

Editorial

# Sustainability in Architectural Education—Editorial

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In the context of the 2018 resurgence of the global movement of Climate Action, architects around the world have taken responsibility for taking actions against climate change and for adhering to the United Nations Sustainable Development Goals (SDGs) in both practice and education. The various international Architects Climate Action Networks in 2019, followed by the UK manifesto of Architects Declare, underpin a wave of greater awareness, positive action, and greater commitment to sustainability in architecture through individual practice as well as policy-based systemic change [1]. Architecture schools around the world have joined this movement and pledged to follow the UN SDGs as part of their curricula. However, the attempt to embed principles of sustainability and environmental design in architectural education is not new and can be traced back decades, if not centuries or millennia. There is, nevertheless, a genuine concern that the current level of sustainability education provided in the mainstream architectural curricula is no longer sufficient to face the urgent climate challenges [2,3] and that a stronger transdisciplinary approach needs to be followed where architectural students are informed and empowered with a different pedagogical paradigm, better tools, and diverse sets of skills.

This Special Issue seeks to examine the barriers and opportunities within the international architectural education scene in shifting values and creating rapid change in curricula and their delivery. It is important to acknowledge the evolution of sustainability in architectural education, encompassing multiple practices involving design studios and technical courses, and to identify early efforts and ways we can build up from those legacies. We must avoid the danger of constantly reinventing the wheel and the fallacy of considering sustainability to be a fringe subject at odds with the other drivers of architectural education, which is traditionally more concerned with aesthetics and representation. Equally, it is important to recognise the emergence of genuine experimentations and unconventional didactic practices that are the result of better knowledge, greater awareness, more refined analytical tools, and, more recently, the new avenues opened by online and digital learning during the pandemic. Hence, this Special Issue includes contributions on historical perspectives and evaluations, experimental learning methods, pedagogical theories, current case study practices, and emerging trends in the integration of sustainability into architectural education globally. This Issue aims to take the pulse and give a snapshot of the various efforts made internationally to enable climate action through architectural education and the formulation of the related new educational paradigms.

Going beyond the scope of building design as an entity and acknowledging the role of the natural context for developing sustainable architectural solutions in a broader sense, three of the articles published in this Special Issue look at the challenges and opportunities of designing green and blue infrastructures, searching for environmental and social sustainability. With regards to greenery, the theme of urban agriculture appears to be a strong component, with the benefit of bringing human life closer to nature within the urban environment in addition to the primary objective of contributing to food production in a future of food shortage because of population growth. The article entitled *Proposing a Pedagogical Framework for Integrating Urban Agriculture as a Tool to Achieve Social Sustainability within the Interior Design Studio* (Contribution 1: <https://www.mdpi.com/2071-1050/14/12/7392>)



**Citation:** Schiano-Phan, R.; Soares Gonçalves, J.C. Sustainability in Architectural Education—Editorial. *Sustainability* **2022**, *14*, 10640. <https://doi.org/10.3390/su141710640>

Received: 5 August 2022

Accepted: 16 August 2022

Published: 26 August 2022

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focuses on the integration of urban agriculture at the domestic level, exploring the spatial potential of residential buildings. Methodologically, the context-based design approach highlights the importance of considering the local culture during the design process. As an example, the work presented here draws lessons from the experience of Cypriots, who have a cultural interest in decorating their residential buildings with green elements.

The work introduced in the article entitled *Defining a Pedagogical Framework for Integrating Buildings and Landscapes in Conjunction with Social Sustainability Discourse in the Architecture Graduate Design Studio* (Contribution 2: <https://www.mdpi.com/2071-1050/14/8/4457>) relies on the benefits of green infrastructure to achieve three key objectives: improving the quality of walkability in the urban environment, encouraging a more respectful relationship between urban citizens and nature and the cultivation of healthy food, and ultimately enhancing well-being and quality of life. For this purpose, buildings and landscape areas are used as the grounds for design explorations, where walkability, active mobility, and greenery are inseparable parameters. As a result, the designed experiments show how parts of the existing urban fabric can be connected through green walking and cycling zones.

