







NOTE



From theory to practice: lessons from transformative learning through a net-zero design competition

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ABSTRACT

This practical note explores the impact of transformative learning through an international design competition focused on net-zero housing in South Asia, the Middle East and North Africa, and sub-Saharan Africa. By fostering interdisciplinary collaboration and hands-on engagement, the competition equipped young professionals with practical skills to address climate-responsive housing challenges. Participants designed affordable, sustainable homes using renewable energy solutions tailored to middle-income households in a Global South setting, supported by workshops, skill-building sessions, and expert feedback. Survey findings highlighted the potential for such initiatives to bridge education, policy, and practice, promoting inclusivity and innovation. This work demonstrates the transformative role of experiential education in advancing sustainability considerations, addressing affordability, and aligning with the Sustainable Development Goals (SDGs).

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Introduction

The building and construction sector accounts for about 37 per cent of the world's CO₂ emissions (United Nations Environment Programme 2022). The built environment remains a major contributor to energy consumption, often reliant on fossil fuels for heating, cooling, and electricity. Transitioning to net-zero designs, which balance energy consumption with renewable energy production, directly addresses this large emission source.

With the rising costs and depleting stocks of fossil fuels, renewable energy (RE) technologies are becoming more innovative, efficient, and cost-effective. The challenge is how to transform the built environment using climate-responsive planning, sustainable engineering, and novel techniques for building design and construction (O'Sullivan, Golubchikov, and Mehmood 2020). Sustainable Development Goals (SDGs) emphasise the interconnectedness of education, climate action, and urban sustainability. Among them, SDG 4 (Quality Education), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action) highlight the critical need for training youth in practical and

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context-sensitive ways. While the concept of sustainability is well-disseminated, its practical application – especially in the housing sector – remains a challenge for the Global South. The urgency of addressing climate emergency, housing affordability, and rapid urbanisation therefore requires innovative education and training for future professionals.

This article shares insights from an international design competition that employed an experiential learning approach (Kolb 1984) to prepare students and young professionals for sustainability challenges. In the higher education and training context, experiential learning is highly connected with the service-learning approach (Jenkins and Sheehey 2022). Service learning itself emphasises reflections from active community engagement and participation to better understand and experience real-world problems (Reeb et al. 2024). This aspect of experiential learning provides strong social, political, and policy design perspectives in formulating experiential learning objectives, activities, and evaluations. Another interesting aspect of experiential learning is hands-on activities, internships, and opportunities to spend time in industry. In the longer term, such learning initiatives offer career benefits by equipping participants with real-life problem-solving skills, encouraging critical thinking and helping with a deeper understanding of sustainability-related challenges. Furthermore, participants are more likely to contribute to the social, economic, and environmental improvements in the respective fields besides fostering lasting commitment, continued involvement and advocacy in plans, projects, and advocacy throughout their professional and personal lives.

The design competition was opened to students and young professionals in the disciplines of spatial planning, architecture, civil, and other engineering fields. The overarching goal was to help mimic the real-life project environment, fostering collaborative multidisciplinary and cross-disciplinary experiences for participants (Alam 2022).

The objective of this international competition was to prepare emerging professionals, especially students and young graduates, to envision and design a climate-adaptive, resilient, inclusive, sustainable, and innovative house that is affordable to own, operate, and maintain by the standards of middle-income level households. The focus was on three large geopolitical regions, i.e. South Asia, the Middle East and North Africa (MENA), and sub-Saharan Africa, due to the complexity of housing and urbanisation challenges. Housing design in these regions must enhance the quality of life and well-being of residents, adapt to climate change, and respond to its projected impacts. For this competition, a Zero Energy House was to combine energy efficiency and renewable energy generation to consume only as much energy as can be produced through sustainable resources over a specified period. This could be done either by fully relying on the onsite renewable energy source/s or by offsetting the use of on-grid energy equally through net-metering or other techniques using renewable energy sources.

In all, 28 teams submitted expressions of interest. Most of the teams were led by final-year students from various architectural and planning schools, while structural and electrical engineers were part of the teams. About 96 per cent of participants were aged between 18 and 25 years. Almost 58 per cent were women. Most of the teams were led by young women; details are provided in Table 1. Many young professionals were recent graduates with degrees in architecture and civil and electrical engineering.

The teams were invited to attend live online lectures and five skill-building workshops and were given opportunities to raise queries in the interactive sessions as well as questions by email and in a

Table 1. Demographic details of the participants.

Education level	Age group	Women	Men
Intermediate	18–25	23	13
	26–35	18	14
Graduate	46–55		1
			1
			1
Postgraduate	26–35		1
Total		41	30

dedicated WhatsApp group. After going through the training workshops and seminars, 20 teams submitted their design proposals by the July 2022 deadline.

The objective of these interactions was to provide experiential knowledge and recent technological advancements as well as international policies and net-zero targets by interdisciplinary field professionals beyond the classroom environment. Most of the queries were focused around (a) technical issues related to net-zero targets, (b) understanding the wider policy context, (c) active vs passive systems, (d) costings and cost-effectiveness, and (e) general queries regarding collaborations. An international jury comprising experts in architecture, urban design, and civil engineering assessed the submitted proposals.

