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PAPER

International Collaboration as a Catalyst for Curriculum Development through Introduction of Practical Learning Approaches in Architectural Education

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ABSTRACT

This paper explores how international collaboration can serve as a catalyst for curriculum development in architectural education through the integration of practical learning approaches. It draws on the Architecture Pop-up Lab Exchange (APLE) academic project—a consortium of seven architecture schools from Italy, Norway, Croatia, Montenegro, and Bosnia and Herzegovina—developed in response to the growing demand from architectural professionals for graduates equipped with real-world competencies. The study introduces a set of criteria for the systematization of diverse practical learning activities, organized within a framework that categorizes experiences across four key pillars: formality, human resources, technical resources, and timeframe. The methodology employed in the APLE project combines workshops, site visits, surveys, interviews, and a detailed case study of pilot studios. These pilot studios, conducted at four higher education institutions (HEIs) in the Western Balkans, offer grounded insights into how practical learning is embedded in distinct local contexts and enhanced through international collaboration. The results affirm the value of practice-oriented architectural education in preparing students for the profession and, more importantly, propose a structured model for its effective implementation within higher education institutions, highlighting both shared challenges and context-specific innovations.

KEYWORDS

international collaboration, architectural education, experiential learning, practical learning models (PLMs), project-based learning (PrBL), design-build

1 INTRODUCTION

This paper addresses the well-known challenge of enhancing the practical component in architectural education by exploring innovations in pedagogy that balance

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thinking and making. The goal is to better align the profile of future architects with the realities of the professional world. Specifically, the study focuses on exploration of distinct international models to identify diverse approaches to curriculum development that integrate practical learning and explore possibilities for innovation in teaching practices. Firstly, terminology and the understanding of "practical learning" vary significantly across academic institutions and countries. Secondly, pedagogical approaches and methodologies differ, reflecting each academic institution's historical background, educational traditions, and local context. A key question arises: How can international experience and collaboration serve as catalysts for innovation in the domain of strengthening practical learning in architectural education? From a labor market perspective, there is a growing emphasis on real-world professional practice, which challenges academic institutions to reconsider their role and adapt their methodologies accordingly. It also raises questions about the distinction between teaching and learning, particularly as practical, experiential learning increasingly occurs outside the classroom.

Having recognized the gap between education and practice, this paper explores the roles of academia and professional stakeholders in the evolving dynamics of pedagogical transformation, with a focus on curriculum flexibility. This paper begins with a historical overview of practical learning in architectural pedagogy, followed by the exploration of a theoretical framework in which the key theories and contemporary teaching practices centered on practical learning are introduced. The section *Materials and Methods* clarifies the quantitative and qualitative methodology employed in the academic project APLE, which serves as the research base for this paper. This section examines key aspects of practical learning models (PLMs) in architecture, including external stakeholders, learning contexts, and formats, and outlines the common analytical criteria. It presents survey findings that overview practical learning activities across study cycles at seven partner institutions, focusing on their content, organization, and level of formalization. Case studies of pilot studios and projects from the universities of Sarajevo, Banja Luka, Mostar, and Podgorica illustrate the impact of pedagogical innovations developed through the APLE project. The concluding part integrates quantitative results with the case studies, highlighting an analytical framework for planning PLMs across diverse academic contexts.

2 HISTORICAL OVERVIEW OF PRACTICAL LEARNING IN ARCHITECTURAL PEDAGOGY

A foundational historical perspective on the concept of practice can be found in Aristotle's *Nicomachean Ethics*, where he defines *praxis* as an ethical, action-oriented practice in which the action and its purpose are unified, guided by *phronesis*, or practical wisdom [1]. Aristotle also defines five intellectual virtues: *epistêmê*, *phronêsis*, *sophia*, and *nous*, whereas *technê* refers to productive knowledge, craft, or art [2]. Similarly, the Latin concept of *Homo Faber* emphasizes that intelligence is defined by tool-making and practical creativity [3].

The early forms of training of builders, which embodied these ancient practical virtues, originated in Antiquity, continued throughout the Middle Ages, and dominantly relied on the transfer of practical skills through apprenticeship and guilds. The Middle Ages recognized the role and title of the "master builder," who was the preserver of the knowledge and skills [4]. It was not until the Renaissance

that architecture began to be recognized as an intellectual discipline. Leon Battista Alberti was among the first to comprehensively define the profession, emphasizing the multidimensional nature of the architect's role and the extent of education required [5]. Alberti's ideas were deeply influenced by the seminal work De Architectura by Vitruvius, dating back to 30–20 BCE, who emphasized that: "The architect should be equipped with knowledge of many branches of study and varied kinds of learning... This knowledge is the child of practice and theory" [6].

The formalization of architectural education is associated with the École des Beaux-Arts in Paris during the eighteenth and nineteenth centuries, when the atelier system was introduced, emphasizing classical design principles and drawing skills. This pedagogical model laid the foundation for the studio-based learning system that has since become a defining feature of architectural education worldwide [7]. Turn-of-the-century movements such as Arts and Crafts, Art Nouveau, and Jugendstil emerged in opposition to industrialization, advocating a return to traditional craftsmanship. These movements emphasized hands-on learning and experiential knowledge over the theoretical and drawing-based instruction promoted by the École des Beaux-Arts [8]. These European avant-garde movements, which reacted against academic and social norms, were also followed by the establishment of private ateliers as alternatives to traditional academic institutions. All these endeavors catalyzed the founding of the Bauhaus school (1919–1933), which promoted the integration of art, craft, and technology. The school's innovative pedagogical model combined two master instructors in parallel, one focusing on acquiring hands-on practical skills, the other on theory [9].

