EGE
REVISTA DE EXPRESIÓN GRÁFICA EN LA EDIFICACIÓN

INNOVATION FOR LEARNING IN THE ARCHITECTURE DEGREE: AN EXPERIENCE IN DRAWING 1

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Abstract

University teaching should be oriented towards the continuous improvement of student learning. In this regard, addressing students' spontaneous ideas and identifying their prior knowledge are highly significant for enhancing teaching practice. This study presents the implementation of a methodology based on the Improvement Cycles in Classroom (ICIC) in the course Drawing 1: Geometry and Perception within the Bachelor's Degree in Fundamentals of Architecture. Specifically, it reports its application to the topic "Surfaces and Volumes". To this end, contrast activities, practical exercises, and observation-based tasks involving architectural elements were designed, all aimed at their geometric documentation through the dihedral and axonometric systems. The evaluation of this proposal reveals a positive impact derived from the application of this methodology, which enables the objective identification of students' learning progress.

Keywords: architectural graphic expression; geometry and perception; teaching innovation; graphic representation; graphic language.

Resumen

La enseñanza universitaria debe orientarse hacia una mejora continua del aprendizaje del alumnado. En este sentido, abordar las ideas espontáneas del alumnado y conocer sus conocimientos previos resultan de gran significado para la mejora de la enseñanza. Este estudio expone la implementación de la metodología basada en el Ciclo de Mejora en el Aula (CIMA) en la asignatura Dibujo 1: Geometría y Percepción del Grado en Fundamentos de la Arquitectura. En concreto, se presenta su aplicación en el tema "Superficies y Volúmenes". Para ello, se diseñaron actividades de contraste, ejercicios prácticos y dinámicas de observación de elementos arquitectónicos, orientadas a su documentación geométrica mediante los sistemas diédrico y axonométrico. La evaluación de esa propuesta revela un impacto positivo derivado de la aplicación de esta metodología que permite identificar un progreso de aprendizaje de manera objetiva.

Palabras clave: expresión gráfica arquitectónica; geometría y percepción; innovación docente; representación gráfica; lenguaje gráfico.

How to cite this article: Ferreira-Lopes, P., & Angulo Fornos, R. (2026). Innovation for learning in the Architecture degree: an experience in Drawing 1. *EGE Revista de Expresión Gráfica en la Edificación*, (24), e25684. https://doi.org/10.4995/ege.2026.25684

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Received: 20 February 2026, Accepted: 29 April 2026,
Available online: 22 May 2026, Published: 30 June 2026.

Crossref Similarity Check Powered by iThenticate

ISSN 2605-082X

1. INTRODUCTION

Social constructivism has become established as a fundamental approach in science education, as it maintains that knowledge is not transmitted in a unidirectional manner but is actively constructed through the interaction between individuals' prior experiences, their own conceptions, and the surrounding sociocultural environment (Vygotsky, 2012). In the case of architecture students, these spontaneous conceptions play a decisive role in the understanding and analysis of elements situated in space, directly influencing the way in which graphic and geometric information is processed. Such prior ideas condition students' perceptions of the activities proposed by teaching staff, which may be perceived as more or less accessible, meaningful, or motivating depending on the degree of coherence they maintain with existing mental models.

For this reason, the identification of conceptual limitations or cognitive discrepancies in relation to a given topic is essential in order to understand how students interpret spatial phenomena and to design didactic proposals that respond appropriately to their starting point. From this perspective, the methodological approach of the present teaching experience is based on the hypothesis that students enter the course with a relevant prior background and are capable of constructing new learning through activities guided by inquiry, systematic practice, and critical reflection on their own learning process.

In the specific domain of Architectural Graphic Expression, several authors have emphasized the need to rethink traditional teaching models in drawing courses, particularly in first-year architectural education. Research presented in international forums such as the Congreso Internacional de Expresión Gráfica Arquitectónica (EGA) and the Jornadas sobre Innovación Docente en Arquitectura (JIDA) highlights that graphic learning is more effective when students actively construct knowledge through observation, experimentation, and iterative contrast between their own drawings and architectural reality. In this vein, educational innovation in architectural graphic expression has increasingly focused on active methodologies that promote student autonomy, reflection, and the integration of theory and practice. Studies by Butragueño Díaz Guerra, Raposo Grau, and Salgado de la Rosa (2018) underline the role of drawing as a cognitive tool that enables analysis, interpretation, and architectural thinking, aligning with constructivist approaches as the tangible nature of the drawing by hand enables a true understanding of the architecture object, especially in the early stages of learning. This approaches adopt a more active learning process and advocate that the traditional "master classes" should be replaced by constructive teaching based methodologies. Similarly, Soler Estrela et al. (2025) and Redondo (2023) argue for methodological models that incorporate progressive learning sequences, foster student autonomy and regard traditional drawing techniques as fundamental and a priority, as they allow for a wide range of graphic experimentation and offer a sense of immediacy in the use of tools that no digital medium can match.

