformation was accompanied by a parallel shift in the educational objectives of the studio. Whereas early iterations primarily explored spatial experience and architectural atmosphere, later phases increasingly addressed collaboration, implementation, social responsibility, institutional negotiation, and ecological awareness. Consequently, the focus of learning moved beyond the production of architectural proposals towards the development of competencies required for contemporary architectural practice, including collaborative authorship, stakeholder communication, implementation literacy, reflective practice, and socially engaged spatial action.

From this perspective, the significance of xSTUDIO lies not in any individual studio project but in the cumulative evolution of its pedagogical structure. The successive studio implementations demonstrate how relatively small methodological adjustments—expanding the range of stakeholders, increasing engagement with real contexts, introducing material experimentation, or extending the scale of intervention—collectively transformed the conventional architectural design studio into a Pop-Up Live Learning Environment. The following section analyses this evolution through four successive studio iterations, identifying the pedagogical transformations that emerged across different spatial contexts, implementation formats, and collaborative configurations.

RESULTS: EVOLUTION OF THE PEDAGOGICAL FRAMEWORK

The longitudinal analysis reveals that xSTUDIO did not evolve through a series of independent educational projects but through the gradual transformation of a single pedagogical framework. Across successive implementations, the studio continuously expanded its learning environment, spatial scope, forms of stakeholder collaboration, and implementation strategies while maintaining a consistent commitment to constructivist learning, experiential education, and socially embedded architectural practice.

From Interior Pedagogy to Live Laboratories

The first formal implementation of xSTUDIO, conducted during the spring semester of 2024, represented a methodological transition from experimental interior pedagogy towards a live learning environment situated in public space. Integrating the courses *Studio Project 6* and *Small-Scale Design*, the studio used the immediate surroundings of the newly completed Faculty of Architecture, Civil Engineering and Geodesy as its learning environment.

Rather than treating the site as a hypothetical design exercise, students worked within an occupied and continuously used public setting, collaborating with building users, project

architects, industry representatives, and invited critics [15]. Six proposals for small-scale spatial interventions were developed to improve circulation, social interaction, and the everyday use of the faculty environment. The emphasis was placed on feasibility, implementation readiness, and material testing rather than on purely representational design outcomes.

Pedagogically, this phase established several principles that would remain characteristic throughout subsequent iterations: learning through authentic spatial situations, collaboration with external actors, iterative design development, and the integration of research, design, and implementation within a unified educational process. The principal pedagogical shift therefore moved the studio beyond the production of architectural proposals towards collaborative engagement with real spatial conditions.

