ABE IEE ADVANCES IN BUILDING EDUCATION
INNOVACIÓN EDUCATIVA EN EDIFICACIÓN

Integrated inter-annual programming of architectural project subjects with cross sectional and longitudinal relationships based on quadruple evolutionary conditioning in design.

Programación interanual integrada de las asignaturas de proyectos arquitectónicos según relaciones transversales y longitudinales basadas en el cuádruple condicionamiento evolutivo.

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Received: 10/06/2024 | Accepted:12/07/2024 | Publication date: 30/08/2024
DOI:10.20868/abe.2024.2.5271

HIGHLIGHTS

- Comprehensive methodology: from mountain refuge to large metropolitan scale.
- Progressive learning: mastery of all architectural scales.
- Complete competencies: students ready for the professional market from living to infrastructure.
- Teaching innovation: technology and sustainability in architectural projects.

RESUMEN

El programa docente de Proyectos Arquitectónicos en la Escuela de Arquitectura de la Universidad Europea de Canarias está integrado desde 2º hasta 6º curso, y se estructura mediante una metodología progresiva que aborda la enseñanza del diseño arquitectónico desde una perspectiva integral. A lo largo de los cursos, los estudiantes exploran diversas escalas y tipologías arquitectónicas, comenzando con proyectos de pequeña escala en el segundo año, como refugios de montaña y viviendas unifamiliares, hasta intervenciones urbanas complejas y edificios institucionales en el sexto año. Esta evolución permite a los estudiantes adquirir un dominio exhaustivo de la disciplina, adaptándose a los diferentes contextos urbanos y programas arquitectónicos. El enfoque pedagógico se basa en cuatro condiciones fundamentales: la escala, la complejidad programática, la intensidad urbana y la tecnología. Los estudiantes desarrollan proyectos que integran estos aspectos, abordando la relación entre diseño arquitectónico y normativa urbanística. Se promueve el uso de herramientas digitales avanzadas y técnicas sostenibles, lo que fortalece sus competencias para enfrentar los desafíos profesionales. El resultado es una preparación sólida que asegura que los estudiantes comprendan profundamente la interacción entre arquitectura, entorno y sociedad. La metodología, aplicada con éxito en los cursos 2021-22 y 2022-23, ha mejorado notablemente la percepción estudiantil de su seguridad personal y la evaluación de proyectos finales. Esto demuestra que los egresados están capacitados para desempeñarse con eficacia en el ámbito profesional, gestionando proyectos de diversas escalas y complejidades con seguridad pre-profesional.

Palabras clave: *integración, proyectos arquitectónicos, escala, limitaciones, progresión, funcionalidad.*

ABSTRACT

Architectural Design teaching program at the School of Architecture of the European University of the Canary Islands is integrated from the 2nd to the 6th year and is structured through a progressive methodology that approaches the teaching of architectural design from a comprehensive perspective. Throughout the courses, students explore various architectural scales and typologies, starting with small-scale projects in the second year, such as mountain refuges and single-family homes, up to complex urban interventions and institutional buildings in the sixth year. This progression allows students to gain an in-depth understanding of the discipline, adapting to different urban contexts and architectural programs. Our pedagogical approach is based on four fundamental conditions: scale, programmatic complexity, urban intensity, and technology. Students develop projects that integrate these aspects, addressing the relationship between architectural design and urban planning regulations. The use of advanced digital tools and sustainable techniques is promoted, which strengthens their competencies to face professional challenges. The result is a solid preparation that ensures students deeply understand the interaction between architecture, environment, and society. The methodology, successfully applied during the 2021-22 and 2022-23 academic years, has significantly improved students' perception of their personal confidence and the evaluation of final projects. This demonstrates that graduates are well-equipped to perform effectively in the professional field, managing projects of various scales and complexities with pre-professional confidence.

Keywords: *integration, architectural projects, scale, constraints, evolutionary, functionality.*

1. INTRODUCTION

Teaching approach in Architectural Design holistically integrates graphic abilities and technical competencies in a variable gradient with the course of projects [1]. This integration occurs both in relation to other subjects of the course (i.e., cross-sectionally) and to other courses in the architecture program (i.e., longitudinally).