These contributions converge with the pedagogical principles proposed by Bain (2007), Finkel (2008), and Porlán (2017), particularly in their emphasis on activating prior knowledge, fostering inquiry, and structuring learning around reflection and contrast activities. Within this theoretical framework, architectural drawing is understood not merely as a technical skill, but as a learning process through which students progressively develop spatial reasoning, graphic precision, critical awareness and meaningful engagement with real architectural contexts.

In line with the above, this paper presents a teaching experience based on the application of Improvement Cycles in Classroom (ICIC) (Delord et al., 2020) in the course *Drawing 1 – Geometry and Perception* (hereafter, Drawing 1), part of the Degree in Fundamentals of Architecture at the University of Seville, with the aim of analysing how this methodology promotes the active construction of knowledge and the development of fundamental graphic competencies.

1.1 THE SUBJECT

The course *Drawing 1 – Geometry and Perception* is one of the core subjects in the first year of the Degree in Fundamentals of Architecture at the University of Seville, where it is included as a basic training subject with a semester-based structure. Its affiliation with the Department of Graphic and Architectural Expression, together with the involvement of teaching staff specialised in graphic expression, highlights its relevance in

the development of the initial competencies of architecture students. As one of the first subjects through which students come into contact with the specific languages of the discipline, the course plays an essential role in students' graphic literacy. In most cases, students enter the degree programme without a solid prior background in technical drawing or architectural representation systems.

The academic orientation of the course focuses on providing the conceptual and procedural foundations necessary to understand applied geometry and representation systems, promoting the progressive acquisition of the ability to interpret, analyse, and formally communicate architectural elements. This initial training is key to supporting the transition to subsequent courses, where more complex design processes are addressed in greater depth. Consequently, Drawing 1 encourages a perceptive and critical approach to the architectural object, laying the foundations for the development of observation skills, spatial analysis, and graphic precision that will be transversal throughout students' entire educational trajectory – competencies that will be essential during the course of the degree.

Drawing 1 is a compulsory core subject that serves as an introduction to the architectural graphic language and aims to provide students with fundamental concepts of graphic representation, using dihedral and axonometric projection systems. The course carries an allocation of 6 ECTS credits distributed over a total of 15 weeks, with 4 hours of on-site teaching and 6 hours of independent student work per week. It is structured into two main blocks: Introduction to Architectural Drawing (7 weeks) and Representation Systems (8 weeks). Its contents are organised into seven topics: Topic 1 – Introduction and fundamentals of drawing in architecture; Topic 2 – Manual drawing; Topic 3 – Theory of perception; Topic 4 – Geometric foundations of projective systems; Topic 5 – Movements in space; Topic 6 – Introduction to geometric documentation: sketching and metric capture; and Topic 7 – Surfaces and volumes. The course is taught by two lecturers who collaborate in the classroom and share teaching responsibilities simultaneously. The ICIC methodology was implemented during weeks 10, 11, and 12 of the course, in relation to Topic 7.

Regarding the general dynamics of the classes, throughout the course students use an A4-format notebook in which they take notes on the content and produce sketches and preliminary drawings as an initial approach to the problems and exercises, which are later developed in A3 or A2 formats depending on each assignment. This A4 notebook is collected on the last day of class and is also subject to assessment. In this way, it is possible to observe not only the students' course assignments but also their notes, organisational strategies, and the evolution of their drawings through this daily working medium.

2. METHODOLOGY

2.1 STARTING POINT AND PRELIMINARY METHODOLOGICAL DESIGN

The implementation of the ICIC model seeks to transform the traditional classroom structure, which is typically characterised by a predominant role of the lecturer as the main transmitter of content and by unidirectional dynamics in which students adopt a passive position. Within this conventional model, theoretical sessions tend to be conducted without prior exploration of students' experiences or initial conceptions, which limits their participation and hinders the connection between theory and practice. This situation gives rise to two main problems: (1) the absence of mechanisms to identify students' prior knowledge and spontaneous ideas, and (2) the lack of continuity between theoretical explanations and practical activities, often requiring content to be reiterated when students begin to solve the exercises.

In contrast, the methodological approach adopted in this teaching experience pursues several fundamental objectives: (1) to identify and objectively assess students' prior conceptions; (2) to strengthen the articulation between theory and practice through integrated activities; (3) to encourage active student participation and their capacity for inquiry and initial reflection, enabling them to approach problems based on their own knowledge, thereby reinforcing autonomy and agency through contrasting activities (Finkel, 2008); (4) to enhance classroom work as a space for the immediate resolution of doubts; and (5) to promote the idea that knowledge must be verified, critically reviewed, and applied flexibly,

allowing students to generate multiple solutions to the same challenge.