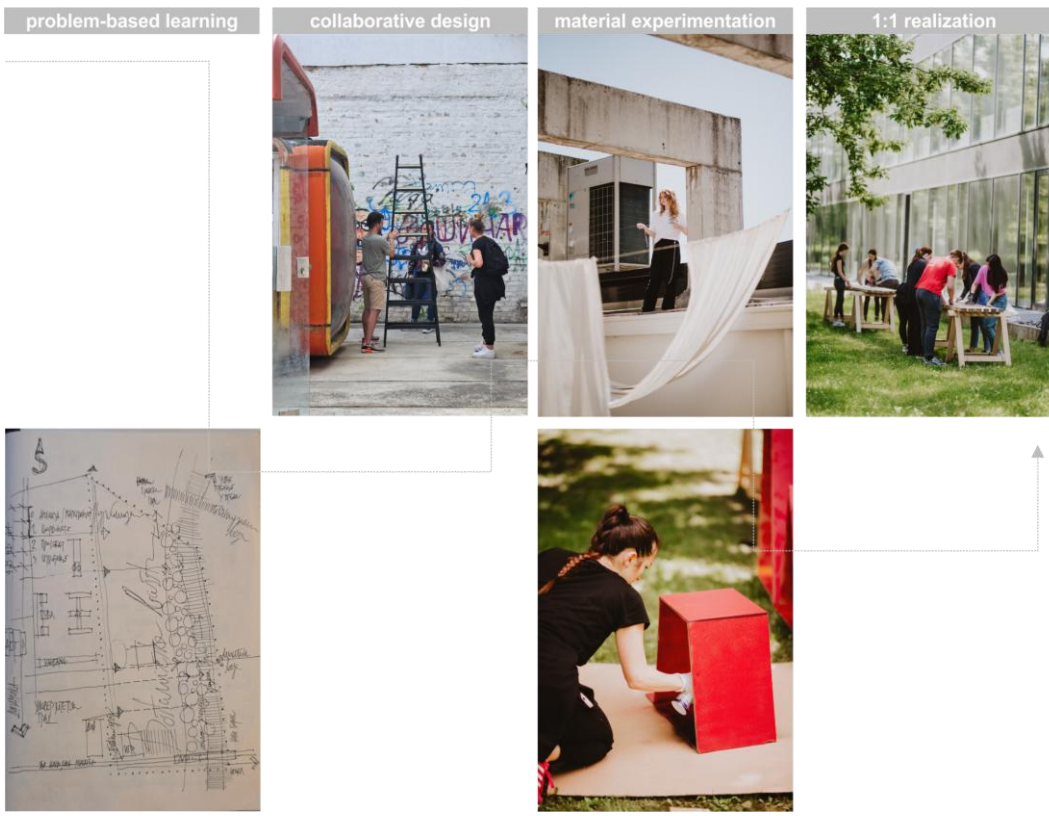


Figure 1. Learning phases during the course 2024/25.

Institutional and Collaborative Complexity

The second implementation, carried out between February and June 2025 within the *Studio Project 6* course, substantially increased the organisational and pedagogical complexity of the model. The focus shifted from the public space surrounding the faculty to the interior of the building itself, which was approached as an evolving institutional environment shaped by multiple users, overlapping activities, and changing spatial requirements.

More than fifty students participated in collaborative teams involving faculty staff, administrative personnel, industry partners, building users, and external reviewers. Fourteen design proposals were organised into thematic clusters addressing exhibition spaces, learning environments, social interaction, and performative interior programmes.

Unlike the previous phase, students were required to negotiate simultaneously with spatial, technical, organisational, and safety-related constraints inherent to an occupied institutional

building. Consequently, architectural design became inseparable from communication, coordination, and decision-making among multiple actors. The pedagogical emphasis shifted from stakeholder participation towards stakeholder negotiation, reinforcing the studio's role as a platform for collaborative problem-solving under real institutional conditions.

Landscape, Ecology, and Living Systems

The third phase extended the pedagogical framework beyond individual buildings towards territorial landscapes. Implemented between March and October 2025 within the master's programme, the studio investigated the Olympic mountains of Bosnia and Herzegovina as complex socio-ecological systems where questions of landscape resilience, cultural heritage, tourism, and environmental sustainability intersect.

Although the spatial scale expanded considerably, the educational logic remained consistent. Students continued to work through collaborative research, field investigations, stakeholder dialogue, and context-specific design development. Public institutions, cultural organisations, and academic partners became active participants throughout the process, broadening both the disciplinary and institutional scope of learning.

This phase marked a significant conceptual transformation. Rather than understanding architecture primarily through individual objects or sites, students engaged with territorial relationships, environmental processes, and long-term spatial strategies. Consequently, the pedagogical focus expanded from architectural intervention towards systems thinking, reinforcing architecture as a practice operating across ecological, cultural, and institutional networks.

From Territory to Living Systems

The fourth phase, initiated during the 2025/26 academic year, represented the broadest conceptual expansion of the pedagogical framework. Located within the Botanical Garden of the University of Banja Luka, the studio investigated the relationship between interior architecture, atmosphere, and living ecological environments through the central question: *Can an interior exist without a ceiling?*

This pedagogical experiment transferred analytical tools traditionally associated with interior architecture into an open landscape characterised by vegetation, seasonal change, humidity, light, shadow, sound, and constantly evolving ecological conditions. Students designed reversible "urban rooms" that generated spatial identity through thresholds, atmosphere, and embodied perception rather than permanent enclosure. The proposed interventions were conceived as temporary, reversible, and ecologically sensitive structures integrated into the living system of the garden.

Compared with previous phases, architecture was no longer understood primarily as the organisation of physical space but as the mediation of relationships between environmental processes, human perception, and ecological dynamics. The pedagogical framework therefore expanded from territorial thinking towards learning through living systems, introducing ecological responsiveness as an integral component of architectural education.

Together, these case studies demonstrate a gradual expansion of pedagogical complexity—from interior experimentation and small-scale urban interventions toward institutional systems, territorial landscapes, and living ecological environments—while maintaining methodological consistency grounded in collaboration, material experimentation, and experiential learning.

Longitudinal Transformation of the Pedagogical Model

Viewed collectively, the four studio implementations reveal a continuous evolution rather than a sequence of unrelated educational experiments. Across successive phases, the learning environment progressively expanded from interior space to public space, institutional systems, territorial landscapes, and living ecological environments. Simultaneously, the pedagogical emphasis shifted from conceptual exploration towards implementation, stakeholder negotiation, systems thinking, and ecological engagement.