Twentieth-century architectural education, which evolved from the methodological foundations of the well-known French, British, Bauhaus, and American models, was subsequently transformed under the influence of global reform movements and experiments. In the 1950s, radical pedagogical movements began to emerge across U.S. schools, led by the group known as "The Texas Rangers," who emphasized research-driven, experimental design studios with hands-on projects [10]. This was followed by the Unité Pédagogique d'Architecture No. 6 (UP6), which challenged the École des Beaux-Arts and promoted politically and socially engaged approaches, including design-build projects [11]. The 1967 The Yale Building Project promoted social activism and institutional change and launched the world-famous design-build project [12]. During the late twentieth century architecture and architectural pedagogies resonated with social sciences and humanities, on one hand, and technology and digitalization, on the other. A historical overview of the relationship between theory and practice in architectural education has shown that architectural education cannot exist in isolation. Although architecture schools have been occasionally influenced by radical pedagogical movements, they "have hardly changed in recent decades, despite the major transformations that have taken place with the growth of globalization, new technologies, and information culture" [11].

3 THEORETICAL FRAMEWORK OF CONTEMPORARY PRACTICAL LEARNING MODELS IN ARCHITECTURAL PEDAGOGY

From historical foundations to contemporary practice, architectural education has sought to address complex economic, social, environmental, and technological

challenges while fostering the skills and knowledge essential for future professionals. However, continuing discussions have focused on bridging the gap between academia and professional practice [13] [14] [15] [16], reflecting on the challenges that students face during the transition from architectural school to professional practice. It is argued that in studio-based education (ateliers), design problems are often constructed for didactic purposes and are therefore oversimplified. The design process tends to be isolated from real-world practice, when instead it should reflect a "design-in-practice" approach. Furthermore, the problems are frequently arbitrarily selected by tutors and remain overly conceptual, lacking the realism and complexity of actual architectural challenges [17].

In response, and to counter the academic isolation, design problems and the design process should be closely related and intertwined with the real context—not only in terms of space and place, which implies transferring the classroom milieu to the outside, but also in terms of people, by including more external stakeholders. In this sense, experiential learning theory, as proposed by Kolb, offers a framework for a "holistic integrative perspective on learning that combines experience, perception, cognition, and behavior," emphasizing that "learning is best conceived as a process, not it terms of outcomes," and it is a "continuous process grounded in experience" [18]. According to Kolb's model, experiential learning can be described as a cyclical process driven by experience, reflection, conceptualization, and action.

Contemporary approaches to architectural pedagogy embrace innovation on three interconnected levels: technological, pedagogical, and social. Technological innovation involves research-based pedagogy and the integration of adjacent disciplines such as engineering, digital tools, and IT, alongside reinforcing sustainability [19] [20] [21] [22] [23]. Various experiential learning tools and methodologies—including hybrid blended learning models enhanced with digital technologies such as AR and VR—can support the innovative resolution of practical problems.

Educational innovations that advocate hands-on approaches are grounded in recognized educational concepts such as experiential learning [18] and learning by doing [24]. Pedagogical tools that have emerged from these concepts include live projects [25], which are "different from typical studio projects in their engagement of real clients or users in real-time settings. Students are taken out of the studio setting and repositioned in the 'real-world'..." [26]. Originating from professional training in medicine in the 1960s, problem-based learning (PBL) was later introduced in engineering pedagogy. PBL begins with the identification of a problem, enhances observational skills, requires a high level of student initiative, and relies on teamwork [27]. Together with PBL, other active learning methodologies that focus on problem-, project-, research-, and team-based learning are Project-based Learning (PrBL), which organizes learning around projects; Research-based Learning, which focuses on research addressing society's needs; Team-based Learning, which emphasizes collaborative work [28]; and, finally, the Design-build approaches [29] [30]. Social innovation is reflected in active learning and place-based education, which promote community engagement and contribute to the development of soft skills such as collaboration, communication, and critical thinking [31] [32] [33].

Unlike traditional *ex cathedra* teaching, the innovative pedagogic approaches involve academic institutions working in collaboration with society (community), public (government) institutions, industry, and professionals. This aligns with the

triple helix model of innovation, bringing together university, industry, and government [34]. According to professionals' insights, learning should be reinforced through capacity building, with a particular focus on developing social skills and teamwork: "Overemphasis of design and the lack of other skills that architects and students must address to sustain a viable practice... schools of architecture are often unrealistic in emphasizing the individual architect rather than the collective effort that firms overwhelmingly employ" [17]. Active involvement of external stakeholders from the real economy distinguishes challenge-based learning (CBL) from PBL and PrBL, consequently increasing students' motivation [35] and improving social skills and enhancing the ability of young professionals to work in teams. Merging technological and pedagogical innovations can be realized through methodologies such as blended learning, which involves the thoughtful integration of face-to-face classroom experiences with online learning experiences [36]. Transitioning from a traditional lecture format to a blended or fully online format can enhance the efficiency of the learning process [37], as well as contribute to other experiential pedagogic methods.

Lastly, practical learning through internships is one of the most widespread components of architectural education. Whether integrated into the curriculum or offered as an extracurricular academic experience, internships greatly "contribute to the development of career adaptability and to the transition between the roles of student and professional" [38]. As noted in the *e-FIADE* Erasmus+ project report, the independent character of diverse educational environments contributes to their effectiveness, as each produces a unique body of knowledge [39].