To develop this learning-improvement-oriented model, a detailed analysis was carried out of the relationship between topics, contents, and the scheduled exercises. As an initial methodological application, this approach was implemented in Topic 7, entitled Surfaces and Volumes. In order to organise and clarify the essential elements of the topic, a diagram of contents and key problems was developed (Fig. 1), structuring the three central questions – what are surfaces and volumes? how are they graphically represented? and what should be considered when producing the drawing sheet? – into four categories: intellectual, procedural, technical-motor, and social-professional. This organisation made it possible to design a more coherent sequence across the different learning stages and to foster a more robust cognitive progression among students.

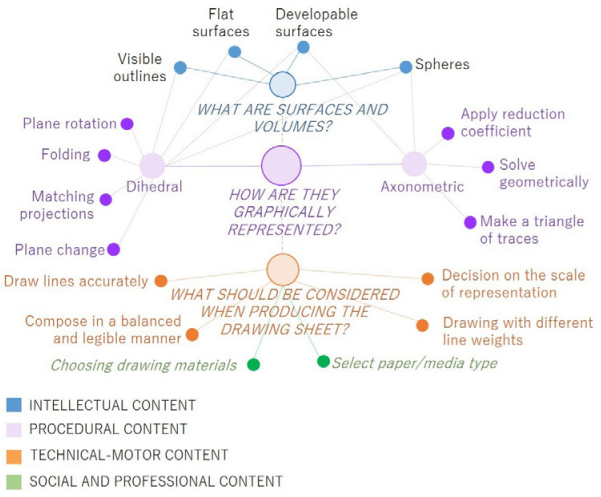

Fig. 1. Diagram of contents for the topic “Surfaces and Volumes”. Source: Authors.

The methodology implemented for the development of this experience is divided into four stages: (1) the construction of a methodological model and the definition of the sequence of activities to be carried out during the sessions; (2) the design and implementation of the initial and final questionnaires; (3) the application of the methodological model designed in Stage 1; and (4) the assessment of student learning and the self-evaluation of limitations, opportunities, and future improvement actions (Fig. 2).

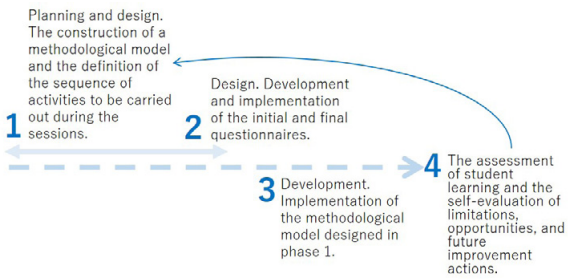

Fig. 2. Phased process for developing and implementing the learning improvement cycle. Source: Authors.

In accordance with the teaching guide of the subject, the learning objectives associated with this experience, and the specific topic o Surface and Volumes, focused on: the correct identification and representation of surfaces and volumes using dihedral and axonometric systems; the development of spatial reasoning and graphic precision; and the progressive autonomy of students in organising and solving geometric representation problems.

Evaluation criteria were directly aligned with these objectives and considered both process and outcome. Special attention was paid to students’ ability to reason graphically, to select appropriate representation strategies, and to demonstrate coherence between spatial representation and drawing accuracy. These criteria were applied consistently throughout the improvement cycle and were made explicit to students during classroom activities and contrast sessions.

2.2 METHODOLOGICAL MODEL AND ACTIVITIES

The ICIC model was designed and implemented over a total of three class sessions, each lasting four hours. The methodological model proposed for its development (Fig. 3) focuses on problem-solving related to the geometric representation of a micro-architectural element – a small pavilion, the Chapel of Santa Ana and its reflecting pool – located within the Cartuja complex, in the garden and orchard area of the Centro Andaluz de Arte Contemporánea (CAAC, Andalusian Centre for Contemporary Art) in Seville (Fig. 4). This architectural object was selected because it is an accessible building of limited dimensions, making it manageable for first-year students. However, despite its reduced scale, it includes multiple levels and is composed of a volumetrically and spatially complex structure, formed by a variety of shapes, surfaces, and volumes.

