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Teaching practices in architectural technology courses. An experiment and future perspectives in the Italian context.

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Abstract

Architectural technology is a subject in constant evolution due to the specificity of territorial production, which is increasingly becoming more global. The constant change in the way of doing architecture requires the transmission of knowledge and skills that see an ever-greater weight in the acquisition of soft skills rather than hard skills, thus enabling to face situations with new complexities. The paper discusses the innovative teaching methodologies experimented with within an architectural technology course, at the Faculty of Architecture, Sapienza University of Rome. It includes considerations regarding the classroom vs. online learning, experienced during the COVID-19 lockdown phases, elaborating on the results of a survey that collected 158 students' views. The results highlight the importance of active learning environments to support the preparation of architects able to manage emerging challenges and make use of information and communication technologies, that are rapidly changing, especially after the shift caused by the pandemic.

Keywords: *Innovation; experimental learning environment; hard skills; soft skills, architectural technology.*

1. Introduction

Higher education has long been at the centre of debate for the update of objectives and delivering methods through new teaching practices, monitored, and updated in 48 European countries by the European University Association, representing more than 800 universities. The rapid change of contemporary society pushed towards a re-evaluation of the university's role in acquiring soft skills rather than hard skills and in creating learning settings that shift the emphasis from information and knowledge to creativity and critical thinking. If hard skills such as the mastery of science, proficiency in a foreign language and technical skills can be assessed easily through practical tests; soft skills are rooted in actions and experiences; they represent the personal knowledge necessary for managing situations; knowing how to communicate effectively; how to work in a group; and how to manage stress. Traditional "teacher-centred" approach in teaching has fallen out of favour as it is seen to favour passive learning. Therefore, contemporary approaches are shifting toward a "learner-centred" methodology (Bishop et al, 2014; Loukkola, & Peterbauer, 2019) and towards a 'trialogical learning", which uses collaborative learning techniques based on activities of concrete hands-on application through tangible objects (Sansone, Cesareni, & Ligorio, 2016). The teacher, therefore, takes on a new role, from "Lecturer" to "Facilitator" (Doyle, 2011) of learning. Faculties of architecture are traditionally characterized by training and formative profiles of a practical nature, which leads to the enhancement of participatory and collaborative teaching techniques that often revolve around project or design applications. This sometimes happens through consolidated methodologies which should increasingly seek to enhance the integration of a learner-centred approach and of a soft skills acquisition process that is based on a constant dialogue with 'digital natives', a generation that is rapidly developing and changing. As Prensky puts it, "Our students have changed radically. Today's students are no longer the people our educational system was designed to teach" (Prensky, 2001).

This work discusses teaching practices experienced within an Architectural Technology II (ATII) course, taught at the five-year single-cycle master's degree programme in Architecture, coordinated by the first and second author, the latter in the last seven years as instructor as instructor. It is a 10 CFU (University Credit) mandatory course of the second curricular year and it aims to prepare students in the field of applications of architectural construction techniques. ATII's main objective is to provide critical and operational tools and methodologies necessary for technical design and construction technologies; understood as the ability to analyse and operationally integrate the needs, the functional and formal requirements, and the technical and construction solutions of architectural work, so that there is a coherent operational continuity between the moment of the decision-making of the design choices and the moment of the technical realization of the building. The course, therefore, aims to provide second-year students with systematized knowledge of the challenges posed during the construction process of a building, concerning the operational relationship

between design and implementation. After having assimilated the basic knowledge in the Architectural Technology I course in the first year, ATII students learn about construction systems and techniques, components, and industrial products for construction. They develop the ability to read an architectural project as an interdisciplinary design process, characterized by sequential acts of different levels of proficiency, in which various actors intervene (client, design teams, companies, etc.). The programme also intends to enhance the development of a comprehensive set of skills necessary for an intricate professional figure such as an architect. At the end of the course, students should demonstrate an adequate level of understanding of construction systems, building components, and industrial products for construction and their assembly methods. They work in groups to develop the architectural drawings of a building and produce all its execution drawings. They have, on one hand, to show acquired full knowledge of phases, procedures and operational tools of the building process, as defined within the local, national and European regulations; and on the other hand, demonstrate creativity, critical thinking and problem-solving. Accordingly, the activities, operation and assessment methods are designed to take into account both hard and soft skills.