The work discussed in *Integrating Water Sensitive Design in the Architectural Design Studio in China: Challenges and Outcomes* (Contribution 3: <https://www.mdpi.com/2071-1050/13/9/4853>) acknowledges that architectural education since the early 1990s has shown several initiatives toward the sustainability of the built environment but missed the component of Water Sensitive Design (WSD), an interdisciplinary approach that considers the water cycle as the primary element of design strategies, integrating the site's ecological and social aspects to structure water management. Consequently, the literature review identified the lack of technical skill sets and limited research and knowledge. To fulfil such a knowledge gap, this study presents the holistic introduction of a WSD proposal in an architectural design studio in China developed at the concept level. The technical assumptions and methodological steps elaborated for this water-oriented design approach were filtered from a critical review of specific technical information, including strategies for sustainable urban drainage systems, stormwater control, and other related subjects.

Reflections on research-led design approaches addressing buildings' environmental and technical aspects were the focus of another three articles, encompassing the topics of life-cycle assessments, environmental conditions, and operational energy demand. The article *Long-Term Experience of Teaching Life Cycle Assessment and Circular Design to Future Architects: A Learning by Doing Approach in a Design Studio Setting* (Contribution 4: <https://www.mdpi.com/2071-1050/14/12/7355>) brings a unique experience of exercising Life Cycle Analysis (LCA) and Circular Economy (CE) assessments in an undergraduate architectural studio in Brazil: the 'Sustainable Architecture and Construction' (SAC) course, at the UNICAMP (Campinas, University). The design studio presented here is based on the premise that architectural students should be trained to routinely incorporate sustainability checks into their design, which, in Brazilian HE, is more of a common practice among Engineering undergraduate courses rather than in Architecture. The data gathered over several years showed how effectively environmental information underpinned the decision-making process during the development of the design project in this course. Basic LCA evaluations in small/punctual exercises in the concept design stage proved to be an effective learning strategy to create technical awareness alongside a holistic understanding of the environmental implications associated with the design choices. Wishing to improve the integration of LCA and CE in the building design, an online calculator was developed and is expected to allow expanded design experimentations in forthcoming courses, allowing for the environmental analyses to be more agile and freeing up time for design explorations/studies.

Along a similar line, a critical review of over a decade of experience that focuses on the Architecture and Environmental Design MSc course at the University of Westminster in London is thoroughly discussed in the article *Pedagogy Pro-Design and Climate Literacy: Teaching Methods and Research Approaches for Sustainable Architecture* (Contribution 5:

<https://www.mdpi.com/2071-1050/14/11/6791>), which highlights the challenges and opportunities of introducing climate literacy at the postgraduate level. In this respect, the article looks at the benefits of an evidence-based approach in the teaching and learning of environmental design principles, with a focus on recurrent methods applied in architectural education in the UK. Reflections on the quality of the students' work pointed to the fact that the lack of environmental knowledge in the design studio, mentioned by Szokolay [4] and others, can be overcome if there is a clear understanding of the value and applicability of the lessons from the taught modules (related to theory and technical subjects) in the elaboration of the design response to the requirements and aims of the design brief. The authors argue that complementary to the integrated studio and the evidence-based approach, the integration of the live project into the environmental design courses has a critical role in enhancing the climate literacy of the students. In this respect, engaging with real buildings in use is an excellent vehicle for the students to acquire a "feel" for the environmental and energy parameters in the built environment, which are at the basis of the climate literacy learning curve. In addition to the in situ case studies, a powerful and quite unique example of the so-called "Live Projects" used in this course is engagement with industry partners at the final stage of the Master's, with the Collaborative Thesis Project, which offers students the opportunity to interact with the practice and learn from the experience of professional working methods.

In the article *Developing Methodological Framework for Addressing Sustainability and Heritage in Architectural Higher Education—Insights from HERSUS Project* (Contribution 6: <https://www.mdpi.com/2071-1050/14/8/4597>), the authors address an interdisciplinary design challenge, looking at the relationship between heritage and sustainability. Based on a wider collection of data from HE courses in schools of Architecture and Urban Design in Europe, the authors identified the limitations of the offered course types in establishing the relationship between different fields and the need for a search (and creation) for new courses that can enable the education of experts in the field of heritage and sustainability. Furthermore, coupled with a strong basis for curriculum design, the prediction of the impact of rapid changes in the environment on the global scale requires practical and theoretical skills by professionals who have diverse roles acting in the global economy. With the ultimate objective to support rapid change in the design curriculum, the methodological framework reinforces multidisciplinary, interdisciplinary, and transdisciplinary issues and different pedagogical approaches to heritage and sustainability to facilitate new comprehensive courses and the exploration of a taxonomy-based curricula design.