The theoretical overview of PLMs in architectural pedagogy highlights the technological, pedagogical, and social innovations that have emerged from late 20th-century concepts of experiential learning and live projects. These approaches can be further enhanced or combined in hybrid, interdisciplinary models to address complex economic, social, environmental, and technological challenges, while simultaneously fostering the essential skills and knowledge of future professionals.

4 MATERIALS AND METHODS

This paper presents the outcomes of research conducted as part of the international Erasmus+ academic project Architecture Pop-up Lab Exchange (APLE) [40]. Initiated in 2023, the project responds to the challenges and issues encountered at the transition between architectural education and professional practice. The APLE project brings together seven architecture schools from across Europe: Sapienza University of Rome (Italy), the Norwegian University of Science and Technology in Trondheim (Norway), the University of Zagreb (Croatia), the University of Montenegro (Montenegro), and three universities from Bosnia and Herzegovina—the University of Banja Luka, the University of Mostar, and the University of Sarajevo, as project coordinator.

Over the course of the three-year project, 430 students and 66 academic staff have collaborated with professionals through a range of activities, including design studios, workshops, and pop-up labs, both within the academic setting and in external settings. The APLE project employed a methodology integrating both qualitative and quantitative approaches, which forms the basis for the methodology adopted in this paper (see Figure 1).

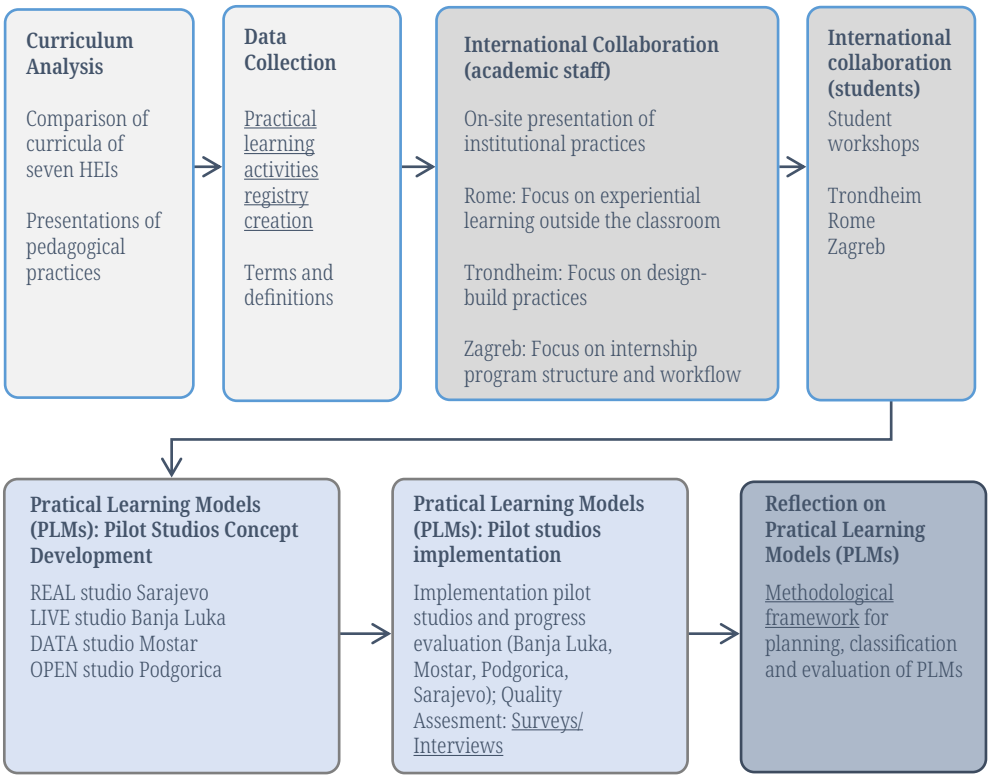

Fig. 1. Methodological scheme illustrating the research stages of the APLE project

Source: Authors' own.

The first stage of the research consisted of an in-depth comparative analysis of the curricula of seven higher education institutions (HEIs), focusing on pedagogical practices, which led to the concise formulation of terms and definitions and the practical learning activities registry creation. International workshops with academic staff and students hosted by each of the seven HEIs focused on on-site presentation of institutional practices. These collaborative activities demonstrated that terms and definitions regarding the scope of "practice in architectural education" significantly vary across engineering academic institutions worldwide. In this paper, all of these experiential learning formats will be referred to as PLMs. The third stage consisted of conceptualization, development, and implementation of new pilot studios in three HEIs in Bosnia and Herzegovina (Sarajevo, Banja Luka, and Mostar) and one in Montenegro (Podgorica), which are presented as a case study in this paper. These pilot studios were developed by merging multiple PLMs with the variables of each HEI's educational setting and serve as the basis for qualitative and quantitative assessment. Each pilot project focused on a specific approach, determined by the dominant PLMs involved, and addressed particular issues according to the requirements and context of each higher education institution. Qualitative research methods included case studies, thematic workshops, and interviews with key stakeholders. These were complemented by quantitative methods, namely surveys carried out among project partners, with results to be presented in the following paragraphs.