Most of the team members had little or no previous exposure to applied contexts and challenges in the formal learning environments of higher education institutions. Thus, participants were encouraged to develop fresh and unique perspectives about the contexts by exploring unconventional pathways, conducting deeper research, speaking to the residents about their needs (e.g. thermal comfort, use of space), and visiting the places in person before making design proposals. In many cases, individual team members developed a connection with the place-based contexts and then subsequently acquainted their group members with the new perspectives, which contributed to team building. Detailed roll-out stages of the design competition are explained in [Figure 1](#).

To measure the impact of the design challenge and its learning objectives, the registered participants were invited for a short online survey. The participants responded to the survey questions which comprised a mix of multiple-choice, Likert scale and open-ended questions. The key findings of this survey are shared here.

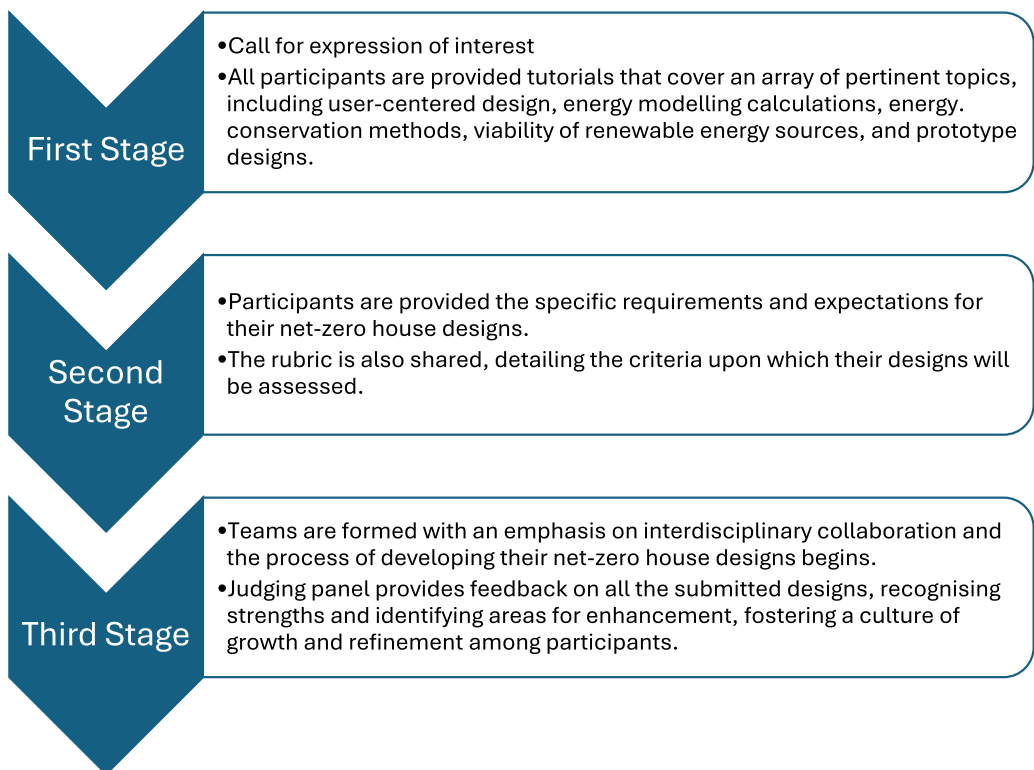


Figure 1. Three stages of the design competition.

Key findings

The range and quality of the proposed solutions were impressive and inspirational, challenging the conventional thinking on designing a sustainable and affordable net-zero house. As a pedagogical corollary of learning landscapes based on the activity–place–outcome model, the training, capacity building, and associated activities over an intensive three-month period had a strategic impact on the participants' experiences (Backman et al. 2019). The key results of the survey are explained in the four categories.

Policy shifts and stakeholder engagement in the built environment

The survey revealed a growing public awareness of the role of policy in transforming the housing and building sectors. A 26-year-old architecture graduate emphasised, "Climate-responsive housing policies should not only set energy efficiency benchmarks but also incentivize sustainable construction practices". Respondents repeatedly called for engaging multidisciplinary teams – architects, engineers, urban planners, and policymakers – in crafting actionable policies. One participant from the competition noted, "Design competitions like this offer practical insights for policymakers to understand what works on the ground". This insight underscores how experiential learning activities, such as design competitions, provide platforms for policy-oriented dialogue and innovation.

The survey also highlighted a disconnect between policy frameworks and implementation in underserved areas. A 29-year-old environmentalist observed, "Without engaging local communities, especially those in rural and urban peripheries, sustainable housing will remain an elite concept, inaccessible to the majority". These statements echo the experiential learning approach used in the design competition, which encouraged teams to design inclusive, climate-resilient housing solutions that cater to middle-income households in the Global South. This could be achieved for example by localising the governance of SDGs (Cheema, Ahmad, and Mehmood 2024).