The practice of innovative teaching is programmed in UEC Architecture School as a referential paradigm aimed at facilitating progressive and holistic learning [2] in architectural projects through a cuadruple helix design. Thus, the programming of different Architectural Design courses, from the 2nd to the 6th year (currently, from the 2nd year in the Degree in Fundamentals of Architecture to the Master in Architecture), is conducted with three boundary conditions. First, scale [3]: from smaller to larger, this teaching practice programs a lower scale in the 2nd year (mountain refuge and single-family housing), progressing to linear associations of single-family houses and multi-family buildings in the 3rd year. In the 4th year, the focus shifts to residential complexes with neighborhood-level facilities and city-scale institutional buildings, moving to supramunicipal scale institutional buildings and broad urban interventions of regeneration and consolidation with residential and institutional elements in the 6th year.

This first condition is complemented by the second, programmatic complexity, with a progressive increase in projected surface area, functions, and uses, from the user level to the supra-urban social impact level. This programmatic complexity is intimately related to the third condition, relative urban intensity [4]. Incrementally, the location of projects in relation to the territory and the city also increases in complexity, from the

natural environment of the refuge and single-family housing in the 2nd year, to metropolitan conurbation areas in the 6th year, through areas of dispersed urbanization with consolidation needs and historic centers requiring heritage protection, as well as areas needing urban regeneration and renaturalization.

Finally, the fourth condition, technology, also enriches the educational development in the field through the integration of construction, sustainability, and advanced technologies, incorporating eco-innovative materials and energy and management systems [5].

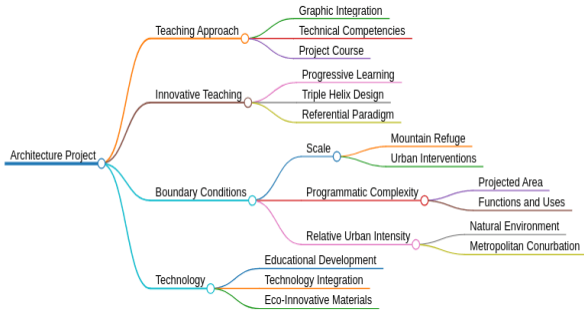

Fig. 1: *structure and key elements of the Architecture Project learning sequence.*

With this design of quadruple evolving conditions, progressive experiential learning in architectural projects encompasses all scales and complexities of professional architectural intervention, a deep understanding of the relationship between architecture, environment,

and society, and advanced skills in digital tools and sustainable technologies [6] [7].

Tested in the 2021-22 and 2022-23 academic years, this practice has facilitated a notable improvement in both student perception (NPS surveys) and the evaluation of final projects concluding the program (PFC results), being included in various quality committees (CC) (degree, center, and employer committees) as a verification point by different interest groups, in addition to the verification obtained each year through the juries of the subjects in the area.

2. MATERIALS AND METHODS

2.1 Feeling freedom from materials.

In the first architectural projects course at the European University of the Canary Islands, students begin their learning journey through a methodology that emphasizes the "creativity exercise." This approach encourages a deep understanding of architecture by experimenting directly with the material, constructive, and structural configuration of projects. Unlike traditional methods focused on artistic design processes or the "fine arts," this course introduces students to architectural logic through critical thinking and material organization. [8]