4.1 Defining the scope of PLMs

During the first stage of research, the data was gathered among the participating HEIs, which resulted in a registry of 23 different pedagogical activities focusing

on practical learning, which is discussed in section 4.2. The most common forms of experiential learning include activities such as guest lectures, studio critiques with practicing professionals, construction site visits, study trips, and place-based and contextual-design assignments. The intermediate level includes studios with community participation, pilot studio projects, design competitions and student challenges, pop-up laboratories, and temporary installations, as well as workshops. The most comprehensive and complex formats of experiential learning are related to the design-build concept, also manifested in models such as live projects, PrBL, and practice-based learning, as well as internship programs.

Due to the diversity of approaches and varying levels of complexity, a set of criteria and a methodological framework were established for the planning, classification, and evaluation of PLMs. While each model addresses a specific issue or design problem to achieve particular learning outcomes, four common pillars form the basis for analyzing PLMs: formality, human resources, technical resources, and timeframe (see Figure 2).

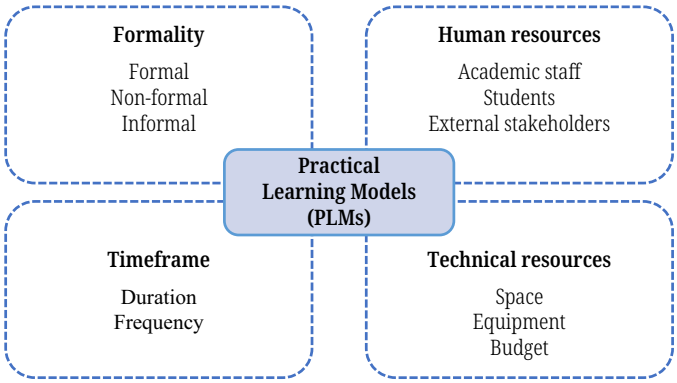

Fig. 2. Four pillars for assessment of PLMs in architectural education

Source: Authors' own.

The formality criterion refers to the extent to which experiential learning activities are embedded within the academic framework [41]. It considers whether these activities are validated through ECTS credits, recognized as obligatory components of the curriculum, or legally defined within institutional policies. According to the UNESCO Institute for Lifelong Learning framework and recent studies on ICT-enhanced continuous education [42], three levels of formality were identified: formal, non-formal, and informal [43]. Formal activities are fully integrated into the academic curriculum and officially recognized by the institution. Non-formal activities are partially connected to the institution, often through collaborations, but they are not formally acknowledged by the academic system; they are neither graded nor recorded. Informal activities are voluntary and extracurricular, undertaken independently by students, typically outside the classroom and detached from the formal academic structure. Despite their lack of official recognition, the studies have shown that "high performing students understood architectural learning as a more diverse activity involving informal as well as formal learning" [14].

The implementation of practical learning requires both human and technical resources in order to generate innovations that address specific issues and design problems, targeting defined learning outcomes. Human resources refer to the contributions of both internal and external stakeholders. Internal stakeholders include academic and administrative staff, as well as students from academic institutions.

External stakeholders include professionals, public institutions, international HEIs, companies and corporations, private SMEs, NGOs, associations, and members of the community or citizens [44].

Technical resources encompass spatial conditions (academic or professional environment, indoor and outdoor), equipment, and budget required for the implementation of each activity. These requirements vary depending on the complexity of the PLM but typically involve learning and working outside the traditional classroom environment [45]. Another important criterion for the identification and classification of PLM activities is the timeframe, which encompasses both the duration and frequency of the activity, as the timing and location of such activities in the curriculum represent some of the greatest challenges [25].

4.2 Quantitative overview of the PLMs

The quantitative analysis conducted in this study was based on the responses collected through a survey distributed to all HEI partners participating in the APLE project. The survey was prepared in an online format (June 2025), with a total of 16 questions organized into four sections: PLM activity types, formality, resources, and timeframe. The first section is used for HEIs to report what types of activities and pedagogical methods were included in their reported PLMs and consisted of multiple-choice answers in order to create recognizable and unique PLM sets.

The formality section defined whether the PLM is recognized in the official curriculum or not, while the resources section defined the scale of the model. The timeframe section included the occurrence frequency and duration of a PLM model.

Although the collected dataset contained a total of 16 unique responses, an examination of the survey data showed that certain assumed models were recognizable through the reported activities and also comparable in terms of the resources involved and their duration. Survey results were used to address the main research questions regarding the possible integration of PLMs in the HEIs participating in the APLE project. In this context, the initial analysis grouped activity types by study cycle to determine at what stage of their architectural education students are able to perform effectively in hands-on environments—in other words, When do architecture students gain sufficient knowledge, skills, and competences necessary to perform effectively in practice?

After that, the study examined academic engagement in different PLMs in order to explore possibilities for, in a sense, improving the learning process in collaboration with practicing experts and other stakeholders involved in the architectural education. This inquiry was framed through the following questions: Which model allows professional engagement to run in parallel with the educational process? Also, which model can be academically guided while simultaneously involving practice? Finally, the study aimed to identify which models are formally recognized and at which study cycle in order to enable the official introduction of PLMs into the curricula of various higher education institutions.