Within this framework, the paper aims to highlight an experimental methodological approach for the creation of a model that integrates different methodologies, tools and activities for the development of both soft and hard skills in a higher education learning experience in the field of architectural technology, emphasizing the role of the teacher as facilitator.

2. Experimental active learning environment

The teacher addresses the programme topics through frontal lectures and seminars. This typically traditional teacher-centred method, however, is complemented by a set of visual and audio-visual tools to enhance direct feedback and stimulate an interactive environment. Therefore, sessions, in ATII, usually start and end with two different types of anonymous online questionnaires for students. The first is used based on the session's requirements, it collects the attendees' feedback regarding the chosen session topics. The second evaluates the level of comprehension of the content addressed during the session. In both cases, results are projected on the classroom screen in real-time and a discussion is initiated to address the collective response. In the first case, the questionnaire represents a tool to stimulate the students' curiosity, setting focus on their role as active participants, sharing their opinion through the questionnaire and the discussion that follows. It also provides the docent with an additional overview of the participants' impressions regarding the chosen topics. This approach has proved to encourage students to actively participate, answer questions raised by the teacher, and proactively ask questions or share feedback during the session, enhancing dialogue, and demonstrating a higher level of involvement. The second questionnaire allows the teacher to evaluate their clarity, adequacy of the content and transfer methods. It creates another space for collective analysis of erroneous answers, facilitating the comprehension of

complicated arguments. On regular basis, the sessions are 'interrupted' by dynamic activities such as tasks, workshops, and presentations, enhancing student-centred learning. Students may sit in small groups and work together to solve an issue that could vary from a research task (e.g., researching recycled construction materials that comply with a local regulation) to working on the elaboration of a conceptual project idea (e.g., defining the suitable set of passive envelope strategies to apply to a case study). The task is often followed by a feedback space through - verbal, written, or audio-visual - presentations that could be informative, demonstrative, or persuasive, and a discussion between the learners and their facilitator. In some cases, the activity could be a one-day workshop to answer a given question within a specific theme (e.g., Green Public Procurement). The classroom dynamics become highly flexible to encourage students to develop their analysis through critical thinking and inquiry-based learning. Occasionally, students are provided with educational material (i.e., educational videos, articles, and literature) and they are given space to study this content, either before class or individually during some of the course hours. The classroom session then is dedicated to the discussion of content, where the facilitator raises questions and initiates a debate for the development of the topics' understanding and comprehension. In the flipped classroom, some examples of the content addressed individually by the learners are online lectures of the docent discussing the current tendencies in the construction sector; educational animations of building elements (e.g., slab blocks types and characteristics); video of a system's installation (e.g., green roof).

During the semester, the students work in groups, of two to three persons, to elaborate architectural execution full package drawings of a case study project, a residential building that they designed (preliminary design) in the Design Studio of the previous school year, enhancing project-based learning. The technical solutions and project drawings progress is supported through regular follow-ups, where two main revision techniques are added to the traditional revisions, with academic staff members. The first technique is the collective revision, where students present their project drawings in front of the whole class and their colleagues provide feedback and share comments openly. This method allows a dialectical comparison between the elaborated outputs, favouring skills for project presentation in front of an audience. The second technique is used at an early phase of the case study progress. The teacher couples the groups , based on defined criteria, for a peer review activity, enhancing cooperative learning. The groups are given a timeframe to assess their colleagues' drawings, then they exchange feedback and improvement suggestions through written documents. Although this technique is supervised by the academic staff, it proved to allow an enhancement of an 'independent' comparison between students' solutions. It resulted in beneficial progress of the case studies, and it received significant appreciation from the students, who applied this method through a collaborative writing technique, and had to think critically, collaborate to analyse their colleagues work and take evaluation decisions.