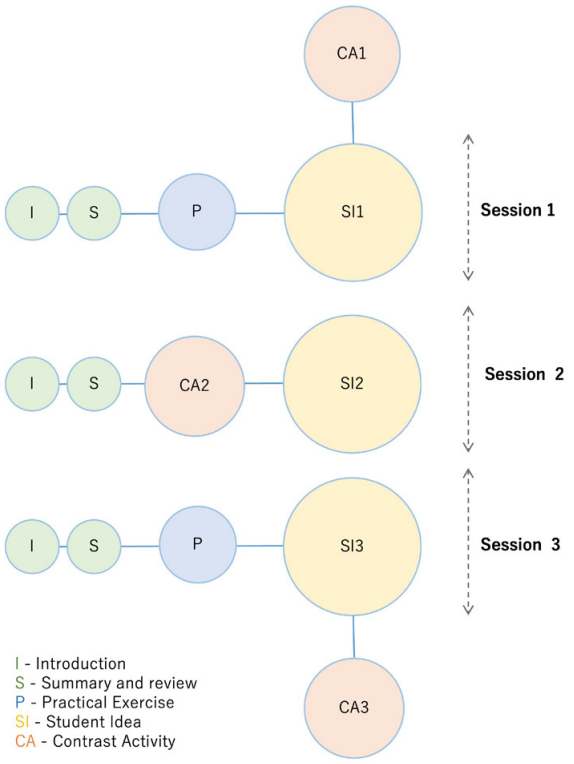

Fig. 3. Diagram of the ICIC methodological model applied. Source: Authors.

This model aims for students to become the protagonists of the learning process and to activate their prior knowledge, giving priority to their ideas - Student Idea (SI)- when geometrically documenting and graphically representing the element (De Alba and Porlán, 2017). The role of the lecturer was that of a facilitator, providing guidance through the discussion of key aspects to be considered and resolving the questions that arose during the development of the exercises. The Contrast Activities (CA) applied within the model refer to activities in which the content taught is addressed in relation to the exercises carried out by students during the sessions. As can be observed, a gradual methodology (Larkin, 2012) was adopted throughout the sessions to support the effective and long-lasting assimilation of knowledge.

2.3 THE ACTIVITIES CARRIED OUT DURING THE SESSIONS OF TOPIC 7

The activities were distributed across three sessions. Figure 5 presents a detailed overview of the structure of each session, including the activity outline, the resources used, and the time allocated to each.

The first session took place at the Centro Andaluz de Arte Contemporánea (CAAC), in the Cartuja complex. In the first part of this session, students were introduced to the historical context of the Templete de Santa Ana (Chapel of Santa Ana). Subsequently, while seated on the staircase near the entrance to the CAAC, the exercise to be carried out by the students was explained. For this purpose, one of the lecturers produced schematic sketches of elevation, section, and plan of the small pavilion in an A4-format notebook. Once the students' questions had been addressed, the group moved to the CAAC orchard area to visit and draw the pavilion. Students worked on drawing and sketching the pavilion until 13:30. The main

Fig. 4. Students drawing in the Chapel of Santa Ana. Source: Authors.

S 1 – What are surfaces and volumes?		S 2 – How to represent surfaces and volumes graphically? What should I take into account on the sheet?		S 3 – How to represent surfaces and volumes graphically? What should I take into account on the sheet?	
I+S	Type: Introduction, summary and organisation of the session. Time: 20 minutes. Resources: Teacher; A4 sketchbook; A3 paper; Questions. Development: Summary of the previous session and explanation of how this class session will be conducted. In this session, the object of analysis is the Chapel of Saint Anne.	I+S	Type: Introduction, summary and organisation of the session. Time: 40 minutes. Resources: Teacher; Whiteboard; Questions. Development: Summary of the previous session and explanation of this one. It is mentioned that we will work with the same object of study. A questionnaire with three questions is handed out for students to answer (20 minutes).	I+S	Type: Introduction, summary and organisation of the session. Time: 20 minutes. Resources: Teacher; Whiteboard; Questions. Development: Synthesis of the previous session and introduction to Session 3. It is mentioned that this class will be a continuation of the previous one, and that we will work with the same object of study: the Chapel of Santa Ana.
P1	Type: Exercise explanation. Time: 20 minutes. Resources: Teacher; A4 sketchbook; A3 paper; Questions. Procedure: The exercise that the students must do is presented. The teacher makes a sketch in an A4 notebook on-site to explain, through the drawing, the practice they have to carry out	CA2	Type: Contrast Activity. Taking measurements, representation, scales, and layout of the drawings on the sheet. Time: 60 minutes. Resources: Teacher; Photogrammetric digital model; Chalkboard; Questions. Development: Using the sketches made in the previous class, students must determine which dimensions are necessary to draw the small temple to scale (plan, elevation, and section). The students begin identifying the required measurements, and the photogrammetry of the small temple is projected so that we can take measurements together.	CA3	Type: Contrast Activity. Theory, design, and notes on the geometric documentation of volumes and surfaces. Teaching the principles, guidelines, and mechanisms for the correct geometric documentation of surfaces and volumes. Time: 45 minutes. Resources: PowerPoint, Whiteboard; A4 sketchbook. Development: The instructor will teach, using slide presentations and board drawings, the concepts and methods for the geometric documentation of surfaces and volumes.
SI1 + CA1	Type: Students idea and Contrast Activity. Carry out the geometric documentation of the small temple through a sketch. Time: 2hs 50 minutes. Resources: Freehand drawing materials, A3 sheets, A4 sketchbook, rigid support for the A3 sheet, measuring tape, level, scale ruler. Development: The students must geometrically document the small temple by means of a sketch. If necessary, the teacher may make some observations or present examples through drawings on A4 or A3 sheets to clarify certain techniques and/or processes that can help students improve their drawing and understand the architectural object.	SI2	Type: Students' Idea Time: 2 hours and 20 minutes. Resources: Drawing materials (A3 and A2 sheets, graphite pencils of different hardnesses, set square, triangle, ruler, scale ruler). Development: Develop several scaled drawings in dihedral (orthographic) projection. One sheet must include the plan, one facade, and at least one section of the architectural object. These drawings must correspond to one another on the sheet. If necessary, the teacher should make some observations or provide examples on the board to clarify certain techniques and/or processes that may help students improve their drawing.	SI3	Type: Students' Idea Time: 3 hours. Resources: Drawing materials (A3 and A2 sheets, graphite pencils of different hardnesses, set square, triangle, ruler, scale ruler). Development: After having started the survey and clarified some doubts, the students must now begin developing on another sheet a military perspective of the small temple. If necessary, the teacher should make some observations or provide examples on the board to clarify certain techniques and/or processes that may help students improve their drawing.