The distribution of activities across study cycles reflects variations in content and complexity (see Figure 3). Bachelor's-level students typically engage in introductory activities such as guest lectures, site visits, study trips, and competitions. Master's-level students participate in more advanced formats, including studio projects, design-build workshops, interdisciplinary collaborations, and mentorship programs, requiring greater autonomy and contextual problem-solving. PhD students are

less represented in the PLMs, as many are already practicing professionals, though some activities (e.g., networking, internships, field studies) overlap with earlier cycles. Participation is nearly balanced between cycles: Bachelor's-level students account for about 51% of involvement, and Master's-level students 48%, indicating broad integration across levels. The second study cycle, however, includes the most complex models, consistent with pedagogical progression in architectural education, where graduate students are expected to integrate advanced skills and external collaboration. Therefore, PLM integration is more suitable for Master's level students (second study cycle), when students are already capable of working in simulated hands-on environments while continuing their education towards Master's degree diploma.

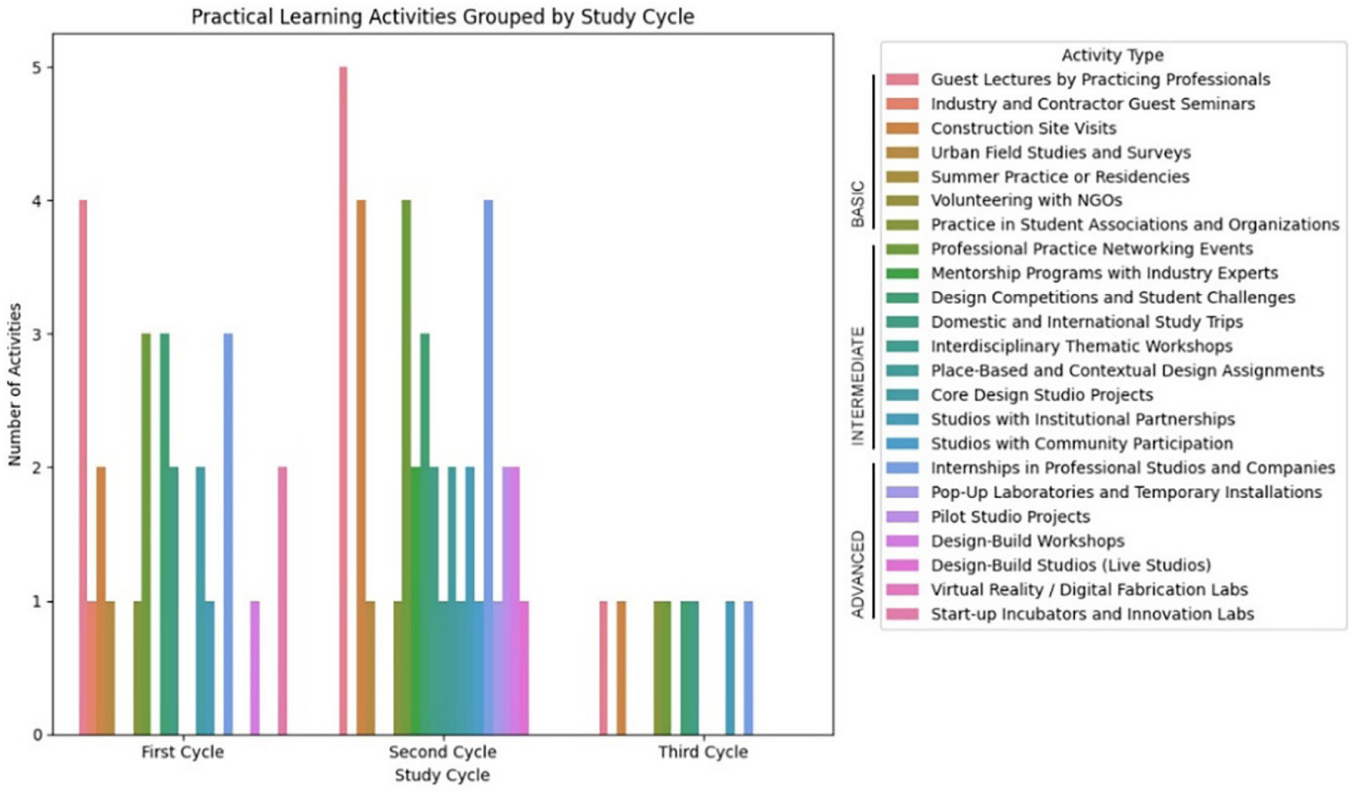

Fig. 3. Distribution of various typologies of PLMs across study-cycles

Source: Authors' own.

On average, each model operates with strong involvement of academic staff and, in some cases, administrative staff, underscoring strong institutional investment. External stakeholders—particularly practicing professionals, companies, and public institutions—play a central role, with NGOs, international partners, and community groups adding further diversity and multidisciplinary.

Staff-to-student ratios vary depending on activity type (see Figure 4). The greater extent of engagement of academic staff is typical for formats such as studios, design-build workshops, and student competitions or challenges, which are often formally recognized and situated in the second study cycle. On the other hand, lower engagement of academic staff appears in internships and placements, where external mentors take on much of the supervision. The survey results show that formality and complexity correlate with greater academic staff involvement, while practice-based

learning often shifts responsibility to external stakeholders. This indicates the value of combining staff-intensive, high-contact formats with stakeholder-led activities to meet diverse pedagogical objectives. This showed that suitable PLM should be academically guided but shifted toward real work environments involving different stakeholders.

