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Geometry and light. The luminous experience as a didactic strategy in architectural education Geometría y luz. La experiencia lumínica como estrategia didáctica en la enseñanza de la arquitectura

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ABSTRACT Theoretical courses in architecture often become detached from bodily and sensory practices that underpin the recognition of architectural space, limiting spatial understanding to abstract concepts and theories. This issue was explored through a pedagogical experience in a first-year Architectural History course aimed at integrating theoretical content with a perceptual approach through light. A series of Islamic lattices were designed and built at 1:1 scale, and the experience was documented through participant observation, photographic recording, and students' written reflections examined using content analysis. The luminous atmosphere generated responses of silence, astonishment, and tactile exploration, and the concepts of light and shadow, intimacy, atmosphere, and geometry appeared repeatedly in the students' accounts. The results suggest that phenomenological experience at full scale fosters embodied cognition and can transform theoretical courses into experimental spaces for design-oriented thinking.

RESUMEN Los cursos teóricos de arquitectura suelen disociarse de prácticas corporales y sensoriales que sostienen el reconocimiento del espacio arquitectónico, limitando la comprensión espacial a conceptos y teorías abstractas. Este problema se exploró mediante una experiencia pedagógica en un curso de primer año de Historia de la Arquitectura orientada a integrar contenidos teóricos con una aproximación perceptual a través de la luz. Se diseñó y construyó a escala 1:1 una serie de celosías islámicas, registrando la experiencia mediante observación participante, registro fotográfico y reflexiones escritas del estudiantado examinadas con metodología de análisis de contenido. La atmósfera lumínica generada produjo respuestas de silencio, asombro y exploración táctil, y los conceptos de luz y sombra, intimidad, atmósfera y geometría aparecieron reiteradamente en las reflexiones estudiantiles. Los resultados sugieren que la vivencia fenomenológica a escala real favorece una cognición encarnada y puede convertir los cursos teóricos en espacios experimentales de pensamiento proyectual.

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1. Introduction

One of the main challenges in teaching architecture is to integrate the acquisition of theoretical knowledge with the development of design skills (Yin et al., 2025). This disconnect often diminishes the conceptual richness of design due to the predominance of written language and abstraction, which overlooks the sensory dimensions of the architectural phenomenon (Lavoie et al., 2025). Holl et al. (1994) warn that understanding architecture solely through words is insufficient, as words do not translate into spatial experience. Bermúdez (2008) points out the difficulty architects face in expressing their aesthetic experiences, resorting to analytical narratives that fail to address the experiential nature of beauty in the work.

From the perspective of embodied cognition theory, these types of tensions are interpreted as a symptom of the separation between theoretical knowledge and the bodily practices that underpin the recognition of architectural space, bearing in mind that certain skills—such as sensitive drawing or situated action—constitute specific forms of tacit knowledge that are constructed through bodily action (Bizzotto, 2022). Based on this theory, as outlined in Barsalou's (2020) review and the work of Zheng et al. (2025), movement, sensory experience, and continuous interaction with the environment are involved, constituting a mind-body-environment system through which abstract concepts can be assimilated.

Against this backdrop, various studies have explored methodologies that bring architectural learning closer to the direct experience of space. Bianchi (2020) emphasizes the conscious observation of environments and the emotions they evoke. Pallasmaa (2009) underscores the irreplaceable role of the body in architectural conception, a claim complemented by recent studies that highlight its role as a channel of understanding—alongside sensory experience—and as a bridge between theory and practice (Daumal Domènech, 2022; Guerrero Pérez et al., 2019). Likewise, Arias Jiménez et al. (2023) recognize the value of students' tacit or prior knowledge, embedded in their mental and motor memory, based on the hypothesis that experiential learning serves as a strategy capable of fostering deep understanding by incorporating the phenomenological dimension into architectural education. In line with this, recent research in architectural education has shown that the deliberate expansion of materialities and communication techniques—even in online learning environments—can enrich design thinking by strengthening sensory and intellectual connections with the built environment (Cimşit Koş et al., 2025).

Experience, understood as an essential dimension of human existence, constitutes—according to Husserl (in Salazar González and Jiménez-Fajardo, 2022)—the foundation of phenomenology for apprehending reality as it manifests itself. This process involves the sensorium—the body understood as a perceptual system that translates external stimuli into meanings (Mallamaci, 2018; Shannon and Weaver, 1964).

In this sense, light plays a privileged role in the construction of architectural atmospheres, the activation of stimuli, and the evocation of emotions (McCarter and Pallasmaa, 2012; Posner et al., 2005; Shirazi, 2014). Recent studies have demonstrated light's ability to induce different moods depending on its color (Sáez Gutiérrez et al., 2025; Zhang et al., 2022), its natural or artificial origin (Espinoza-Sanhueza et al., 2025), and its relationship with architectural space, generating everything from serenity in European churches (Navarrete, 2020) to contemplation in works such as Libeskind's Holocaust Museum (Vaccaro Cruz, 2018).

1.1. Light through Islamic latticework as a source of exploration

In the early stages of architectural education, one of the most persistent challenges is the disconnect between theory and practice, which leads to a compartmentalization of knowledge and fragmented learning. This gap is particularly evident in theoretical courses, where the content—though essential for a cultural and historical understanding of the discipline—is often addressed in a manner disconnected from design practice (Yin et al., 2025). In many curricula, these courses aim to broaden students' architectural culture through the analysis of examples from diverse traditions; however, the effectiveness of such learning can be limited by the lack of opportunities to access direct experiences that allow students to engage with the phenomena being studied, thereby reducing the integration between theoretical knowledge and spatial understanding (Kesim and Baturayoğlu Yöney, 2021). This problem is exacerbated when architectural works are inaccessible to students, whether due to their distance from students' homes or to unforeseen circumstances, such as the COVID-19 pandemic (Yahia et al., 2023).

In light of this challenge, an academic exercise was proposed as a strategy to bridge theory and practice through an applied perceptual experience, and to bring architectural works from other parts of the world into a completely different geographical context. The objective was to translate the content of a theoretical course into a phenomenological exploration of light, understood not only as an architectural theme but also as a pedagogical tool capable of stimulating perception and design thinking.