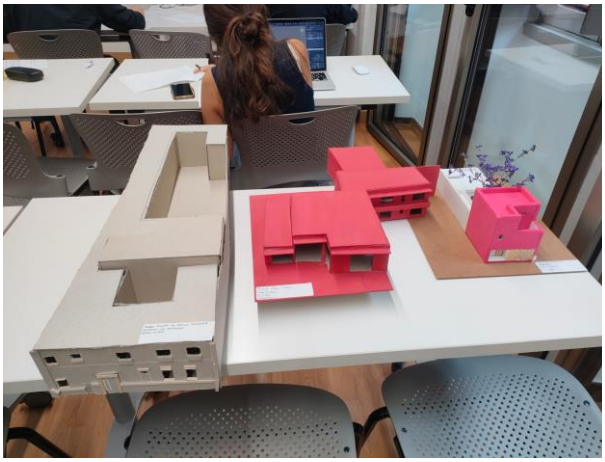

Fig. 2: *first projects on short living units, after personnel hub*

Instead of starting with abstract aesthetic concepts, students begin with shelter projects in natural environments, where they confront the geometric conceptual generation based on a thorough analysis of the architectural concept. This initial experience, devoid of urban references, compels students to explore the relationship between form, function, and environment, developing skills that extend beyond artistic abilities and focus on complex structural and constructive thinking.

Throughout the course, projects evolve from creating shelters to designing single-family homes, exploring how material and structural conditions are organized under a rigorous architectural thought system. This way, the superficiality of artistic design is set aside to develop an integral and applied architectural thinking. This methodology not only trains students in material and structural design but also equips them with tools to tackle architectural projects in complex and challenging contexts

2.2 Scale-up: residential mix

The third-year curriculum of the degree program emphasizes the development of residential architectural typologies. The approach is progressive throughout the year, with learning outcomes divided into domestic models evolving from small to large scale.

In the first half of the academic year, in the course titled *Project Workshop G3*, students learn to address various single-family housing typologies [9] [10]. These vary depending on the urban

planning context in which they are situated. Therefore, the focus is on small-scale residential typologies, such as terraced houses, row houses, housing in colonies, or garden city housing [11] [12].

To achieve these objectives, real urban plots are proposed, requiring consideration of two fundamental aspects: on one hand, the application of an architectural program focused on spatial quality, and on the other, ensuring these spaces comply with the regulatory urban and habitability parameters [12] [13]. This approach raises student awareness from an early stage about the conditional relationship between architectural design and urban planning regulations applied to residential building typologies [14] [15].

After mastering the learning outcomes related to small-scale domestic models, the course progresses to more complex models. Thus, from the second half of the year, in the course titled *Project Workshop G4*, collective residential housing models are proposed [10]. At this stage, not only is the scale of the plot increased to apply a larger architectural model, but an urban growth sector at a territorial scale is proposed, allowing students to reflect on new high-density residential models, such as block or tower housing typologies.

To achieve this, in the first stage, students work collectively to reflect on and propose an urban plot model that enables the implementation of building models for the desired environment and urban growth model. In the second stage, each student individually develops their building proposal in accordance with the urban planning parameters established in the collective phase. The aim is to develop high-density systems that combine collective residential use with other compatible uses.

2.3 Community spaces-Small scale

In this project workshop, after having explored domestic space through individual and collective housing in previous courses, students reflect on the essential qualities of living in a community. This is achieved through research and design work on collective spaces.

Collective space supports our life in society; it provides a framework that transcends the intimacy of the domestic sphere, enabling us to interact with others. The public nature of community spaces endows them with particular characteristics that are common to all, regardless of the program developed in each. One of the course's objectives is to reflect on these conditions, their needs, and possibilities, understanding that public space requires spatial and programmatic demands different from those of the domestic sphere.

This workshop aims to take a significant step in learning the design task, acquiring new tools, and improving the use of those already acquired, consolidating a solid foundation that allows students to confidently tackle complex programs in subsequent courses. To this end, the course focuses on small-scale collective space, deepening the understanding of mechanisms that generate quality spaces contributing to improving people's lives and facilitating social life.

Fig. 3: *visiting sites for scale-testing and material analysis, basis in the medium-scale urban intervention*

The course begins by exploring basic spatial conditions of public space through the analysis of small, singular built pavilions, followed by the individual design by each student of a small summer pavilion.

This exercise aims to immerse students fully in pure spatial concepts and their materialization in the configuration of constructed space, working directly on creativity and the process of conceptualizing ideas. With this introductory exercise, students will be better prepared to tackle the rest of the course with more ease and confidence.