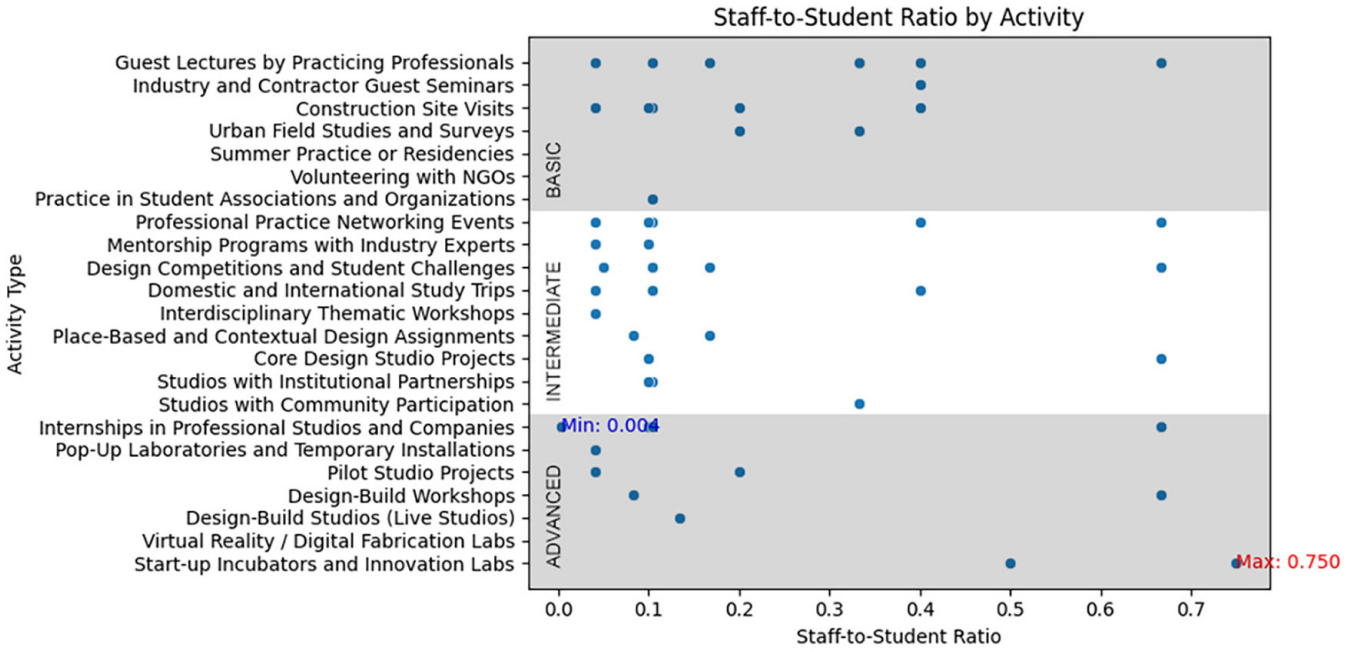

Fig. 4. Academic staff-to-student ratios by activity

Source: Authors' own.

Formality also varies across study cycles. Formally recognized activities are most concentrated in the second study-cycle, where advanced formats such as design-build workshops, partnership studios, and interdisciplinary projects are integrated into the curriculum with structured assessment and credit. This reinforces the role of the Master's level as the stage most strongly aligned with professional practice and complex project delivery.

Non-formal activities, present in both the first and second study cycles, often take adaptable forms such as mentorship programs, urban field studies, and contextual design assignments. In the first study-cycle, they are typically guided and exploratory, while in the second study-cycle, they involve greater autonomy and analytical depth. Their semi-recognized status enables flexibility and responsiveness to stakeholder input while operating alongside the formal curriculum.

Informal activities include short internships, summer residencies, workshops, and competitions. Although not formally embedded, they provide practice-oriented, student-driven, or partner-initiated experiences that foster innovation and rapid engagement with real-world challenges, albeit with variable quality and accessibility.

Overall, higher levels of formality align with stronger curricular integration and greater administrative complexity, especially in the second cycle. Non-formal models function as a bridge between academia and practice, while informal models provide agility. Maintaining all three levels of recognition allows for both structured

skill progression and adaptive, opportunity-driven learning across architectural education.

5 RESULTS: COMPARATIVE ANALYSIS OF THE CONCEPT DEVELOPMENT, IMPLEMENTATION, AND EVALUATION OF PILOT STUDIOS

The development and implementation of the four APLE project pilot studios—REAL studio, LIVE studio, DATA studio, and OPEN studio—demonstrate how varied pedagogical formats can be strategically adapted to specific institutional contexts while collectively strengthening practical learning in architectural curricula. Although rooted in comparable regional conditions, each studio embodies a distinct constellation of PLMs, shaped by its academic environment, available resources, stakeholder networks, formality, and timeframe. As part of a broader case study examining pedagogical innovation across Western Balkan partner universities—including Mostar, Podgorica, Banja Luka, and Sarajevo—these studios further highlight the diverse strategies employed by HEIs to integrate real-world challenges into architectural education. Insights gained through collaboration with EU partners enabled these institutions to connect experimental, research-based, and systematized approaches, ultimately enhancing the quality and relevance of practical learning in the region.