As a changing and symbolic phenomenon, light transforms space and, in turn, is transformed by it. Bergman (1987) described it as a living, emotional presence, capable of taking on multiple qualities—

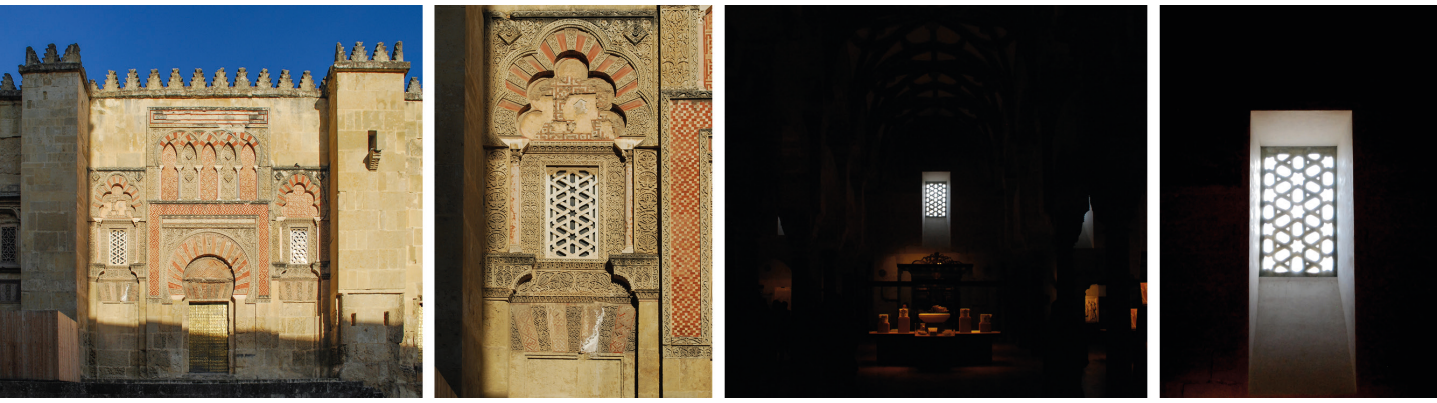


Figure 1: Córdoba Mosque, with emphasis on a latticework. Exterior and interior views. (2016)

soft, warm, violent, or serene. Along similar lines, Pallasmaa (2009) argues that twilight and dim light stimulate the imagination and daydreaming, while Tanizaki, in his original 1933 essay, emphasizes that beauty arises from the play of shadows, where the contrast between matter and light reveals the depth of space. As the perspective of embodied cognition suggests, experiences of this kind allow students to mobilize both perceptual skills and tacit repertoires of action, integrating body, technique, and spatial recognition into a single gesture (Bizzotto, 2022).

In Islamic architecture, light takes on a spiritual and symbolic dimension that is particularly evident in the use of the lattice (Mazzetto and Noca, 2025). Beyond its climatic function, it has been noted that the lattice creates an atmosphere of intimacy and contemplation, where filtered light becomes rhythm and texture. Its modular structure, based on geometric repetition, expresses a quest for order and transcendence linked to the idea of infinity. Dabbour (2012) argues that Islamic art favors geometry because of its abstract nature and its ability to express spiritual truths; Tennant (2003) and Lu and Broug (2016) add that geometry, art, and mathematics converge in this tradition, giving shape to patterns that combine precision and symbolism.

In this context, the exercise aimed to translate the theoretical understanding of the phenomenon of light into a concrete experience, where students could explore the relationship between concepts such as light, matter, and geometry, and their impact on spatial conditions. Through the analysis, design, and construction of a latticework, light served as a unifying element between historical reflection and design practice, promoting active and sensory learning. From this perspective, the hypothesis put forward is that the direct experience of a spatial condition on a real-world scale can be transformed into design knowledge to convey abstract architectural concepts, such as those covered in the History of Architecture course. This would allow for the establishment of a bridge between practical and theoretical knowledge, fostering a more integrated, reflective, and phenomenological approach to architectural education.

2. Methods

2.1. Pedagogical context

The starting point for the exercise was the History of Architecture course, offered in the first year of the program. The course runs for one academic semester, meeting once a week for a 4-hour block, and for this experience, it included 82 students. The long-term objective of the course is based on the observation and analysis of works from the past, understood as active forms that can be reinterpreted and applied to contemporary challenges. From this perspective, a teaching experience was proposed that focused on the perceptual dimension of Islamic architecture, taking the lattice as the object of study—an element that articulates technique, geometry, and atmosphere.

This project sought to understand the sense of intimacy and protection created in interior spaces through the modulation of light, as well as the structural principles that shape this architectural device. A critical review of historical references was conducted, particularly focusing on the latticework of the Mosque of Córdoba (Figure 1), where these elements function as mediators between the interior and exterior spaces. According to Souto (2007) and Martínez Capdevila (2023), the Aljama Mosque in Córdoba is one of the most emblematic buildings of Andalusian Islam and a milestone in the history of Islamic architecture, whose visual language had a decisive influence on Western Islamic art and on subsequent reinterpretations in Western architecture.

Consequently, the teaching team designed an experience that integrated theoretical content with a concrete practical activity, aimed at fostering meaningful learning. This approach is part of a line of pedagogical innovation with a certain history, in which 1:1-scale exercises have been tested in previous years—such as reconstructing a Greek column to understand proportions and scale, or a rose window from a Gothic cathedral to understand geometry, color, and the incidence of light.

However, in the case described here, the decision was made to design a multi-stage educational activity in which theoretical concepts from complementary subjects—such as geometry, design, drawing, and digital fabrication—were applied to collectively contribute to a perceptual experience. The teaching approach combined two dimensions: a procedural one, aimed at integrating analysis, representation, design, and fabrication; and an attitudinal one, centered on collaborative work and the collective experience of the results.

To this end, a teaching method was designed to allow students to perceptually experience the theoretical concepts studied in the course. The topic focused on light in Islamic architecture, approached through the study, design, and construction of latticework built to a 1:1 scale, with the aim of creating a sensory experience based on light. The choice of full scale responded to the need to experience architectural phenomena in their physical magnitude, which, according to Cárdenas Merino et al. (2025) and Studio Mumbai Architects (2011), facilitates the understanding of abstract concepts. The design assignment consisted of understanding the geometric principles implicit in the design of a traditional Islamic latticework from the Mosque of Córdoba, in order to conceive a pattern from scratch that would allow for exploring the result in terms of creating a light-based atmosphere.

2.2. Design of the exercise: from theory to design

The course curriculum included 16 classes, each lasting 4 hours, of which 8 sessions devoted part of their time to the exercise, with only the final class dedicating its entire duration to it. In this way, theory and practice were integrated into the pedagogical process. Table 1 details the phases and time allocation for the exercise, which was carried out by 10 groups of students enrolled in the course.