Importantly, this expansion did not replace the original educational principles but continuously built upon them. Each new iteration retained the core characteristics established during earlier phases—experiential learning, collaborative inquiry, material engagement, reflective practice, and authentic spatial action—while introducing additional layers of complexity through new spatial scales, stakeholder configurations, and implementation contexts.

Consequently, the evolution of xSTUDIO demonstrates that the transformation of architectural studio pedagogy does not depend on a single methodological innovation but on the cumulative integration of multiple pedagogical shifts over time. The longitudinal development documented in this study therefore provides the empirical foundation for identifying the transferable pedagogical principles discussed in the following section.

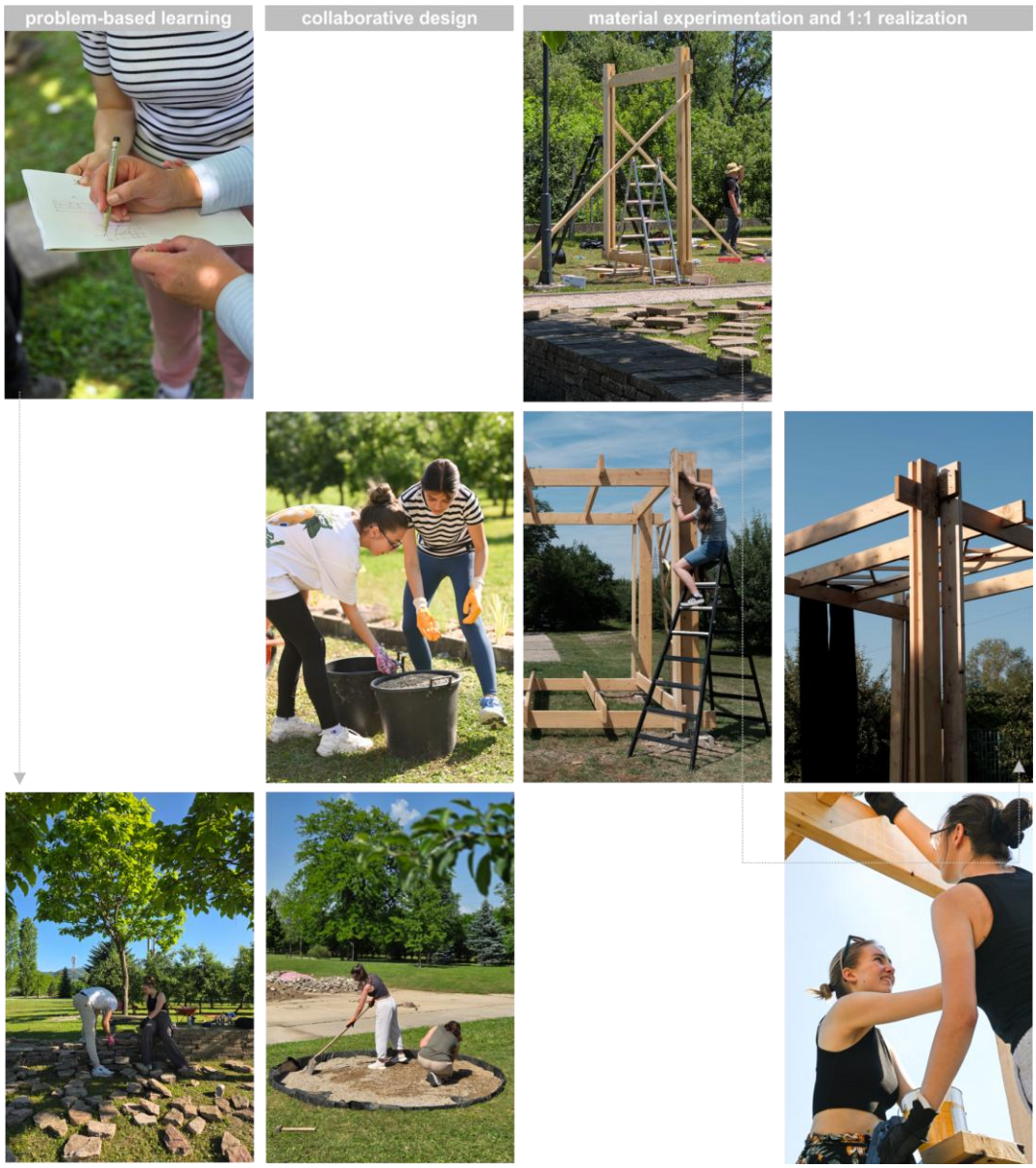


Figure 2. Learning phases during the course 2025/26.