Fig. 5. Details of the three sessions taught. Source: Authors.

difficulties arose when drawing the vaults, arches, and the spire of the Templete.

There was insufficient time for students to take measurements; therefore, the sketches remained undimensioned and were left pending until the following session.

In the second session, students were first asked to add dimension lines to the sketches produced during the previous session. The sketching needed to be complete, as it was intended to serve as the necessary reference for the next exercise: producing scaled geometric documentation on an A2 format sheet.

Prior to the course, the lecturers had developed a photogrammetric survey of the Chapel with a twofold aim (Fig. 6). Firstly, to support this last exercise by ensuring metric coherence across all graphic representations, and secondly, as a way to approach one of the competencies defined in the teaching guide of the subject: *the appropriate and applied knowledge of graphic surveying techniques in all their phases, from sketching to scientific reconstruction, as applied to architecture and urban planning*. As for the first objective, the textured model of the chapel obtained using photogrammetric techniques

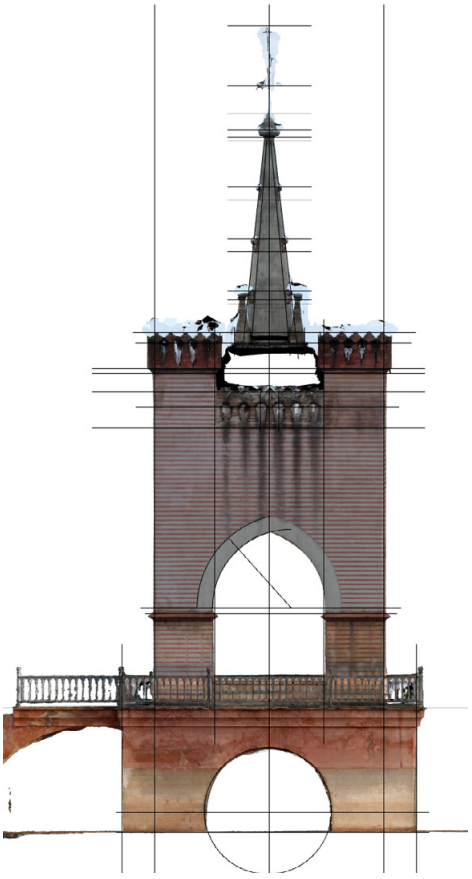

Fig. 6. Photogrammetric textured model. Front elevation. Source: Authors.

was imported and manipulated in Rhinoceros software (Robert McNeel & Associates, 2024), where it served as a spatially accurate reference model. Regarding the second objective, the brief presentation by the lecturers on the surveying process using digital photogrammetry (SFM) and the results obtained provided students with an initial introduction to this cutting-edge surveying method, given that the course programme did not allow for a more in-depth exploration.

During the first part of the second session, students identified the dimensions required to complete their sketches and scaled drawings, and these measurements were extracted directly from the textured model by the lecturers using the software environment. This procedure guaranteed dimensional consistency among the students' graphic outputs while allowing classroom time to be focused on the interpretation and transfer of metric data into the corresponding projection systems. Once all dimensions had been defined, students began planning the drawing sheet. They were required to consider how to organise the drawings on an A2 sheet so that at least one section, one elevation, and the roof plan of the entire complex could be included.

At this stage of the session, the objective was for students to become familiar with the use of the scale ruler and the transfer of dimensions onto the A2 drawings. In the second part, students continued developing the exercise in class while raising any questions that emerged.