The aforementioned phases can be summarized as a series of iterative processes that began with an understanding of the cultural heritage behind the construction of Islamic latticework, taking into account its context and location (Figure 2). The latticework was designed based on geometric abstractions derived from an analysis of the patterns found in the Mosque of Córdoba. Patterns, modulations, and symmetries were identified; contemporary reinterpretations were then designed, which—as a constraint for generating an original design—incorporated three layers of patterns that, when superimposed, would form a lattice.

To design and manufacture the lattices, they were first drawn and cut by hand from three sheets of lined cardboard measuring 8 × 16 cm and 1 mm thick. They were then tested in small-scale viewfinders constructed from boxes measuring 20 × 40 × 60 cm, each with a 2-cm-diameter hole for observing the interior. Finally, they were redrawn using AutoCAD vector drawing software and then cut with a laser cutter from MDF boards, resulting in three layers measuring 40 × 80 cm and 0.6 cm thick.

Phase 6 took place in a space with controlled lighting, in an adapted auditorium where all light sources were blocked off. An opaque frame was installed at the main entrance to support the lattices (Figure 3).

No.	Phase	Classes	Activities	Hours dedicated per class
1	Selection of an original latticework design from the Mosque of Córdoba.	1 class	Outline of the exercise. Teachers presented three latticework designs from the mosque. Selection of one latticework per group.	0.5 hours 0.5 hours
2	Analysis and geometric abstraction of the chosen lattice.	2 classes	Feedback on students' progress.	1 hour
3	Design. Reinterpreting patterns in a new lattice.	2 classes	Redrawing the latticework in vector drawing software (AutoCAD). Feedback on students' progress.	1 hour 1 hour
4	Construction of the selected latticework models in cardboard at various scales.	1 class	Feedback on the laser-cut cardboard lattices.	1 hour
5	Viewers: 1:5 small-scale model of a space illuminated solely by the lattice.	1 class	Group review of the results. Feedback on the laser-cut cardboard latticework.	1 hour 1 hour
6	Assembly of a 1:1-scale lattice in a specially prepared, darkened space.	1 class	Group viewing of the latticework made from MDF. Student reflections.	3 hours 1 hour
	Total	8 classes		14 hours

Table 1: Phases of the exercise. (2025)

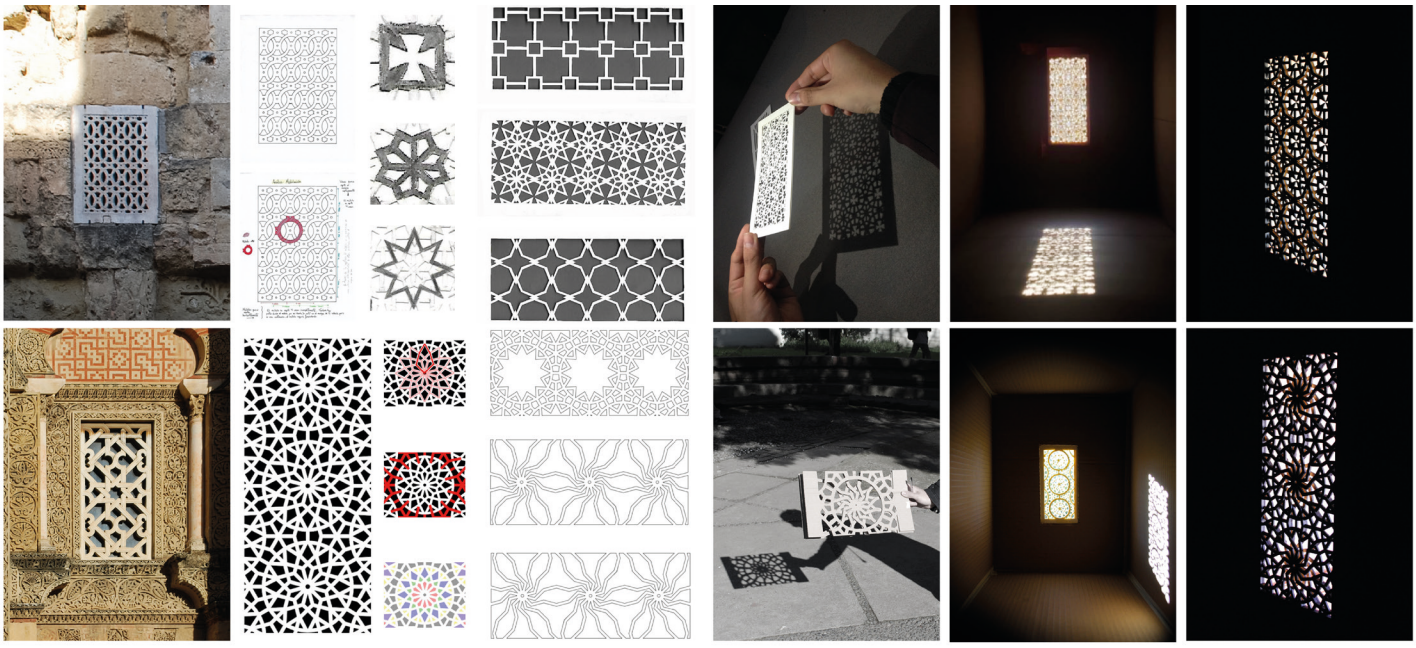


Figure 2: Summary of the process of analysis, design, and fabrication of a contemporary lattice inspired by a lattice from the Mosque of Córdoba I. (2019)

This created a darkened space where the lattice served as the sole source of light, allowing participants to experience the light phenomenon in its physical and perceptual dimensions.

2.3. Measurement of learning

To evaluate the pedagogical impact of the exercise and triangulate the findings, three complementary strategies were applied as a qualitative exploratory methodological approach:

1. Participant observation, in line with Angrosino (2012), capitalizing on the sustained interaction between faculty, teaching assistants, and students throughout the semester.
2. Photographic documentation, used as a means of analyzing the processes and atmospheres generated, following the methodology of McCarter and Pallasmaa (2012) and Shirazi (2014).
3. Written reflections by the students, completed at the end of the exercise, in which they briefly described their perceptions and what they learned from the experience.

For Strategy 3, immediately after the testing session of the louver systems in the auditorium (10 minutes per prototype), students were asked to answer an open-ended question in writing as a closing activity for the session. The objective was to identify, based on the length of the responses, recurring concepts that would allow for the detection of trends. The question posed was as follows: What did you learn from the experience of observing the light phenomenon created after the lattices were assembled? Their reflections were collected anonymously and used exclusively for analytical purposes. The results section includes textual excerpts in quotation marks, while ensuring the anonymity of the participants at all times.