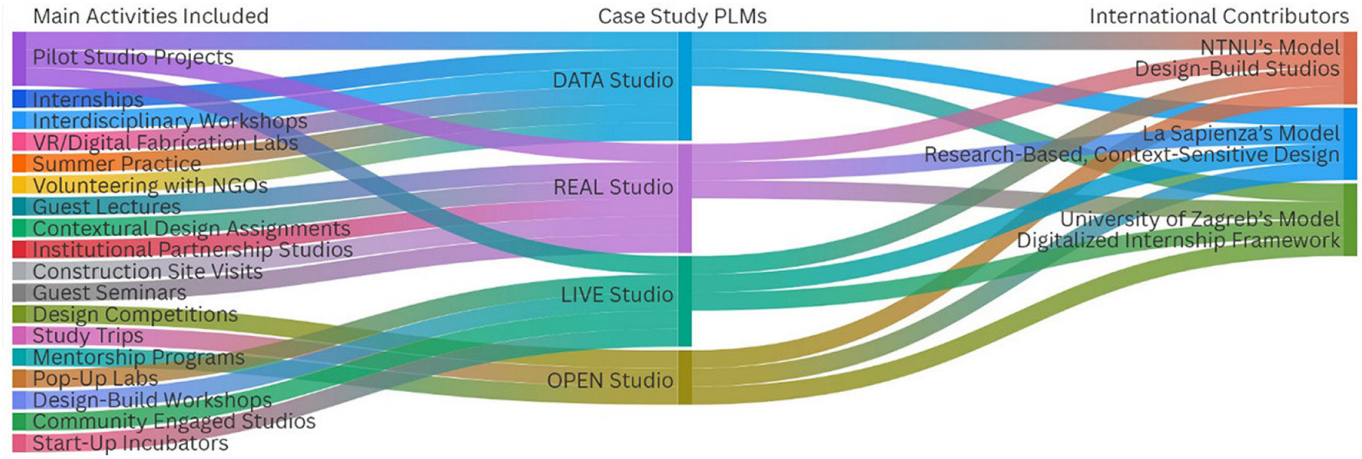

Fig. 5. Case study diagram

Source: Authors' own.

The insights emerging from the four pilot studios are synthesized in the Case Study Diagram (see Figure 5), which visualizes how each studio was configured through the combined influence of institutional context, locally feasible practical learning activities, and knowledge transfer from EU partner universities. The diagram highlights the way Western Balkan HEIs selectively integrated elements of established PLMs from EU partners—each of which has a long-standing tradition of experiential, research-based, or digitally supported pedagogies. By mapping the flow of activities, partnerships, and international inputs, the diagram illustrates how these diverse components converged to shape the final composition of the four APLE pilot studios. A detailed, comparative overview of their structure, methodologies, resources, and pedagogical outcomes is provided in Table 1.

Table 1. Comparative analysis of the four pilot studios created within the APLE project

Category	REAL Studio (UNSA Sarajevo)	LIVE Studio (UBL Banja Luka)	DATA Studio (SUM Mostar)	OPEN Studio (UoM Podgorica)
Implementing institution	University of Sarajevo—Faculty of Architecture, B&H	University of Banja Luka—Faculty of Architecture, Civil Engineering and Geodesy, B&H	University of Mostar—Faculty of Civil Engineering, Architecture and Geodesy, B&H	University of Montenegro—Faculty of Architecture, Montenegro
Description	Pilot studios based on real assignments in collaboration with institutional partners	Design-build studios blended with community participation	Collaborative studios reinforced with digital tools	Studios as models of professional architectural environments
Synthesis of practical learning activities	Guest Lectures by Professionals, Place-Based and Contextual Design Assignments, Studios with Institutional Partnerships (Real Studios), Construction Site Visits, Pilot Studio Projects, Industry and Contractor Guest Seminars	Pop-up laboratories and Temporary Installations, Design-Build Workshops, Studios with Community Participation Design-Build Studios (Live Studios), Interdisciplinary Thematic workshops, Pilot Studio Projects, Start-up Incubators, and Innovation Labs	Internships, Interdisciplinary Thematic Workshops, Pilot Studio Projects, Virtual Reality/Digital Fabrication Labs (Data Studios), Internships in Professional Studios and Companies, Summer Practice or Residencies, Volunteering with NGOs	Design Competitions and Student Challenges, Design Competitions and Student Challenges, Domestic and International Study Trips, Mentorship Programs with Industry Experts (Open Studios)
Key topics and issues addressed	Architecture exhibition set-up design; Place making and prototyping in the future museum district in Sarajevo; Heritage conservation studio on damage diagnostics of historical facades and portals in Sarajevo; Internship studio; Modeling course; Gaming course	Outdoor place making and transformation of the faculty campus, Urban furniture design; Exhibition setup design; Indoor place making and transformation of selected interior zones in the faculty building; Sustainable regional urbanism study of the Olympic Mountains	Heritage-sensitive waterfront development; Research of existing urban and architectural environment; Digital/analogue hybrid workflows for solution proposals through experimentation	Professional integration within studios; Municipal collaboration; Micro-interventions in real sites in different cities in Montenegro—design of urban furniture, green façades, and revitalized streets; International competitions and projects
Human resources: academic partners	Bachelor students (20 per studio/semester—total 80); Master students (15–20 per studio/semester—total 70); Academic staff (2–5 per studio/semester—total 20); Administrative staff (2 per semester/studio- total 8)	Integral studio (30 per activity/semester, total 120); Academic staff (3–4 per studio/semester—total 16); Administrative staff (1–2 per semester/studio—total 5)	Pilot studio (15–20 students per activity/semester, total 75); Academic staff (3 per studio/semester—total 12); Administrative staff (1 per semester/studio—total 4)	Open studio (20–25 students per activity/semester, total 85); Academic staff (2–5 per studio/semester—total 18); Administrative staff (1–2 per semester/studio—total 6)
Human resources: external partners	Renowned local and international architects (40 professionals); Local conservation institutions (5); Municipalities (4); Museums (3)	External partners (10 professionals); Citizens (20); Industry representatives (14); Interior projects teams (4)	Municipal authorities (2); Local cultural/environmental organizations (4); International workshop leaders (6)	City of Podgorica, Municipal authorities (3); Ministries (3); Engineers (15); Architects (10); Curators (3); International partners (3)
Technical resources	Indoor and outdoor studio activities, Modeling workshop, Survey measurement tools; Computer Lab	Pavilion prototypes, City-based testing grounds/areas, Fabrication materials, and wooden elements for outdoor furniture	Digital modelling tools, GIS/analytical software, Mapping tools, Modeling tools	Construction sites, Municipal data, Competition briefs, and facilities