The course continues with the main exercise consisting of designing and developing a small facility building, such as a socio-cultural center for young people, always in a real location accessible to students, which is visited for fieldwork. The exercise begins with a site analysis from different perspectives, followed by the development of a small-scale urban planning proposal. Based on this foundation, the building project is developed, covering approximately 500 square meters of built area. A predefined program is used, and exterior spaces associated with the building are included as a starting condition. After the analysis phase, each student determines an intervention strategy for the site, which is expressed as a conceptual scheme and then developed into an architectural project with the formal and material definition of the building.

2.4 Metropolitan scale design

The *Project Workshop G7* "*Re_Frame: Urban Regeneration and Sustainability of the Santa Cruz Refinery*" proposes a speculative intervention at the Santa Cruz de Tenerife Refinery in the year 2123, within a scenario of climate and economic crisis. The goal is to transform the refinery, a symbol of industrial exploitation, into a regenerative and sustainable space. The pedagogical approach focuses on the creative reuse of existing infrastructures and the implementation of advanced technologies and renewable energies. The course is structured into three phases, beginning with the generation of ideas through conceptual images created with AI tools, which act as project triggers. These conceptual images allow for the exploration of new design possibilities from the outset of the process.

The project was approached through six conceptual layers: Materiality, Energy, Circulation, Program, Structure, and Furniture. Each layer was fundamental to understanding the complexity of the design, and they were worked on independently to ensure the accumulation of information and the enrichment of the project.

The workshop was structured around three speculative hypotheses that guided the project development:

1_New Garden of Eden: This hypothesis was based on creating a space that harmoniously

integrated nature and urban environments, inspired by the metaphor of the Garden of Eden. Students envisioned regenerating the refinery into a sustainable oasis, where green areas, vertical gardens, and water spaces would promote reconnection with nature. Renewable energy solutions and advanced nanomaterials were incorporated to purify the air and absorb pollution. This approach aimed to balance the built environment with nature, respecting existing topography and vegetation.

2_New Babylon by Constant Nieuwenhuys: Inspired by Constant Nieuwenhuys' utopian concept [16], this hypothesis proposed a city in constant flux, where architecture was modular and adaptable. Students imagined transforming the refinery into a flexible and self-sufficient metropolis, with modular structures that could change according to the needs and desires of the inhabitants. This approach introduced the idea of an autonomous and creative society, where technology freed people from mundane tasks, allowing them to engage in creative and experimental activities.

3_Wall-E: Drawing from Pixar's film, this hypothesis addressed sustainability and environmental recovery of the refinery. Students explored recycling and reusing materials from the dismantled refinery, creating green spaces such as vertical gardens and urban farms to purify the air and promote biodiversity. Additionally, sustainable infrastructure incorporating renewable energy sources was proposed, replicating the effort to restore a devastated planet.

Advantages of the Speculative Methodology:

Working with these speculative hypotheses offered several pedagogical and project-based advantages: *Unrestricted creativity*: By envisioning futuristic and utopian scenarios, students were freed from current regulatory constraints and contexts, allowing the exploration of innovative and radical solutions. *Encouragement of critical and reflective thinking*: These hypotheses prompted students to reflect on the long-term impacts of their designs in future contexts, addressing contemporary issues such as climate change, uncontrolled urbanization, and sustainability. *Flexibility and adaptability*: The methodology allowed students to work with concepts of modular and adaptable architecture, helping them understand how urban environments can evolve and respond to changing societal needs, and finally an *Interdisciplinary approach:* The futuristic scenarios demanded the integration of multiple disciplines, such as ecology, technology, and sociology, enriching the design process and fostering a holistic approach.

2.5. Approaching the professional realm

In this course the objective is to bring the student closer to the reality of the professional realm, and to the challenges and responsibility that an architect-designer must face in the performance of his/her profession. For this, it is essential for the student to understand the complexity of conditions of various kinds that occur in the urban environment and to which the architect must respond.

Thus, this workshop-studio offers the student the possibility of testing, in a directed and supported manner, what involves developing a real project in a specific and complex urban context, while prepares the student to respond with his/her proposal to the previously identified problems. By doing so, this course pivots on a critical and multifocal reflection on specific urban conditions [17], while enhances in the student the ability to provide a coherent and consistent project response to those, addressing real problems and offering solutions with a high capacity for transformation and improvement of environments.