Table 1. Longitudinal analysis graph

Phase	Learning environment	Spatial scale	Stakeholders	Implementation	Pedagogical shift
Origins (2022/23)	Museum	Interior	Cultural institution	Conceptual interventions	Spatial experience
Phase I	Faculty surroundings	Public space	Users, architects, industry	Feasibility	From design to collaboration
Phase II	Faculty building	Institutional system	Multi-actor	Technical & organisational constraints	From collaboration to negotiation
Phase III	Olympic mountains	Territory	Public institutions	Landscape strategies	From buildings to systems
Phase IV	Botanical Garden	Living landscape	Ecological actors	Reversible interventions	From territory to living systems

DISCUSION: EMERGING PEDAGOGICAL PRINCIPLES

The longitudinal analysis suggests that the transformation of the architectural design studio cannot be attributed to a single methodological innovation. Rather, it emerged through the cumulative integration of multiple pedagogical shifts that progressively redefined the learning environment, the role of educators and stakeholders, and the object of architectural learning itself. Across successive studio implementations, xSTUDIO evolved from an experimental educational initiative into a flexible pedagogical framework capable of integrating constructivist learning, experiential education, stakeholder collaboration, and implementation-oriented architectural practice.

Learning Through Authentic Contexts. Perhaps the most significant pedagogical transformation concerned the relocation of learning from hypothetical design scenarios towards authentic spatial situations. Throughout all studio iterations, students worked within existing institutional, urban, territorial, or ecological contexts, engaging directly with the spatial, organisational, and social conditions that shaped each design task. In this sense, learning emerged through situated inquiry rather than through the simulation of professional practice, closely reflecting Dewey's concept of experiential education [6] and Schön's reflective practice [3]. Real contexts became active educational resources rather than merely project locations.

Learning Through Collaboration. A second defining characteristic of the pedagogical model was the gradual expansion of collaboration beyond the academic studio. Public institutions, cultural organisations, industry representatives, local communities, and building users participated throughout the design process, contributing to problem definition, project development, implementation, and evaluation. Consequently, authorship evolved from an individual design activity towards a collaborative process of negotiation and shared responsibility. This transformation closely corresponds to constructivist understandings of knowledge as socially constructed through interaction and dialogue [7], [8].

Learning Through Implementation. Across successive studio iterations, implementation increasingly became an integral component of learning rather than a final stage following design. Material testing, prototyping, construction logistics, feasibility assessment, and reversible interventions enabled students to understand architecture as a process of making rather than solely of representation. Such experiences substantially expanded students' awareness of materials,

construction processes, technical constraints, and implementation strategies, reinforcing Kolb's experiential learning cycle through the continuous interaction between action and reflection [9].

Learning Through Negotiation and Uncertainty. As the complexity of studio environments increased, architectural design progressively became an exercise in negotiation rather than optimisation. Students were required to reconcile institutional requirements, technical regulations, financial limitations, organisational procedures, ecological considerations, and diverse stakeholder expectations. Rather than limiting creativity, these constraints became productive components of the learning process, supporting Till's understanding of architecture as a discipline fundamentally shaped by contingency and external relationships [1]. Within this framework, uncertainty worked not as an obstacle but as an educational resource.

Learning Through Reflection. Reflection remained a continuous component throughout all phases of the pedagogical process. Public presentations, exhibitions, workshops, stakeholder discussions, and structured reflection sessions transformed evaluation from a final assessment into an iterative process of collective learning. Simultaneously, the educator's role gradually shifted from that of an authoritative design critic towards facilitator, coordinator, and mediator of collaborative learning processes, consistent with Schön's understanding of reflective studio pedagogy [3].

Learning Through Ecological Engagement. The final phase of xSTUDIO expanded architectural learning beyond buildings and public spaces towards living ecological systems. By investigating atmosphere, vegetation, seasonality, biodiversity, and environmental processes within the Botanical Garden, students engaged with architecture as a dynamic relationship between spatial intervention and ecological change. This evolution introduced ecological responsiveness as a pedagogical principle rather than solely as a design objective, closely aligning the studio with the values promoted by the New European Bauhaus initiative [10].