In the third session, a brief review of the content covered in the previous weeks was carried out. During this part of the session, we also discussed the previous exercise by projecting some of the students' work onto the screen. In doing so, we aim to ensure that both mistakes and successes are identified and observed by the students themselves. This was followed by the contrast activity, during which, through slides and guiding questions, content related to the concepts of surfaces and volumes – their definitions, categorisation, and the procedures for addressing their representation – was discussed. Once this part was completed, students were assigned the exercise of drawing a military projection of the pavilion, concluding the session with the development of this task and the resolution of the corresponding questions (Fig. 7).

2.4 QUESTIONNAIRE

Educational innovation, as noted by Bain (2007), requires positioning students as central and active agents in the construction of their own learning. In line with this, the learning process must be systematically assessed, both to identify the level of understanding achieved by students and to detect potential areas for future improvement. This evaluative dimension constitutes a key

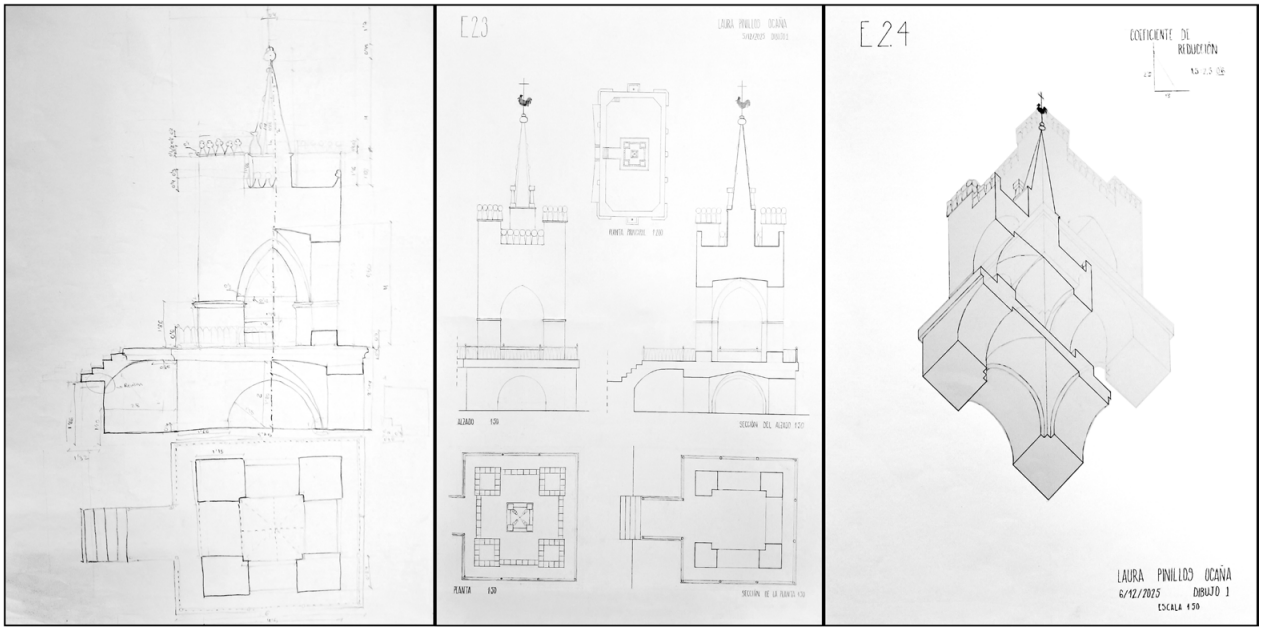

Fig. 7. Results of the exercise consisting of sketching, scaled geometric documentation, and military projection of the Chapel of Santa Ana. Source: students Laura Pinillos and Sofía Cops.

element for contrasting the outcomes of the process and, at the same time, for reinforcing and validating the implemented methodological model (Porlán, 2017).

Furthermore, assessment makes it possible to analyse students' starting and ending points, thereby enabling a longitudinal reading of their development throughout the improvement cycle (Rivero and Porlán, 2017). For this purpose, a questionnaire was designed consisting of three questions or problems, together with an image showing five sculptures of regular polyhedra. Students were given 20 minutes to complete the instrument at two different moments: at the beginning of Session 2 and at the end of Session 3.

Due to time and logistical constraints, it was not feasible to administer the questionnaire during Session 1, as this session took place outside the classroom and the available time was entirely devoted to drawing the pavilion. Although the three questions were answered independently, they formed an articulated set of linked and progressive questions, designed to progressively assess students' understanding as the learning process advanced. The three questions included in the questionnaire were as follows:

- There is an arbitrary polygon in space. What should be done to represent it and obtain its true magnitude?
- If, instead of an arbitrary polygon, we have an equilateral tetrahedron, what should be done to represent it and obtain the true magnitude of its surface?
- If you had a plan and an elevation, drawn to scale, of an irregular polyhedron such as those shown in the image below, what would be missing in order for the representation of its shape and dimensions to be reliable with respect to reality?