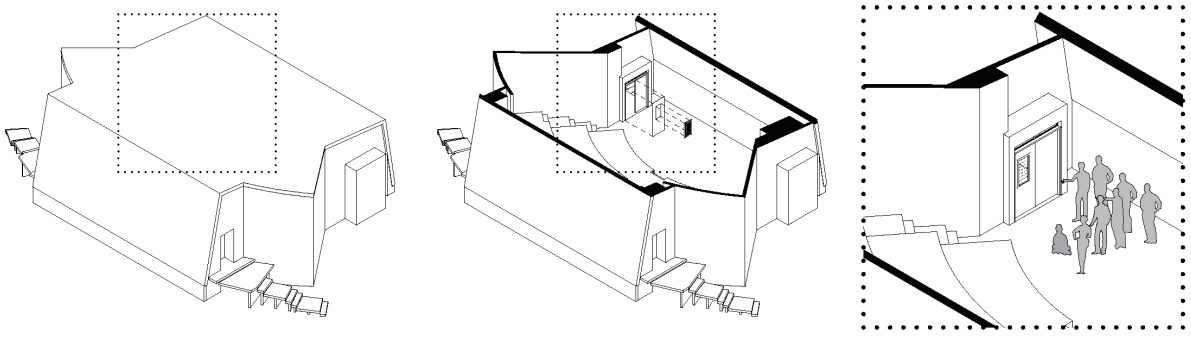


Figure 3: Installation of the louver in the adapted auditorium. (2025)

Given the subjective and experiential nature of the phenomenon, the data obtained from these responses were studied using content analysis following Krippendorff's (1997) approach, which allows for the formulation of reproducible and contextualized inferences based on symbolic data—an approach still in use today in the field of education (Szabó et al., 2025).

2.4. Content analysis procedure

Coding: The analysis of the 82 written reflections was conducted using an inductive approach to content analysis. In the first stage, open coding was applied, recording emerging keywords that summarized the students' ideas and perceptions based on their responses. Subsequently, axial coding was performed, grouping these keywords into eight learning categories. For example, the "Light and Shadow" category included responses containing terms such as "light," "reflection," "light control," and "shadow."

Unit of Analysis and Segmentation: Each complete response was analyzed, allowing for multiple assignments; that is, text segments were not restricted to a single category if the student linked several phenomena within the same idea. A representative example of this segmentation can be seen in the following account: "Light enters in a regulated manner [Light and Shadow], allowing one to visualize the various shapes that compose it [Geometry], creating an atmosphere that is both private and enchanting [Intimacy][Atmospheres]." This approach made it possible to capture the complexity of the sensory experience without reducing it to isolated concepts.

Averaging procedure and resolution of discrepancies: Coding was performed in a blind manner by two independent researchers. In cases where there were discrepancies in category assignment, a frequency-averaging method was used. In this way, the final value for each learning field does not depend on the perspective of a single observer but reflects the weighted assessment of both, thereby minimizing subjective bias.

Data validation: To clarify the validity and consistency of each data point, the percentage of direct agreement between coders was calculated, supplemented by Cohen's Kappa coefficient (κ), which is widely used to measure agreement between two evaluators in concept identification processes or studies (Hanegraaf et al., 2024). It is defined by the equation:

$$\kappa = (p_o - p_e)/(1 - p_e)$$

where p_o is the observed proportion of agreement between the two reviewers and $p_{(e)\,is}$ the proportion of agreement expected by chance based on the marginal distributions of each evaluator. RStudio software was used to calculate this coefficient.

In the case of architecture education, similar studies have been conducted using this survey-based data collection technique (Bianchi, 2020; Ro and Bermúdez, 2015). This procedure made it possible to identify recurring patterns in student perceptions and to assess the integration of theoretical knowledge and design comprehension.

3. Results

3.1. Design process (Phases 1 through 5)

The 82 students completed phases 1, 2, 3, 4, and 5 over a total of seven classes. Each group successfully reinterpreted various design patterns based on pre-existing lattices, creating three layers that, when superimposed, filtered the passage of light. In total, ten lattices were designed.