Subsection: Writing Introductions

An internal survey was conducted among fourth-year (final-year) students of the Architecture Study Programme at the Faculty of Architecture, Civil Engineering and Geodesy, University of Banja Luka, during the 2025/26 academic year, with the aim of analysing students' perceptions of contemporary approaches to architectural education and identifying learning activities that complement traditional studio-based teaching.

The survey was conducted electronically using Google Forms between 9 and 22 February 2026. The questionnaire was distributed via email to all fourth-year students based on the official student registry provided by the Student Services Office, with a total population of 60 students. A total of 36 valid responses were collected, representing a response rate of 60%.

Analysis of the open-ended responses revealed a strong preference among students for experiential and practice-oriented forms of architectural education (Table 2). The most frequently mentioned activity was site visits to construction sites and relevant buildings (69.2%), followed by workshops involving practitioners and professionals from the field (42.3%). Approximately one quarter of respondents emphasized the importance of architectural competitions (23.1%) and interdisciplinary collaboration (23.1%) as valuable learning opportunities. Other identified activities included material testing and experimentation (19.2%), small-scale design-build projects (11.5%), and mentorship by practicing architects (7.7%).

Collectively, these findings indicate that students perceive direct engagement with professional practice, stakeholders, materials, and the built environment as an essential complement to conventional studio-based education. The results highlight the importance of learning environments that extend beyond the boundaries of the academic setting, enabling students to develop practical knowledge, collaborative skills, and a deeper understanding of the processes involved in architectural production. In this context, the findings support the pedagogical principles underpinning the xSTUDIO Pop-Up Live Learning Environment, which promotes situated, experiential, and practice-based approaches to architectural education.

Rather than introducing new findings independent of the case study, these student perspectives reinforce the pedagogical principles identified through the longitudinal analysis. The strongest educational expectations expressed by students—direct engagement with professional practice, collaboration with external actors, material experimentation, implementation, and experiential learning—closely correspond to the defining characteristics of the xSTUDIO framework. This convergence suggests that the pedagogical transformations documented in this study are not only internally

Table 2. Student perspective

Identified Student Need	Responses (n = 26)	Share of Respondents	Corresponding xSTUDIO Pedagogical Principle
Site visits to construction sites and exemplary buildings	18	69.2%	Embodied spatial experience
Workshops with practitioners and industry experts	11	42.3%	Stakeholder engagement
Participation in architectural competitions	6	23.1%	Real-world implementation
Interdisciplinary collaboration (e.g., with civil engineering students)	6	23.1%	Collective authorship
Material and structural testing	5	19.2%	Material experimentation
Small-scale design-build projects and prototyping	3	11.5%	Learning by making
Mentorship by practicing architects	2	7.7%	Implementation literacy

CONCLUSION

This paper analysed how an architectural design studio can evolve into a Pop-Up Live Learning Environment through the longitudinal development of xSTUDIO within APLE Lab Banja Luka. By examining successive studio implementations between 2022 and 2026, the research demonstrated how architectural education can progressively expand from speculative design towards authentic, collaborative, implementation-oriented, and socially embedded learning.

The longitudinal analysis identified a set of transferable pedagogical principles that characterised this evolution, including learning through authentic contexts, stakeholder collaboration, material engagement, implementation, reflection, and ecological responsiveness. Together, these principles reposition the architectural design studio as a flexible learning environment in which knowledge is constructed through direct engagement with real spatial situations, societal actors, and material processes rather than through hypothetical design exercises alone.

Importantly, the findings do not advocate replacing the conventional architectural design studio. Instead, they demonstrate that Pop-Up Live Learning Environments extend its pedagogical capacity by integrating dimensions of contemporary architectural practice that remain difficult to address within traditional studio teaching, including collaborative authorship, stakeholder negotiation, implementation literacy, and socially responsible spatial action. At the same time, the study indicates that the successful adoption of such approaches depends not only on pedagogical innovation but also on institutional flexibility, interdisciplinary collaboration, and sustained partnerships with actors beyond academia.

Although the research is grounded in a single institutional case, its primary contribution lies in identifying pedagogical principles that are potentially transferable across different architectural schools and educational contexts. Rather than proposing a fixed teaching model, the study argues that the scalability of Pop-Up Live Learning Environments resides in the adaptability of their underlying principles to different institutional, cultural, and spatial settings. Further research should examine these principles through comparative studies involving different universities and educational environments, contributing to a broader understanding of how architectural studio pedagogy can respond to the evolving professional, societal, and ecological challenges of contemporary practice.

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DECLARATIONS OF INTEREST STATEMENT

The authors affirm that there are no conflicts of interest to declare in relation to the research presented in this paper.

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