To develop this final course, each student chooses a research topic of interest, and an urban-scale location linked to a larger territorial area where they wish to develop it. In this way, the course is based on personal motivation by theme and place and allows, by contrast between the various characteristics of the places and themes of all students, to address in class a very broad casuistry of urban and peri-urban conditions that would otherwise be difficult to achieve in a single course. This variability of situations and conditions constitutes the basis of reflection and debate, always alive and not predetermined, on which the course is articulated. [18]

Fig. 4: *final exposition of the 6th degree course, with a public exposition at professional level cover-up.*

At a programmatic level, the course is structured in two exercises, the first corresponds to the analysis and the second advances a proposal. The main objective of the first exercise is to ensure that the student can carry out a kaleidoscopic and in-depth analysis of the chosen place. Relying on the rigor of this analysis, the student must be able to identify in a solvent and critical manner the existing urban problems at their different scales and, finally, advance multi-scalar design measures for their correction.

The second part of the course focuses on the development of the program, the conceptualization of the building and its implementation. The objective of this exercise is to ensure that the student is capable to offer a conceptual approach based on the critical understanding of the reality analysed in the previous exercise. To achieve this, the student must develop a first approach to the development of the project, one that integrates a response at various scales [19], attending to the specific program previously defined and considering the technical and technological instrumentation available

3. RESULTS AND DISCUSSION

The integration of the quadruple helix methodology in the architectural projects program has proven to be a highly effective approach in developing comprehensive professional skills among students [20]. By interweaving the four key conditions—scale, programmatic complexity, urban intensity, and technology—students gain a holistic understanding of architectural design that spans all dimensions of the discipline [21]. This educational framework allows students to progressively master a wide range of architectural scales and typologies, from small-scale residential projects to complex urban interventions, even until the building works management.

Fig. 5: *building works management training in a professors´professional practice building, intercourse practice*

As a result, their learning experience is both profound and extensive, equipping them to confidently undertake projects of varying scales and complexities from the very beginning of their professional careers. This robust preparation ensures that graduates are capable of addressing diverse architectural challenges, positioning them as versatile and competent practitioners in the field. The following 6 outcomes have been achieved:

- Conceptual orientation linked to initial real-world data and their physical, programmatic, and contextual constraints.
- Definition and development at the programmatic level of the project's intended uses.
- Design of projects that integrate responses at various scales, addressing a specific program and the constraints and nature of the urban setting in which they are located.
    - Appropriate use of auxiliary project tools derived from other subjects.
    - Articulation of formal design processes with their material development.
    - Use of appropriate graphic procedures related to the urban scale, understanding their distinct characteristics compared to those associated with the object or architectural building scale [22].

4. CONCLUSIONS

This pedagogical methodology effectively ensures that students enrolled in the Architecture program acquire a comprehensive and rigorous understanding of all disciplinary concepts intrinsic to the architectural profession. By working across a spectrum of programs and scales—from small-scale residential projects to complex urban interventions—students are systematically exposed to the multifaceted nature of architectural practice. This curricular approach enables them to address the various demands of architectural design, including the resolution of programmatic, spatial, and technical aspects while adhering to regulatory frameworks and contextual constraints. Consequently, students develop a robust capacity for critical thinking, design ideation, and technical execution [23].

Moreover, the structured progression from individual to collective and public space design equips students with the necessary skills to navigate and articulate architectural projects at diverse scales of intervention [24], from the intimate domestic realm to larger, urban contexts. The methodological integration of conceptual analysis, programmatic definition, and material development ensures that graduates possess the requisite competences to engage with all facets of architectural practice. Upon completion of the program, students are fully prepared to assume professional responsibilities, having developed proficiency in the design and execution of projects across all

scales and typologies for which they will hold professional attributions in their future careers [25]. This comprehensive preparation positions them to seamlessly transition into the professional marketplace, equipped to contribute meaningfully to the architectural discourse and practice.

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