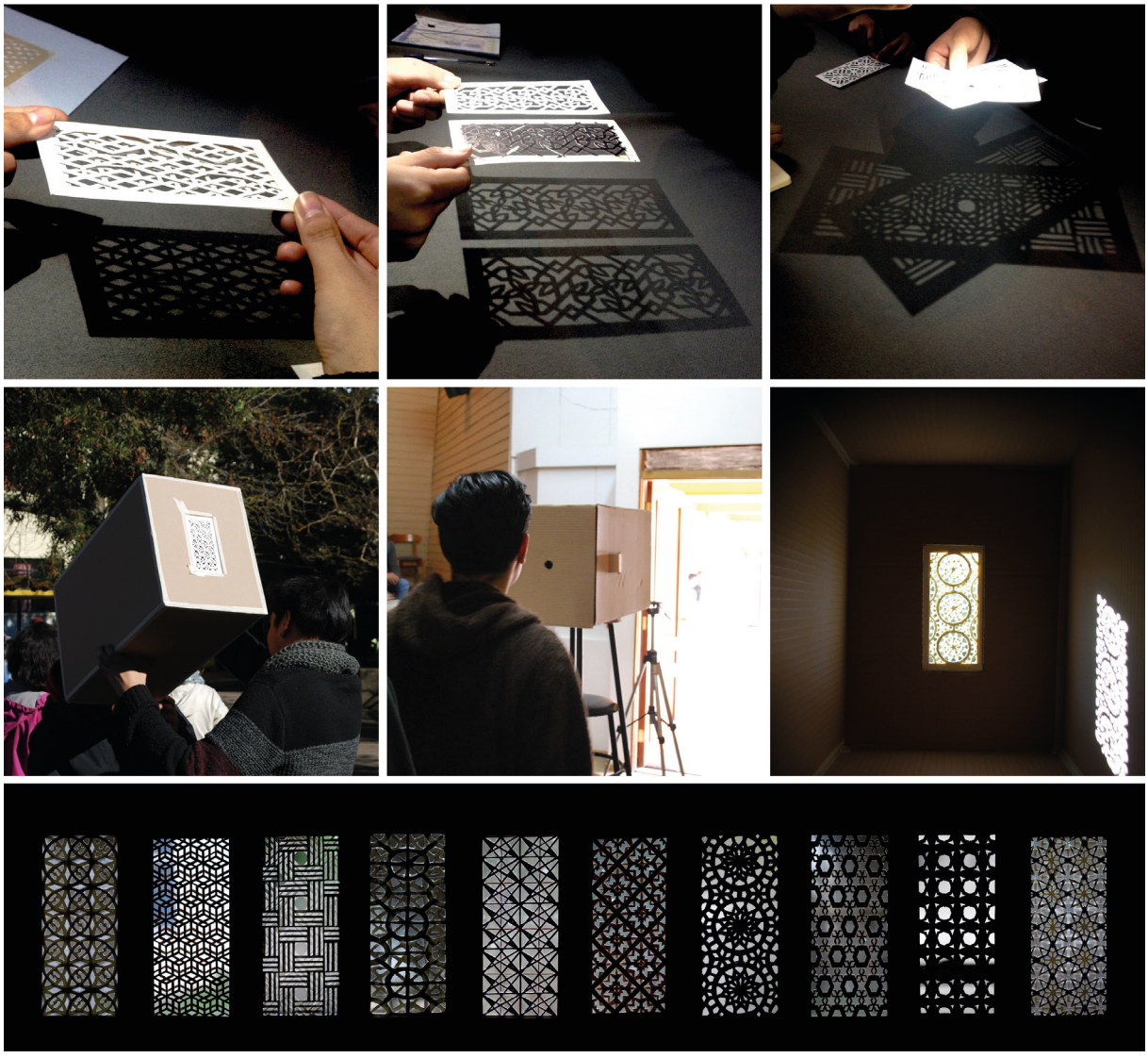


Figure 4: Phase 3, lattices drawn and cut by hand (top row). Phases 4 and 5, lattices tested in viewers (middle and bottom rows). (2019)

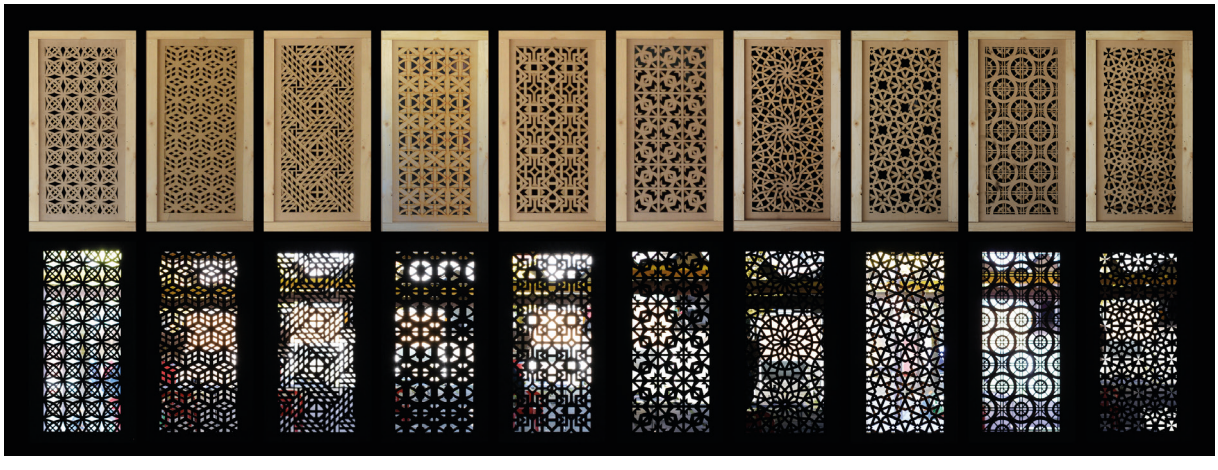


Figure 5: Record of the louver prototypes, exterior view [top] and interior view [bottom]. (2019)

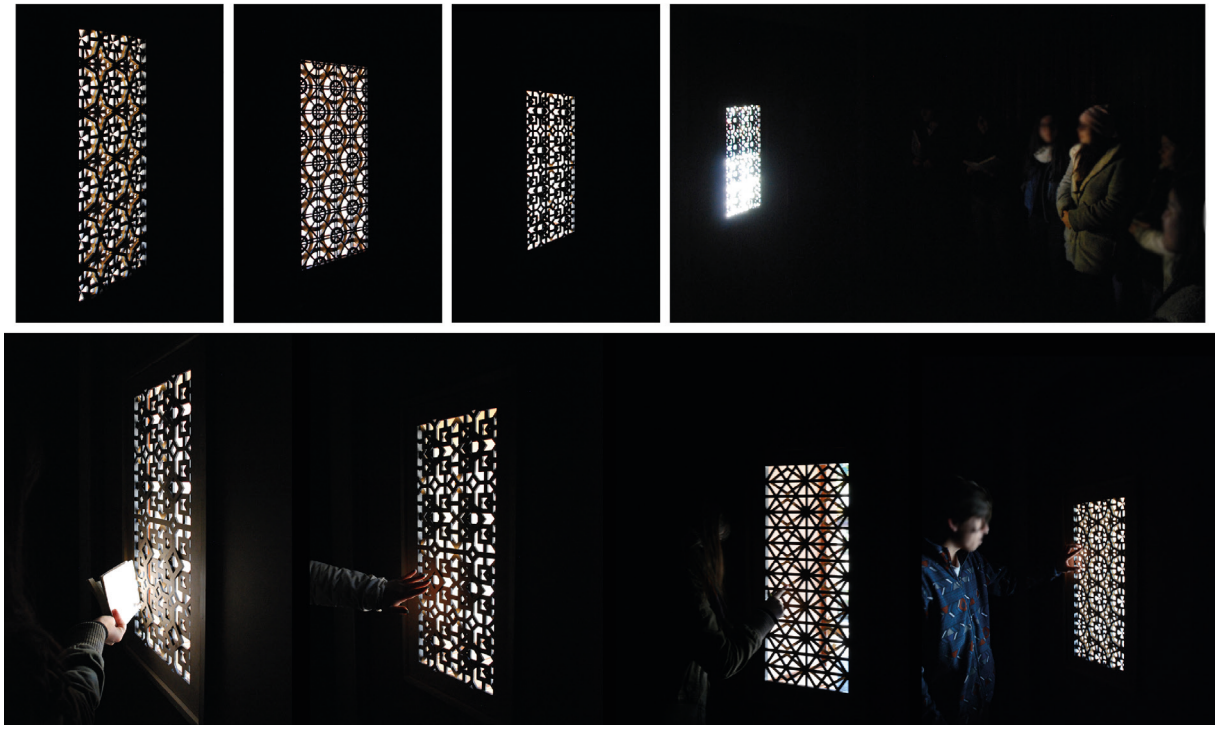


Figure 6: Perceptual experience in front of the latticework installations in the auditorium. (2019)

During the analysis, design, and small-scale prototyping phases, in 5 of the 10 groups, the initial cardboard sketches allowed more light to pass through than intended, a fact that became evident in phases 4 and 5. Based on these tests, progressive adjustments were made to the pattern designs, and student participation in the corrections increased: students discussed among themselves how to modify the thickness of the elements, the density of the weaves, and the overlapping of layers to achieve more defined shadows (Figure 4).