3. EVALUATION AND RESULTS

3.1 EVALUATION OF STUDENT LEARNING

Once the sessions had concluded, and with the responses from both questionnaires – the initial and the final – available, these responses were analysed in order to determine whether students had successfully assimilated the content. In total, the sample consisted of 21 students.

To objectively observe and analyse learning progress, the learning ladders method was implemented (Porlán, 2017: 81). This method categorises students' knowledge into levels and represents it in the form of a ladder.

In the specific case addressed here, four levels were established. Level 0 included students who did not answer any of the questions correctly. Level 1 comprised students whose only correct response was the first question of the questionnaire, referring to the representation of a polygon. Level 2 included students who answered Questions 1 and 2 correctly. Finally, Level 3 corresponded to students who answered all three questions correctly.

An improvement in level was observed in 17 out of the 21 students. Specifically, among the students who initially started at Level 0, two progressed to Level 2 and three advanced to Level 3. Of the six students who were initially at Level 1, following the application of the ICIC, five progressed to Level 2 and one advanced to Level 3. Likewise, four students who initially started at Level 2 succeeded in reaching Level 3. On the other hand, two students who were previously at Level 2 remained at that level. Finally, four students were already at Level 3 prior to the intervention. In this regard, at the end of this teaching experience, it was observed that nine students reached Level 2 (43%) and twelve students reached Level 3 (57%) (Fig. 8).

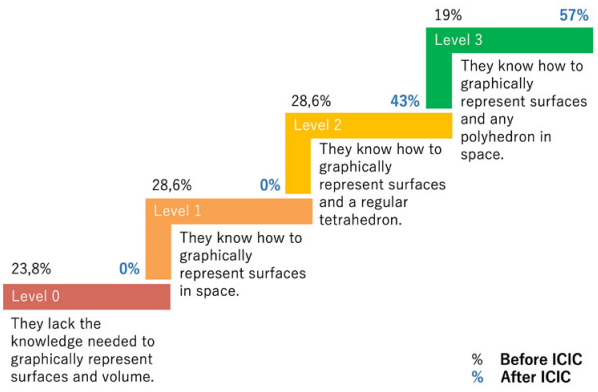

Fig. 8. Learning ladder. This figure shows the defined levels and the percentage progress for each level, before and after the ICIC.

3.2 SELF-EVALUATION OF TEACHING PRACTICE

Finally, at the end of the course, a questionnaire was administered to students with the aim of

collecting informed evaluations and specific suggestions regarding both the ICIC methodology and potential improvements in the overall development of the course. The instrument consisted of three open-ended questions: (1) Which exercise or session did you enjoy the most or consider to have been most relevant to your learning?; (2) Which aspects or activities of the course did you find least satisfactory? How could they be improved? Please include some suggestions; and (3) With regard to classroom dynamics and the volume of exercises, do you consider them to have been effective and appropriately calibrated?

The results obtained show a broadly positive evaluation. One hundred per cent of the participants indicated that the sessions related to the analysed topic were the most interesting of the course and those in which they perceived the most significant progress in their learning. Likewise, students highlighted the particularly motivating nature of these classes, emphasising the impact of the first session, which was held outside the classroom, due to its contribution to experiential learning.

In relation to the second question, 80% of respondents indicated that one of the exercises in Topic 2 was particularly challenging. This exercise involved producing a composition based on three triad-shaped wooden pieces and subsequently representing it positioned on an inclined plane using the dihedral representation system, which required a high level of spatial visualisation.

Finally, regarding the suitability of the number of activities and the overall course dynamics, 100% of students evaluated both aspects positively, stating that the workload, the proposed dynamics, and the temporal organisation of the sessions were appropriate and conducive to effective learning.

3.3 QUALITATIVE ANALYSIS OF LEARNING PROCESS AND GRAPHIC OUTCOMES

In addition to the quantitative progression identified through the learning ladders and the information obtained from the questionnaires, a qualitative analysis of the learning process and the graphic production developed during the sessions provides further insight into the impact of the ICIC methodology. This analysis is based on direct classroom observation, the evolution of students' sketchbooks, and the comparison between early and final graphic outputs produced throughout the improvement cycle.

One of the most significant qualitative indicators observed was the progressive refinement in students' graphic reasoning. During the initial stages of the experience, many students approached the representation of surfaces and volumes in a fragmentary manner, focusing on isolated views or graphic operations without establishing a coherent spatial strategy. As the sessions progressed, and particularly after the contrast activities, students increasingly demonstrated an integrated understanding of the architectural object, coordinating plan, section, elevation, and axonometric projections with greater consistency and precision.

The analysis of students' working notebooks further revealed an evolution in the way problems were approached. Early sketches often showed difficulties in managing scale and proportion. By contrast, later entries evidenced greater confidence, more deliberate graphic decisions, and clearer sequencing of operations. This progression suggests not only an improvement in technical execution, but also the development of meta-cognitive awareness regarding the drawing process itself.