Construction site activities have been part of the course's programme for years. For three days, students follow the "learning by doing" approach in the educational construction site and laboratories of the Joint Body for Training and Safety in Construction in the Province of Rome (CefemeCtp). They are divided into smaller groups that are followed by CefemeCtp instructors. They first follow a full-scale demonstration of the realization of building part(s) with traditional technologies (e.g., brick walls, masonry arches, etc.), and then each group realizes a building part, then the groups alternate. Participants also meet building materials suppliers who showcase updated technologies and systems in a dedicated seminar hall, explaining their installation methods through full-scale on-site applications. This is almost always followed by the students' realization of the explained system. This experiential learning experience allows architecture students to touch building materials with their own hands, understand their weight, size, and texture, not only through drawings or scaled models; and above all to have a first idea of the activities that take place on a construction site. The whole procedure is supervised by the course staff members that are present on-site, enhancing links with the other course content, and stimulating dialogue. Often, students decide to adopt techniques or systems, that were demonstrated, in their project case studies' solutions.

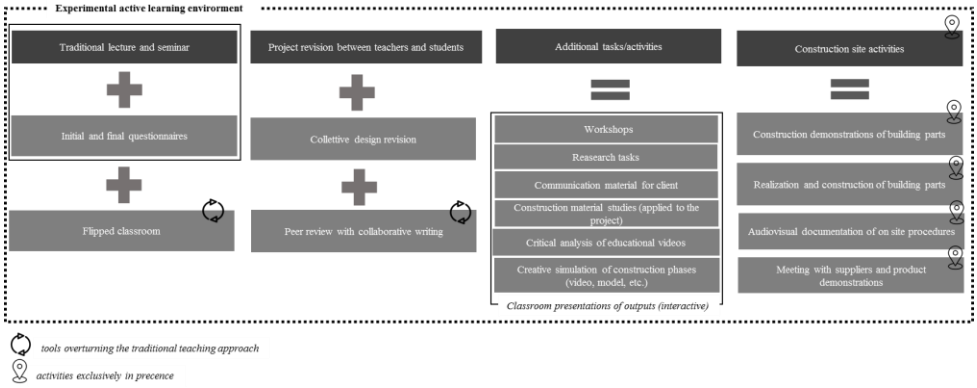

Fig 1. Experimental active learning environment by Authors.

During the course, the academic staff integrates various active learning instruments to stimulate the expansion of soft skills that students will possibly need in their future profession. For example, students create short videos of their CefemeCtp site activities or other construction sites, accompanied by verbal critical analysis of the visual content. They prepare communication and promotional material for their work (i.e., project brochures), where they learn at an early stage to translate the complexity of technical content into a communicative format for clients. Students also present a "book of building materials" that includes a categorized listing of construction and technical products used in the case study. This plays a role in understanding how organise technical information and read detailed project elements. Throughout the year, the staff aspires to create an open environment that welcomes different presentation and communication strategies, encouraging creativity. The

results of this approach are limited due to the students' relatively limited familiarity with advanced presentation tools at an early stage. However, students occasionally adopt the invitation and present original results. One example is a student that showcased the construction phases of his project, in reinforced concrete, brought through a physical model maquette with the video documentation of the sequential installation of the structural and building components from beginning to end of the process.

The students' assessment and grading is based on a set of tools and criteria to inclusively evaluate all the skill sets and knowledge acquired during the course. Assessment includes a detailed evaluation of all the student's activities and participation during the semester, the results of the intermediate test(s), the produced outputs (project drawings, brochure, book of material, elaborated material) and the performance in an oral exam.

3. Classroom vs online learning modalities

Online teaching, forced by COVID-19, pursued the same objectives as classroom "in-person" teaching but was delivered in total remote mode. This required a different time management approach, involving new planning and scheduling methods, and a completely new operation, significantly different from the ones that take place in the classroom. During the online teaching, the TAII's construction site experience was not possible; it was replaced by a selection of educational videos to be assessed and analysed collectively. Most of the other teaching tools, mentioned above, were carried out and the learning practices used in the classroom sessions were implemented, stimulating an active and dynamic setting. Total remote teaching highlighted the potential for reaching a wider audience of students, emphasized the need for flexibility, and reduced the negative environmental impact caused by the mobility and transportation sector. In ATII, the sessions were delivered through G-Meet videoconferencing platform and the other activities were managed through the Moodle platform, which includes multiple settings, including the possibility of linking or providing access to external platforms (G-Drive, YouTube, websites, etc.).