Regarding interest in the exercise, during phases 2, 3, and 4, it was necessary to emphasize the submission of progress reports and participation in feedback sessions. In contrast, in phase 5, the students themselves requested additional corrections, extending the review session by approximately 30 minutes to discuss the lighting effects observed in the models. At this stage, while testing the latticework in the viewing boxes (small-scale models in 20 × 40 × 60 cm boxes, shown in Figure 4), the groups discussed comparisons between the results they obtained and the historical latticework they had analyzed, paying particular attention to the shape of the shadows cast on walls and interior surfaces.

3.2. 1:1-Scale experience

Phase 6 consisted of testing the 1:1-scale louver prototypes. Ten different louvers were produced (Figure 5), which were installed in the specially equipped auditorium shown in Figure 3.

During these tests, the instructors and teaching assistants observed that, upon entering the auditorium, there was consistently a moment of silence among the group, accompanied by a shift in their gaze toward the areas illuminated by the louver. After a few minutes with each installation, students frequently reached out their hands toward the beams of light (Figure 6), exploring the shape of the shadow on their skin or on the floor.

Movements toward and away from the louver plane were also observed, as students sought to verify changes in light intensity, the degree of exposure, and the sense of intimacy. In several instances, some students left the auditorium and re-entered to compare the difference between the interior and exterior.

The teaching staff recorded spontaneous comments regarding the temperature of the space, the perception of airflow, and ambient sound, all associated with the auditorium's enclosure and the concentration of light on a single plane.

These reactions contrasted with those from previous stages, particularly in relation to the viewfinders (Figure 4), where the focus of attention was primarily on the shape of the shadow and the geometric effectiveness of the pattern.

Regarding the students' written reflections, in response to the question "What did you learn from the experience of observing the light phenomenon created after the installation of the louvers?", the 82 responses were reviewed through content analysis. Eight learning domains were identified, the most prominent being: light and shadow, with 61 mentions; intimacy and privacy, with 35; atmospheres, with 34; and geometry, with 21 (Figure 7).

The following sections detail the categories with evidence drawn from the written reflections:

Light and Shadow: This category dominated the narratives, focusing on the louver's ability to "bring light out of its natural state, directing it and reflecting the design itself." Students highlighted that "light enters in a regulated manner... allowing one to visualize the various forms that compose it" and how the shadow generates a "harmonious, repeating pattern."

Intimacy and privacy: This was closely linked to the "curtain effect," defined by the students as the possibility of "seeing outward by approaching the latticework" while maintaining "privacy when they [Muslims] pray." This perception of "isolation from the outside" was key to understanding the social function of this historical device.

Atmospheres: The accounts describe the creation of a "dimly lit space" that generates a "perception of space... making it feel smaller and more pleasant." For many, the result was an "atmosphere that is both private and charming," or even a "significant and complex atmosphere" derived from the control of sunlight.

Geometry: The learning focused on the "precision of forms" that highlights the "perfection that Islamic architecture seeks to represent." Students internalized concepts such as the "continuity of lines... with no beginning or end" and the challenge of achieving a sense of "infinity" within the framework of the latticework.

Construction Practices and Techniques: Students valued the "importance of meticulous work" to achieve the desired lighting effects. They highlighted learning to "use AutoCAD" and the difficulty of "aligning the layers" so that the digital design would match the MDF wood fabrication.

Air Control: Although the exercise focused on lighting, the students came to understand the lattice as an element that provides "benefits (shade, ventilation, privacy, etc.) without using any energy." It was identified as an "architectural element that regulates and allows the entry of light and natural ventilation."

Beauty: The aesthetic experience was described as an "attractive and captivating form," noting that "symmetry gives us a sense of beauty." The students concluded that the design generates an "elegance and significance" that transcends the functional.

Utility: The lattice was recognized as a "functional and aesthetic element" and an "architectural device that articulates technique, geometry, and atmosphere."

Regarding the reliability of the content analysis conducted by the two reviewers (Figure 7), six of the eight categories achieved a substantial degree of agreement (between 0.6 and 0.8) according to Cohen's kappa coefficient. The "intimacy and privacy" category achieved a near-perfect degree of agreement (between 0.8 and 1.0), while "utility" achieved a perfect degree of agreement (1.0). These values support the consistency of the coding process and the validity of the patterns detected in the responses.

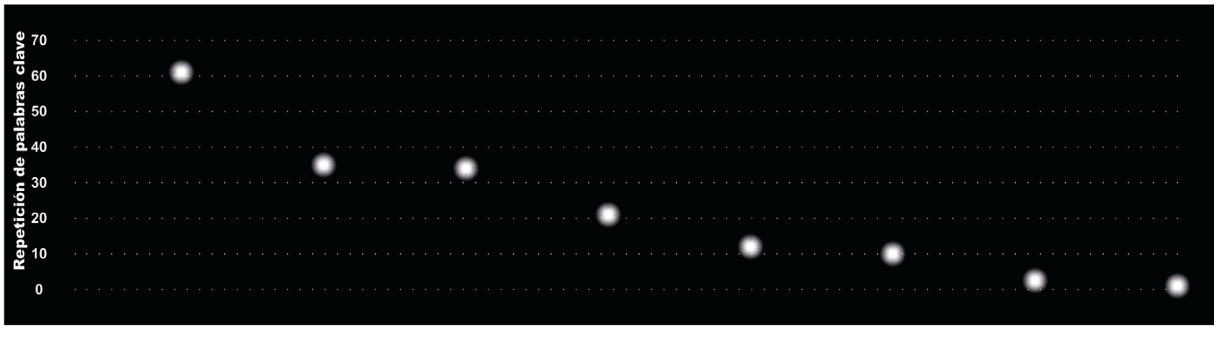


Figure 7: Learning domains identified based on the average frequency of key concepts. The level of agreement among the reviewers, as measured by Cohen's kappa coefficient, is indicated below each domain. (2019)