Classroom dynamics during the sessions also provide relevant qualitative evidence. As students became more familiar with the methodological sequence, they increasingly formulated questions that reflected higher levels of conceptual understanding, moving from procedural doubts to more strategic inquiries related to representation choices and spatial interpretation. These interactions enabled teachers to identify misconceptions in real time and address them collaboratively through comparative activities, thereby strengthening the continuity between teaching, learning and assessment.

Finally, the comparative observation of the graphic results produced at different moments of the process indicates that the ICIC methodology contributed to a more homogeneous level of achievement within the group. While initial differences in skill level were evident, the structured sequence of activities, combined with continuous feedback, enabled most students to reach a similar level of graphic competence by the end of the experience. This reinforces the idea that the improvement cycle not only supports

individual progression but also helps to reduce performance disparities within the classroom.

4. CONCLUSIONS

This study has made it possible to analyse in depth the potential of the Improvement Cycles in Classroom (ICIC) as a tool for optimising teaching–learning processes in *Drawing 1 – Geometry and Perception*, a core subject in the Degree in Fundamentals of Architecture. The experience, developed within a single topic, proved particularly revealing for assessing the feasibility, relevance, and internal coherence of the methodological teaching model, allowing both its benefits and the limitations inherent in an initial implementation to be identified.

The results obtained show that holding the first session outside the classroom had a notable impact on students' motivation and their disposition towards learning. The challenge of representing an architectural object of medium complexity generated cognitive and perceptual stimulation that fostered processes of spontaneous inquiry and autonomous reflection on the geometries present in the built environment. This initial dynamism reinforced the understanding of core concepts such as surface and volume by situating them within a real and meaningful context for students. However, this activity also made it possible to identify a relevant practical limitation: restricted access to the object of study. This finding has led the teaching staff to conclude that, for future implementations, it is essential to select architectural elements that are accessible both during and outside teaching hours, thus ensuring the continuity of students' autonomous work.

Likewise, although the active role of students already formed part of the previous teaching methodology, the systematic integration of the ICIC significantly enhanced engagement, participation, and the quality of classroom interactions. Prior to the implementation of the model, frequent episodes of disengagement were observed during theoretical classes, associated with the traditional structure of unidirectional exposition. On the contrary, the introduction of contrast activities, inquiry-based sequences, and collaborative dynamics has generated a more stimulating learning environment, fostering greater sustained attention and increased involvement in the proposed exercises.

With regard to teaching staff, the structured planning of sessions – conceived as a form of teaching diary – has proven to be a highly valuable resource. The clear definition of timeframes, objectives, contents, and resources has contributed to the development of more coherent classes, reducing improvisation and enabling continuous reflection on teaching practice. This systematisation has facilitated a more orderly and transparent process, both in the preparation and in the assessment of activities.

Although the study was conducted with a single group of 21 students, the observed learning progression and the positive qualitative outcomes suggest that the ICIC methodology offers clear advantages over more traditional lecture-based approaches previously used in the course. Prior to the implementation of this model, teaching was mainly structured around theoretical explanations followed by individual exercises, which often resulted in delayed feedback and difficulties in identifying students' prior misconceptions. The introduction of inquiry-based sequences, contrast activities, and structured reflection has contributed to a more continuous and coherent learning process. Furthermore, these dynamics enabled the coexistence of individual graphic responses with moments of shared discussion, allowing students to contrast their own solutions with consensual interpretations developed collectively in the classroom.

Nonetheless, the absence of a control group constitutes a limitation of the present study. Future research lines should include comparative analyses between groups following traditional methodologies and those applying improvement cycles, in order to obtain more robust evidence regarding the specific impact of the ICIC model on learning outcomes. These future analyses could also explore in greater depth how structured opportunities for comparing individual and consensual responses contribute to the evaluation process and to students' awareness of their own learning evolution. Expanding the sample size and transferring this learning methodology to other graphic expression subjects and topics would further strengthen its validity and applicability.

In this sense, the experience presented does not aim to offer a closed teaching model, but rather a flexible and transferable methodological

framework that can be adapted to different educational contexts within architecture. Within this framework, even in predominantly individual work environments, the deliberate incorporation of dialogue, shared reflection, and peer comparison emerges as a relevant factor for the development of transversal skills related to collaborative work and for reinforcing learning assessment processes. The results obtained support the potential of the ICIC approach as a valuable tool for fostering active, reflective, and meaningful learning in architectural graphic expression.

ACKNOWLEDGEMENTS

We would like to thank project RYC2022-036213-I, funded by Ministry of Science, Innovation and Universities of Spain (MICIU/AEI/10.13039/501100011033) and 'FSE+'.

AUTHOR CONTRIBUTIONS

Patricia Ferreira Lopes: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing; Roque Angulo-Fornos: Conceptualization, Formal analysis, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing.

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