(Continued)

Table 1. Comparative analysis of the four pilot studios created within the APLE project *(Continued)*

Category	REAL Studio (UNSA Sarajevo)	LIVE Studio (UBL Banja Luka)	DATA Studio (SUM Mostar)	OPEN Studio (UoM Podgorica)
Level of formality	Formal (Studios are embedded in the curriculum as electives); non-formal (Workshops), Informal (Guest lectures)	Non-formal (Embedded in elective studio format, strongly experimental)	Formal (Internships and structured professional exposure)	Formal (Studios as collaborative labs with professionals); non-formal (Competitions Informal (Guest lectures)
Timeframe/intensity	One-semester studio and one-week workshops	Intensive short cycles: pop-up labs, prototypes, material experiments	Semester-long and ongoing professional exposure	Semester-long with periods on construction sites and workshops
Key contributions by international partners	La Sapienza's model of research-based, context-sensitive design, modelling workshop organization, University of Zagreb's digitalized framework to internship implementation	NTNU's model for design-build studios and live projects, and on-site workshops	University of Zagreb's digitalized framework for internship implementation	NTNU's model for design-build studios and live projects, and on-site workshops, La Sapienza's model of research-based, context-sensitive design, modeling and participating in competitions
Outcomes	Strategic proposals, community toolkits, temporary installations, policy-relevant insights	Prototypes, material experiments, public presentations, start-up ideas	Enhanced professional readiness, stronger academic–industry ties	Built prototypes, site-based learning, improved understanding of construction processes
Main pedagogic innovations → result of the APLE project	Introduction of three new elective courses and an internship program in the curriculum.	Integration of entrepreneurship, prototyping, and community action within pop-up labs	Early exposure to professional practice; systematic integration of internships	"Learning by doing" through real construction; enhanced implementation of internships

Source: Authors' own.

These presented case studies illustrate diverse yet complementary approaches and innovations, pedagogical, technological, and social, to embedding practice into architectural education. While the architecture schools in Sarajevo and Podgorica emphasize place-based and socially responsive studios—similar to practices in Rome—Banja Luka, much like Trondheim, focuses on experiential learning through design-build studios and pop-up labs. Mostar continues to refine its pedagogical approach through enhanced collaboration with professionals, whereas Zagreb exemplifies strong institutional integration of digital innovations. The APLE project thus demonstrates that meaningful curriculum development in architecture can be achieved by balancing experimentation with institutional support, merging top-down coordination with bottom-up creativity, and catalyzed by international exchange to strengthen local capacity.

6 CONCLUSION

This paper has demonstrated, through research conducted within the Erasmus+ APLE project, how international collaboration can act as a powerful catalyst for curriculum development in architectural education by introducing and upgrading practical learning approaches. Building on a theoretical and historical overview of the evolution of practical pedagogy, the study highlights how architectural education

can embrace innovation on three interconnected levels—technological, pedagogical, and social. In recognizing the diversity of pedagogical practices across partner institutions and the varying interpretations of practical learning, the research introduced the comprehensive term PLMs to encompass the full spectrum of activities and formats.

A combined quantitative and qualitative analysis of partner HEIs revealed that each institution implements distinct PLMs tailored to its cultural, pedagogical, and institutional context. Examples from EU partners, such as NTNU's design-build studios, La Sapienza's place-based research-driven workshops, and the University of Zagreb's digitally structured internships, illustrate a wide range of approaches—from hands-on construction and direct community engagement to analytical reflection and institutionalized practice—each enriching student learning and preparing graduates for the professional field.

The pilot studios introduced in Western Balkan HEIs further highlight the versatility of PLMs: the University of Sarajevo's REAL studio engages students with real assignments while fostering interdisciplinary collaboration; the University of Banja Luka formalizes pop-up pilot projects within semester-long credited studios, framing them in entrepreneurial terms within the LIVE studio format; the University of Mostar integrates EU-inspired practical learning methods to strengthen structured teaching and credited practice into the DATA studio; and the University of Podgorica's OPEN Studio embeds professional practice, urban policy, and public micro-interventions, cultivating interdisciplinary skills, civic engagement, and professional readiness.

The presented pedagogical, technological, and social innovations, along with the pilot studios, were analyzed using a set of criteria—including formality, human resources, technical resources, and timeframe—which serve both as an analytical and programming framework. This approach enables systematic comparison, adaptation, and potential scaling of PLMs across HEIs. International collaboration not only facilitates the transfer of pedagogical innovations but also promotes critical reflection on local practices, supporting curriculum development that is responsive to technological, pedagogical, and social changes. By integrating these principles into architectural education, institutions can cultivate graduates who are equipped with real-world competencies, interdisciplinary understanding, and the capacity for innovative engagement with contemporary professional and societal challenges.

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