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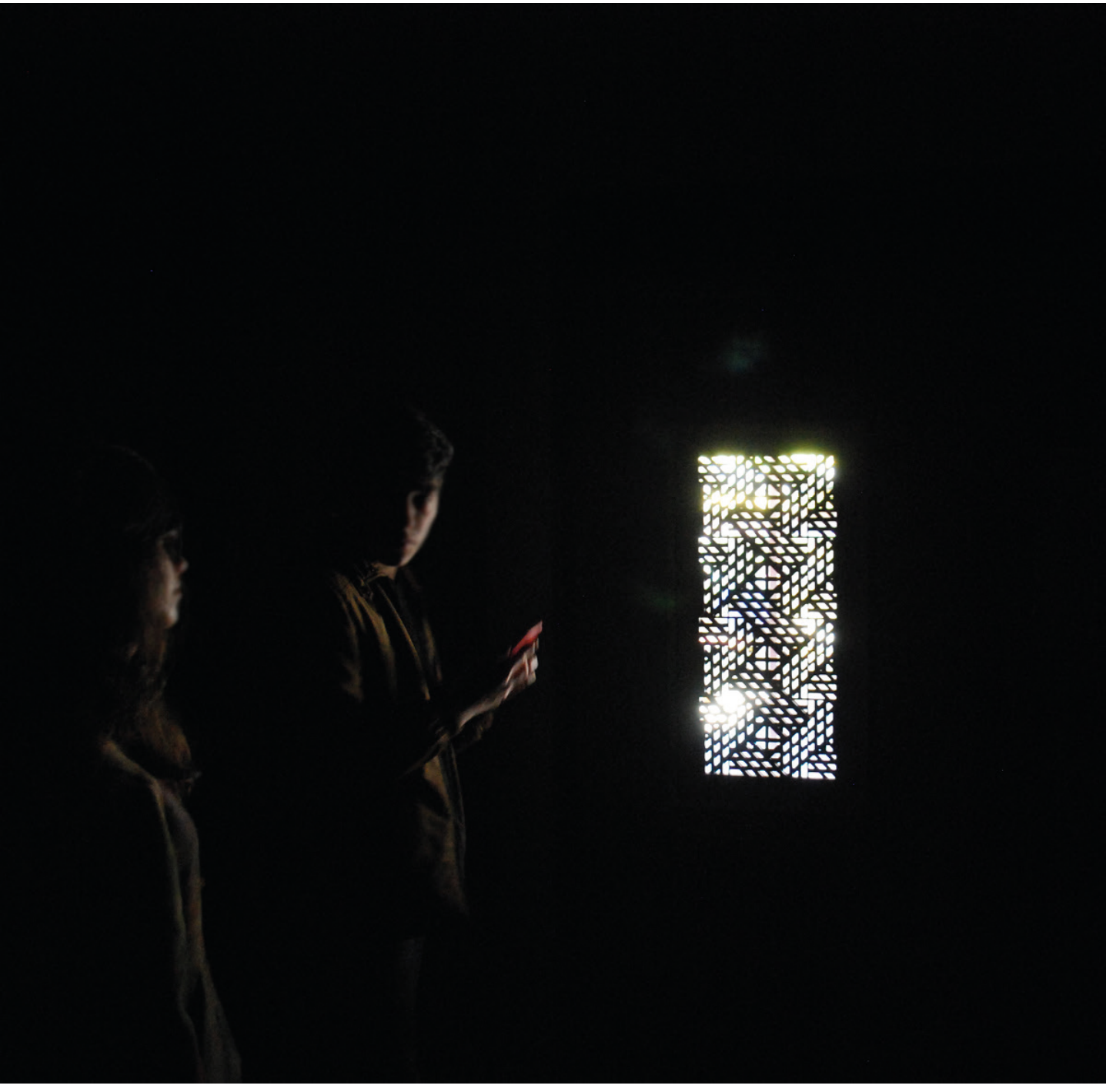
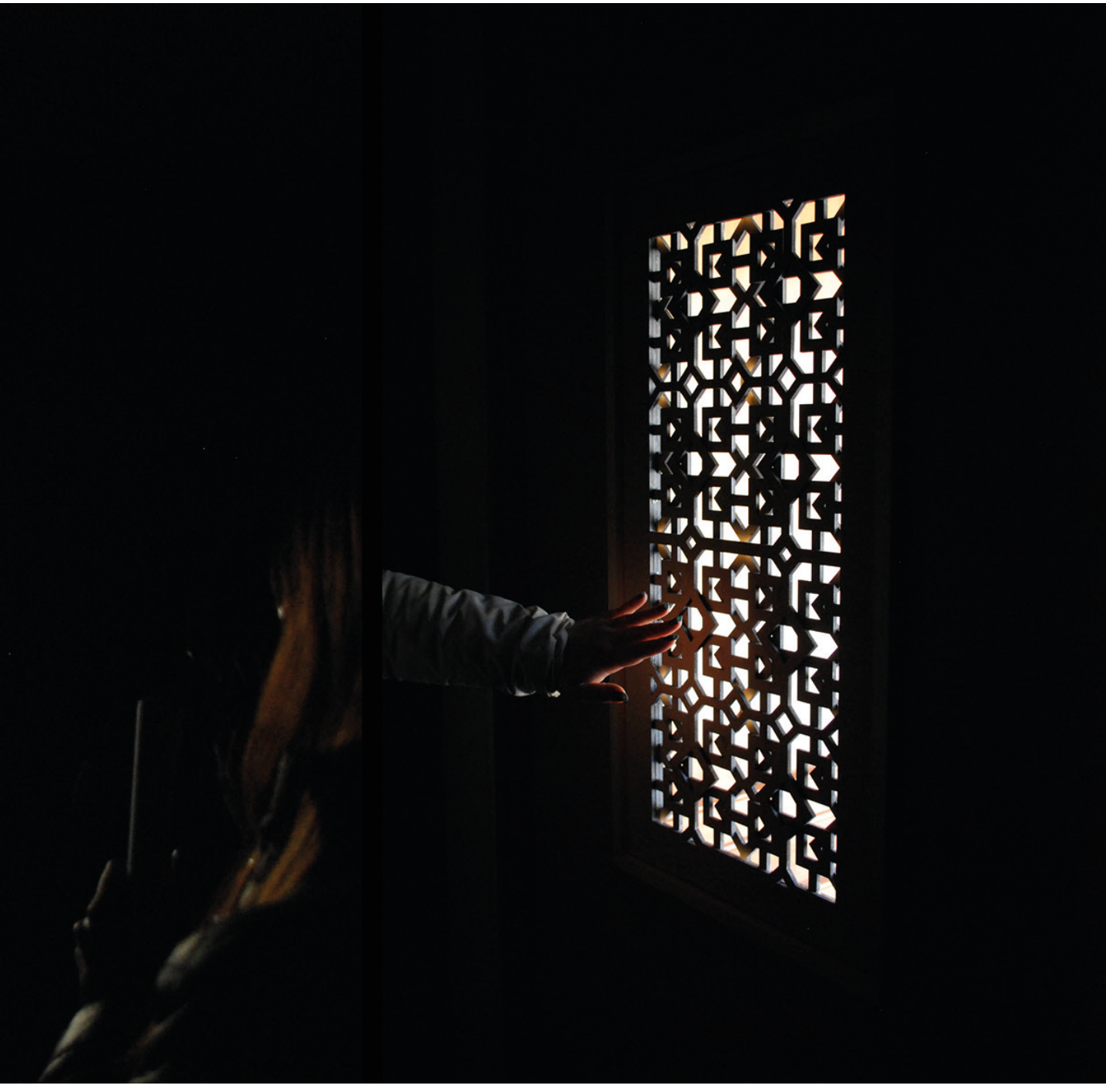