In the United States, some argue that COVID-19 accelerated the transition process between home and distance learning (Stanley, 2020). This could lead to the initiation of courses that are performed completely online, even for universities that are defined by their official statutes as "in-presence higher education institutions". This transition, however, suggests an invitation to reassess the role of public universities today. The primary challenges that can be observed for the launch of full online courses in the university environment are the possibility/impossibility of a fully reliable internet connection, the adequacy of use of information and communication technology tools by everyone, and the lack of a real learning environment when using those tools. This lack means reduced personal exposure and conflicts, and therefore lower ability to develop human relationships and improve critical

thinking and interpersonal skills. Moreover, students with, personal or environmental, vulnerabilities might be subject to additional accessibility barriers for these courses. A further consideration in retrospect is that the students who attended the course in its fully online format used technical language and expressions that can be defined as “poor and basic”, compared to their colleagues who followed the course in class in previous years. This aspect was particularly evident during the oral evaluation sessions and verbal presentations. This could be assumed to be because online sessions allow a flexible, less controlled, and less interactive space, which potentially could lead to the participants' distraction. To date, and predictably soon, the blended learning modality seems to be the method that will prevail. To reinforce this hypothesis are the results of a survey performed between March-April 2020, to 158 students, attending the second and third year of the Faculty of Architecture, Sapienza University of Rome, where the answer to the question "Of all the frontal courses to be followed and attended at the university, how many would you like to follow online?" 39% indicated that they would like to have both possibilities (face-to-face and online) and 25% preferred to take only a few courses online, while only 31% indicated “none and prefer face-to-face (in presence) courses”. When asked about work modalities, 60.8% indicated that they would prefer to work some days from home and other days in the workplace (office, company, etc.), compared to 38% who would prefer to fully work in the workplace.

4. Results and Conclusion

The article presented a learning and teaching model applied in the "Architectural Technology II" course for second-year architecture students at Sapienza University of Rome. The authors of this paper are not pedagogues and without claiming that the highlighted methods and tools experimented with within the course were applied in their full orthodoxy, it is evident that the results were evaluated positively by both students and teachers. The integration of questionnaires with the frontal lectures/seminars resulted in active participation during the sessions. Students showed high involvement and interest in the student-centred learning activities. The integration of group work, presentations of different types, and activities that increase interaction between students enhanced the development of soft skills (teamwork, communication skills, flexibility, adaptability), parallelly with the technical content and practical knowledge acquisition. The variation of the revision technique for the case study project received significant appreciation from the students, who found it as an opportunity to analyse and make assessments from other perspectives, but also present and receive feedback in a different and more stimulating manner. The construction site activities had an evident and straightforward impact on the students' understanding and approach towards the analysis and decision-making process of the technical solutions. The integration of integrated activities and outputs of various formats proved to develop different skills and stimulated the students' creativity. Over the years, the students evaluation surveys of the course (performed

anonymously as a part of the university's processes for quality assurance) showed that interest and appreciation of the subject increased with the increase of the student-centered and experiential learning methods.This experimental model represents an example in an Architecture school in Italy, that is rapidly developing and increasingly becoming more global. The generations and learning means are changing and the role of teachers is continuously evolving, from ''Lecturer'' to ''Facilitator'', to respond to this paradigm shift. In 2017, the Quality and Innovation of Didactics Working Group (GDL-QuID) was established to develop strategies and guidelines for the progress, improvement and innovation of teaching in Sapienza University. Groups like this are functional to providing permanent training, and updating staff members with, hard and soft, skills and necessary tools (e.g., Information Technology and innovative teaching practices) for a process that, while dealing today with a generation of digital natives and digital transition, continues to evolve. This has been highlighted by the implications of COVID-19, which shook the balance between classroom and online learning; and it is leading to the integration of additional, partially or fully performed, online courses, that represent a step towards more inclusive and innovative approach to learning and teaching. This paper, however, highlighted the primary, contextual, challenges to enhance the benefits of both classroom and on-line learning. Adaptability plays a fundamental role for academic staff members, and all actors of the educational process, to face future challenges in architectural education, and higher education in general, and prepare a competitive generation of workforce, with all skill sets to respond to local and international cross-cutting issues. Future work could assess the impact of the experimented methods on student development and employability. It can also assess the optimization methods of the blended, classroom and online, teaching model.

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