Chapter 49

Design for Change: Transformational Cross-cultural and Transdisciplinary Learning Experiences to Solve Global Healthcare Sustainability Challenges

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Abstract

As populations live longer and healthcare demands rise, building a sustainable and resilient healthcare system is urgent. Around the world, healthcare is under pressure—not just to treat more people, but to do so sustainably. However, what is often overlooked is the high environmental cost of modern healthcare systems, particularly through their carbon footprint and material waste. Globally, the healthcare sector contributes significantly to greenhouse gas emissions, comparable to large industries. In response to the challenges, this article presents an educational initiative centred on cross-cultural and multidisciplinary collaboration among undergraduate students in design and health sciences. Through immersive experiential learning and design sprints, students explore real-world healthcare sustainability challenges, generating context-sensitive, equitable, and environmentally responsible solutions. This model highlights the importance of integrating environmental stewardship, technological ethics, and inclusive design. The authors posit that a curriculum engaging undergraduate health and design students from diverse cultural backgrounds is essential for lasting change in healthcare systems.

Keywords: *Design Education, Health Education, Design Sprints, Experiential Learning, Sustainability, Problem-based Learning*

Introduction

According to *Harvard Medicine*, the global healthcare sector contributes between 4.4% and 5.2% of greenhouse gas emissions—comparable to or exceeding aviation[1]. In Australia, healthcare accounts for approximately 7% of national carbon emissions, reaching 30% across the Asia-Pacific region[2]. These emissions are linked to climate-sensitive health conditions, including respiratory and cardiovascular diseases and heat-related morbidities. Beyond emissions, material waste in healthcare presents a

[1]Stephanie Dutchen, "Confronting Health Care's Carbon Footprint," Harvard Medicine: Nature, Nurture, 2023, https://magazine.hms.harvard.edu/articles/confronting-health-cares-carbon-footprint.
[2]Jeremy Chan, "Managing Asia's Healthcare Waste and Emissions Remains Challenging Amid Increasing Climate Risks," Eco-Business, 2024, https://www.eco-business.com/news/managing-asias-healthcare-waste-and-emissions-remains-challenging-amid-increasing-climate-risks/.

pressing challenge, with over 16 billion injections administered each year globally, using single-use plastics that contribute to biohazardous and environmental waste[3]. Healthcare sustainability is one of the most pressing challenges of the 21st century, as modern systems also generate significant environmental impacts through emissions, waste, and energy use. Technological advancements tend to concentrate in urban, high-income regions, leaving rural and marginalised populations at a disadvantage, highlighting the need for inclusive innovation strategies, particularly as digital health systems introduce additional environmental considerations across their lifecycle[4], including the growing intersection between artificial intelligence, healthcare, and climate impacts[5]. The challenge lies not only in technological deployment but also in governance, regulation, and ethical stewardship to prevent digital exclusion and systemic discrimination. This urgency is further reinforced by global policy frameworks calling for climate-resilient and low-carbon healthcare systems[6].

Although these challenges are often assumed to be addressed within health sciences, the required skill sets extend beyond this domain. Design processes are recognised for supporting sustainability, particularly in product design, and as evidenced by Papanek, designers have contributed to the sustainable development agenda since the 1970s[7]. In 'Design for the Real World', Papanek describes designers as agents of change capable of innovating products, services, and systems. He positions design beyond aesthetics, with its success measured by its ability to deliver meaningful, functional solutions within context. These theories underpin contemporary design education, emphasising the role of design in shaping worldviews, relationships, and empathy.

Globalisation and the transfer of ideas across cultural and political boundaries require an understanding of cross-cultural relationships. To achieve effective and sustainable healthcare innovation, global competencies are essential. As Jensen notes, organisations must consider cross-cultural collaboration to connect global and local knowledge and build shared innovation cultures[8], reinforcing the need for globally aware practitioners[9].

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[3]World Health Organization, "Healthcare Waste," WHO, 2024, https://www.who.int/news-room/fact-sheets/detail/health-care-waste.

[4]Yacine Hadjiat, "Framework for the Environmental Sustainability of Digital Health Systems," *PLOS Digital Health* 2, no. 5 (2023): e0000268, https://doi.org/10.1371/journal.pdig.0000268.

[5]Daiju Ueda et al., "Climate Change and Artificial Intelligence in Healthcare: Review and Recommendations Towards a Sustainable Future," *Diagnostic and Interventional Imaging* 105, no. 11 (2024): 453–59, https://doi.org/10.1016/j.diii.2024.06.002.

[6]COP28 UAE, *COP28 UAE Declaration on Climate and Health* (United Nations Framework Convention on Climate Change, 2023), https://www.cop28.com/en/cop28-uae-declaration-on-climate-and-health.

[7]Victor Papanek, *Design for the Real World: Human Ecology and Social Change* (Academy Chicago Publishers, 1971).

[8]Karina R. Jensen, "Global Innovation and Cross-Cultural Collaboration: The Influence of Organizational Mechanisms," *Management International / International Management / Gestiòn Internacional* 19 (2015): 101.

[9]Lisa Scharoun et al., "Understanding Design Culture from East to West: A Transdisciplinary Approach to Teaching," in *Contemporary Design Education in Australia: Creating Transdisciplinary Futures*, ed. Lisa Scharoun et al. (Intellect, 2023).

Providing students with learning experiences in significantly different cultural contexts enhances cultural intelligence[10] by broadening perspectives and supporting global learning outcomes[11]. The authors posit that these competencies can be developed through immersive experiential and problem-based learning (PBL), where cross-cultural and multidisciplinary design sprints enable students to address real-world healthcare sustainability challenges

Methods

Students addressing real-world problems in diverse cultural settings are pushed to transcend boundaries and create impactful solutions, with adaptation to cultural contexts fostering innovation[12]. An experiential PBL methodology supports knowledge sharing and equal participation among individuals from diverse backgrounds.