The importance of finding innovative teaching methods aimed at improving climate literacy and the evaluation of such innovative input and its impact is a theme that emerges in various articles as a testimonial of similar trends across Europe. The attention to practical engagement and experience-based learning is highlighted in the article *Collaborative Learning Experiences in a Changing Environment: Innovative Educational Approaches in Architecture* (Contribution 7: <https://www.mdpi.com/2071-1050/13/16/8895>), where the authors conducted semi-structured interviews with staff members in new courses tailored to address the gaps in the climate change agenda as central to their learning offer and essential to creating a direct dialogue with the local stakeholders towards the co-creation of more impactful projects. The research involved evaluating five courses in Chile, Haiti, and Italy and identifying the challenges and opportunities of each course, comparing the various degrees of public engagement and the application of live project pedagogies. The article sheds light on the importance of such an action learning approach and an involvement in contextual social agendas as crucial for the future development of a climate-literate course preparing the architects of the future.

A similar approach for evaluating the effectiveness of specific courses, in this case directly surveying the students' perception of their advancement in climate change literacy, was presented in the articles *Implementation of the New European Bauhaus Principles as a Context for Teaching Sustainable Architecture* and *A Survey-Based Study of Students' Expectations vs. Experience of Sustainability Issues in Architectural Education at Wroclaw University of Science*

and Technology, Poland (Contribution 8: <https://www.mdpi.com/2071-1050/13/19/10715> and Contribution 9: <https://www.mdpi.com/2071-1050/13/19/10960>, respectively). In the former article, interesting parallelism is drawn between the Bauhaus/Baukultur of the early XX century and the New European Bauhaus movement promoted by the European Commission in 2019 as part of the European Green Deal, where the arts and crafts need to respond creatively to the challenges brought on not by the industrial revolution but by a much-needed climate revolution [5]. The article illustrates a case study of a postgraduate course in Poland and how the architectural design studio can be modelled on the New European Bauhaus performance criteria. This was followed by a self-developed metric to evaluate the student's project based on such criteria, as well as a self-reflection exercise where the students were surveyed to test their level of appreciation of the necessary new knowledge acquired through such a programme. The students displayed a high degree of satisfaction and perceived an increase in specialist knowledge. The latter article also exemplifies educational programmes in Poland and specifically targets the undergraduate and postgraduate students of architecture courses where sustainability modules and climate literacy is introduced for the benefit of their design skills. The article also reviews a large body of literature that specifically addresses the issue of integrating sustainability into architectural curricula, identifying a gap in the method of analysis of such studies, which does not quantify the experience vs. expectation factor of students. The authors developed a comprehensive survey, accompanied by an original data analysis tool called the Expectation Fulfilment Rate, which revealed not only the positive experience and satisfaction that students had towards the learning of certain subjects but also the gap in fulfilling their expectations regarding other subjects. Specifically, the results of this survey were used as the evidence base for improving the course and also highlighted the wide range of sub-topics encompassed by the wide umbrella of sustainable architecture and the complexity of finding a balance between them or potentially making clear from the start the remit of certain curricula.

In general, the evidence-based approach (based on numerical procedures), taken as a main drive to the design development, is the main differentiator between a more traditional approach and many of the pedagogic initiatives presented in this special edition. In the case of the AED Master Course, it can be observed that although creativity is somehow downplayed in the early stages of the student's learning process, this surely comes back when the analytic tools have been mastered and when greater confidence is acquired in balancing knowledge and application. The same happens in the undergraduate course at UNICAMP, the University of Campinas in Brazil. Other examples highlight the importance of engaging with the local community and active stakeholders in order to have even a greater impact on real changes in society and the crucial role of evidence-based methods also in the evaluation of students learning experiences and expectations.

Despite the urge for a more holistic as well as technically strong design curriculum for courses in schools of architecture and urban design that address sustainability issues, all of the research work presented and discussed in this Special Issue touch on the importance of nurturing creativity and innovation. Citing the great Albert Einstein: *"We cannot solve our problems with the same thinking we used when we created them"*. Another key that was found in every article is that context (climate and culture) is at the core of sustainable responses in architecture and urban design. In this way, methodologies and frameworks to work with context are fundamental. However, although methodological procedures and tools are very helpful, they define a base upon which creative but informative thinking will develop.

#### List of Contributors

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**Funding:** This research received no external funding.

**Conflicts of Interest:** The authors declare no conflict of interest.

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