Figure 8: Silence and contemplation of the latticework in the auditorium. (2019)



3.3. Difficulties and Challenges

Based on participant observation of teachers and teaching assistants, along with the students' reflections, certain operational and cognitive tensions were identified at specific moments and within certain groups during the process. Although these situations were not widespread but rather isolated, they are particularly valuable in that they highlight critical aspects that influence the development of the experience and guide potential adjustments to the pedagogical approach.

In some cases, the phenomenological dimension tended to be overshadowed by a predominantly mathematical and geometric approach, centered on calculations and drawings, which displaced aspects such as atmosphere or wonder. Added to this were difficulties associated with the use of digital tools, particularly AutoCAD, whose uneven mastery created imbalances in the workload.

Furthermore, the transition from design to fabrication revealed technical and logistical challenges, both in the precise adjustment of the layers and in the availability of services for cutting the latticework. At the same time, the dynamics of the course led, in some cases, to peer comparisons that unnecessarily complicated the proposals, driven by the perception that "other groups had much more eye-catching layers."

Finally, discrepancies were observed in collective decision-making when there was no consensus on aesthetic criteria, as well as episodes of frustration associated with working on a small scale. In the latter case, some students noted that "the slightest error meant starting over," which transformed the process into a technical challenge that, at times, overshadowed the exploration of light.

4. Discussion and conclusions

The results obtained provide significant evidence supporting the proposed hypothesis—that the direct experience of a spatial condition on a real-world scale can be transformed into design knowledge for conveying abstract architectural concepts.

The spontaneous emergence of a phenomenological vocabulary in the students' accounts (light, shadow, intimacy, atmosphere) suggests that the exercise facilitated embodied cognition. The sense of wonder observed during the installation (Figure 8) aligns with what Pallasmaa (2006) proposed as early as 1996, and with Sáez Gutiérrez et al. (2025). In this sense, the silence and the tactile exploration of the beams of light can be interpreted as signs of an understanding of space that relies on the integration of the visual, the haptic, and the atmospheric.

From a phenomenological perspective, the evidence reinforces the idea that light, treated as a pedagogical tool, structures atmospheres capable of evoking emotional responses. The correspondence between the students' perceptions and the historical properties of the Islamic lattice as a regulator of privacy and vision—as analyzed by Kenzari and Elsheshtawy (2003)—indicates that the exercise allowed for a situated reinterpretation of the lattices of the Mosque of Córdoba through the students' own sensorium. This approach makes it possible to articulate the experiential nature of architecture, overcoming the limitations of the written word highlighted by authors such as Holl et al. (1994) and Bermúdez (2008).

The collective dimension of the process—both in group work and in the shared observation of the results—also emerges as a key component for the development of perceptual empathy and collaborative design thinking, in line with studies that highlight the role of peer learning in architectural education (Wang, 2025).

These findings are part of a line of research that considers bodily and material practices as sources of architectural knowledge and pedagogical resources, where the act of drawing, modeling, building, or inhabiting on a 1:1 scale activates specific forms of spatial cognition that go beyond verbal discourse (Bizzotto, 2022; Cárdenas Merino et al., 2025; Cimşit Koş et al., 2025). The experience with latticework can be understood as a device that engages students' bodies as mediators between geometry, light, and space, reinforcing learning that does not depend solely on theoretical explanation (Figure 8).



Figure 9: Light trail captured in a photograph due to the darkness of the auditorium. (2019)

This allows us to highlight that the main contribution of this study lies in the validation of a methodology that transforms theoretical courses into active laboratories for design experimentation, overcoming the traditional divide between theory and practice. As illustrated in Figure 9, by transforming light into pedagogical material and linking the formal heritage of Islamic architecture with contemporary digital fabrication tools, the study generates empirical evidence that the 1:1 phenomenological experience fosters embodied cognition in the foundational stages of the degree program. In this way, light emerges as a cross-disciplinary teaching tool capable of mediating between matter, atmosphere, and perception, placing this experience in dialogue with lines of research that study spatial cognition and image maintenance in three-dimensional environments (Akdoğan et al., 2025; Kırkan et al., 2025).

However, it should be emphasized that this experience is not a substitute for a physical visit to a historic site or an architectural work. The full-scale model allows for the reinterpretation of lighting conditions but omits complex environmental factors such as latitude, temperature, or the original materiality, which influence other relevant aspects of inhabiting a space, such as sound (Alambeigi et al., 2024), touch, or even smell (Zumthor, 2010).

On the other hand, the challenges observed demonstrate that these teaching methods do not automatically guarantee embodied cognition. Phenomenological learning can be undermined by the operational friction of the process, where aspects such as disparities in digital skills and the fatigue of manual prototyping can shift sensory wonder toward analytical detachment. The above highlights the need to moderate technical efforts so that they are not overly demanding for students, as the pedagogical device may otherwise risk becoming an operational obstacle rather than a facilitator of the situated architectural experience.

This leads to the idea that a temporal gap should be established between the creation of the device and the light experience, thereby generating a distance between the students and their work, with the aim of neutralizing the analytical burden that may arise from technical development in favor of a purer, more phenomenological sensory experience.

Finally, in methodological terms, the study acknowledges limitations due to its exploratory, qualitative nature. The absence of a control group or longitudinal measurements prevents us from ensuring that these learnings will persist throughout the students' educational journey. Future lines of research could consider longer-term studies and/or integrate neuroarchitecture methodologies (Ezzat Ahmed et al., 2021; Medhat Assem et al., 2023) to quantitatively measure the impact of these sensory configurations on human well-being and behavior, in line with the work of Leonards et al. (2025) and Attaianese et al. (2025).

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