PBL draws on complex real-world problems without single solutions, with group work enabling multiple perspectives and a more comprehensive investigative approach[13], aligning with design thinking approaches to problem-setting and need-finding in complex contexts[14]. To support this, students engaged in pre-work and a symposium featuring global experts who provided a strong knowledge base. Through these activities, students were introduced to the UN Sustainable Development Goals 3, 11, and 8, forming a foundation for developing solutions addressing global healthcare challenges.

Experiential learning extends beyond the classroom and relies on the formation and reformation of ideas through immersion in unfamiliar environments that promote rapid shifts in perspective[15].

Design sprints are intensive studio experiences, typically lasting 5 days or less, where teams ideate, prototype, and test solutions through guided design thinking processes, widely applied in healthcare to

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[10]Lisa Scharoun et al., "Transforming Perspectives: Fostering Cross-Cultural and Transdisciplinary Competencies through Industry Engagement on Short-Term Study Tours," in *Contemporary Design Education in Australia: Creating Transdisciplinary Futures*, ed. Lisa Scharoun et al. (Intellect, 2023).

[11]Lisa Scharoun, "Short-Term Study Tours as a Driver for Increasing Domestic Student Mobility in Order to Generate Global Work-Ready Students and Cultural Exchange in Asia Pacific," *Perspectives: Policy and Practice in Higher Education* 20, nos. 2–3 (2015): 83–90, https://doi.org/10.1080/13603108.2015.1075917.

[12]Marianella Chamorro-Koc and Lisa Scharoun, "Design Sprints, Designathons and Place-Based Learning in the Context of Real-World Health Problems," *International Journal of Art and Design Education* 44, no. 3 (2025): 677–92, https://doi.org/10.1111/jade.12578.

[13]Gjoko Muratovski et al., "Approaching Global and Local Examples of Transdisciplinary Projects in the United States, Indonesia, China and Australia," in *Contemporary Design Education in Australia: Creating Transdisciplinary Futures*, ed. Lisa Scharoun et al. (Intellect, 2023).

[14]R. Bender-Salazar, "Design Thinking as an Effective Method for Problem-Setting and Needfinding for Entrepreneurial Teams Addressing Wicked Problems," *Journal of Innovation and Entrepreneurship* 12 (2023): 24, https://doi.org/10.1186/s13731-023-00291-2.

[15]Scharoun et al., "Understanding Design Culture from East to West: A Transdisciplinary Approach to Teaching."

develop user-centred solutions in complex systems[16], often incorporating expert insights and co-design with users[17].

To foster culturally adaptable healthcare prototypes, the authors designed a design sprint integrating experiential and PBL approaches.

Case Study: Design For Change Study Tour

The authors facilitated a two-week learning experience for 108 design and health students from multiple international institutions. In June 2024 and 2025, participants travelled to Malaysia and Singapore to engage in a symposium and design sprint focused on healthcare sustainability. Students from diverse disciplines worked in multicultural teams. They examined healthcare systems through multidisciplinary perspectives to better understand end users and develop inclusive, actionable solutions. The program began with a symposium featuring global experts equipping students to address SDGs 3, 11, and 8. Experiential learning was further supported through cultural immersion activities and visits to healthcare facilities, exposing students to different practices, environments, and challenges. During a five-day design sprint, teams developed solutions informed by both multidisciplinary insights and cultural understanding, aiming to create tools that operate across cultural boundaries.

Results

The program provided students with experience in cross-disciplinary collaboration, a critical approach for addressing global challenges. It also fostered a sense of empowerment in navigating complex global issues. The project demonstrates how systems thinking, materials science, and design innovation can converge to support circular healthcare solutions.

To illustrate this, the design thinking process undertaken by student teams is outlined below.

Step 1: Problem Identification

After the symposium and site visits, teams identified key problems, such as sterile wrap waste, reframing it as an opportunity for circular innovation within a sector recognised as highly resource-intensive and emissions-heavy[18], where plastic recycling rates remain low despite technical recyclability[19], reflecting broader challenges in medical waste management systems[20], particularly in land-constrained contexts where waste disposal capacity is limited[21].

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[16]Anni Pakarinen et al., *Design Thinking in Healthcare: From Problem to Innovative Solution* (Springer Cham, 2023), https://doi.org/10.1007/978-3-031-24510-7.
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Step 2: Stakeholder Analysis

Teams mapped system lifecycles and conducted stakeholder analysis, developing personas and journey maps to inform co-design processes.

Step 3: Prototype

Teams developed functional prototypes and presented them to industry panels, including concepts such as Enzima, which explores advanced recycling of sterile wrap waste[22].

Step 4: Community Engagement

Student engagement was supported through visual communication strategies to promote awareness and adoption of sustainable practices.

Conclusion

Healthcare innovations with global relevance are developed by teams capable of navigating diverse cultures. Traditional education models often struggle to equip students with the interdisciplinary and systemic thinking needed to address complex challenges. The Design for Change initiative supports rapid innovation and cross-cultural understanding, which are essential for addressing healthcare sustainability.

Learning 1: Building Confidence and Cultural Awareness

Cultural intelligence is critical, and unfamiliar contexts challenge assumptions and foster innovation.

Learning 2: Transdisciplinary Approach to Innovation

Transdisciplinary approaches enhance problem-solving by integrating diverse perspectives across cultures.

Learning 3: Global Collaboration

Collaboration accelerates skill development and prepares students for global professional contexts.

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