The role of experiential education in renewable energy adoption

Education emerged as a cornerstone in promoting renewable energy and sustainable housing solutions. Respondents highlighted gaps in public awareness, particularly regarding practical applications of RE technologies. A student from the design competition reflected, "The workshops gave us a deeper understanding of how to integrate renewable energy with energy-efficient design, something that was missing in our formal curriculum". This aligns with the service-learning and experiential approach emphasised in the introduction, where active engagement and hands-on sessions deepen learning outcomes.

Another respondent from the survey emphasised, "Schools should teach sustainability not just as a concept but as a practice, through real-life applications like building a zero-energy house". The design competition illustrated this by enabling participants to move beyond theoretical learning and apply their knowledge to a tangible, impactful project. This type of experiential education not only empowers students but also equips them with the skills necessary to tackle climate challenges practically.

Addressing affordability and accessibility through innovation

Both the survey and the competition underscored the financial barriers to adopting renewable energy solutions. Respondents advocated for cost-effective and accessible options. A young civil engineer participating in the competition remarked, "We realized the importance of modular designs and prefabrication techniques to bring down construction costs without compromising sustainability". This insight reflects how experiential learning fosters innovation tailored to real-world constraints.

Another survey respondent suggested, "Decentralized solutions like community solar grids or shared renewable energy projects could make these technologies accessible to low- and middle-income households". The competition reinforced this idea by challenging participants to design

energy-efficient, affordable housing that meets the needs of middle-income families. Such initiatives demonstrate how education and innovation can address systemic challenges in the housing and energy sectors.

Sustainability through context-specific solutions

Participants and survey respondents alike emphasised the importance of designing solutions that are culturally and environmentally appropriate. A young architect noted, “The competition pushed us to explore vernacular architecture and traditional techniques, which are often more sustainable than modern construction methods”. This aligns with the survey finding that public support for renewable energy increases when solutions are grounded in local realities. A rural participant in the survey shared, “Simple technologies like solar water heaters or windmills can make a big difference in remote areas if they are designed for ease of use and maintenance”. The competition encouraged similar thinking by requiring participants to develop housing designs adaptable to various climatic conditions in Asia and Africa. This demonstrates the power of experiential learning to promote innovative, sustainable solutions tailored to diverse geographic and sociopolitical contexts. The effectiveness of the key takeaways through the initiative is evident in the fact that the design challenge processes were integrated into several final-year courses in the participating universities to share insights into the participating students’ transformative learning experiences.

Conclusion

The experiential learning initiative demonstrated through the international design competition provided valuable insights into how sustainability pedagogy can effectively prepare emerging professionals to address real-world challenges. The initiative underscored the importance of a multidisciplinary approach, bridging gaps between education, policy, and practice, while also highlighting areas for further enhancement. However, it must be clarified that the initiative had its challenges, such as lack of face-to-face contact and in-person interaction due to the dispersed and remote locations of the experts, training staff, and the participants. Then there was the issue of finding a common language that is understandable for architects, engineers, and planners alike. These hurdles were addressed earlier on through continuous communication and collaboration between the key actors.

There are four key takeaways from this experience. First, higher education institutions should incorporate design challenges and service-learning opportunities into formal education and training, enabling students to apply theoretical knowledge to tangible projects. Participants, in our case, moved beyond theoretical concepts, gaining firsthand experience in sustainable housing design. This process enriched their ability to contextualise sustainability discourses and develop culturally and environmentally pertinent solutions. As higher education institutions seek to improve their curricula, integrating real-world applications through experiential learning can create a generation of professionals who are better equipped to tackle planetary sustainability challenges.

Second, the competition fostered interdisciplinary collaboration among architects, engineers, and planners, which illustrates how interdisciplinary coalitions can yield innovative, workable solutions to complex problems in the situation of polycrisis (Lawrence et al. 2024). Partnerships with local governments, NGOs, and the private sector can enhance these initiatives and therefore be incorporated in other similar initiatives.

Third, addressing affordability and accessibility through innovation emerged as another significant outcome of the competition. Many teams considered local materials, modular designs, prefabrication techniques, and decentralised energy solutions, which have the potential to reduce construction costs while ensuring sustainability and preserving environmental knowledge. These innovative approaches are particularly relevant for middle-income households in the Global South and should feature in student competitions, where affordability remains a key barrier to adopting net-zero housing solutions.

Finally, through its policy-oriented framework, the competition highlighted gaps in existing housing policies and provided actionable recommendations for enhancing energy efficiency and housing affordability. The competition demonstrated that integrating local knowledge with modern sustainable practices can yield more effective and inclusive pathways, reducing the disconnect between policy and practice, and addressing the unique circumstances faced by various communities in the Global South. Replicating this competition model at regional and national levels could expand its reach, fostering greater awareness and innovation, and informing policymakers, creating frameworks that support sustainable housing development.

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