

Education for Sustainability approaching SDG 4 and target 4.7

Ana Elena Builes Vélez
Natalia Builes Escobar
Compilers



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Introducing a New Design Culture on Sustainability¹

Emilio Rossi

University of Chieti-Pescara

Alexa Mattram

John Stocker

University of Lincoln

Abstract

As promoted by Sustainable Development Goal 4, cultural and structural investments in high-quality education are important to ensure inclusive and fair quality teaching and promote lifelong learning opportunities for all. This is important considering Target 4.7, which promotes the education for Sustainable Development. The role of the Higher Education sector is paramount. To feed students' curiosity and empathy toward these issues, Design Universities should foster a new design culture hinged on

¹ This work presents the process used for the redesign of the Cultures module, a Year 2 module offered to all students enrolled in the BA (Hons) Product Design programme at the University of Lincoln, where the first themed contents on Design for Sustainability have been developed and integrated into Programme's Teaching and Learning strategies (T&L).

sustainability from the undergraduate level, as this topic is now relevant to any teaching agenda. Students trained in Design for Sustainability can benefit from a vast set of theoretical and design knowledge developed in the field since 90s. It is known that the cultural transition toward sustainability requires systemic changes and original learning processes linking contextual values and students' needs with strategic policies addressed by cultural institutions. To meet the above bottom-up and top-down drivers and to increase the quality of teaching, learning, and student experience, new modules are needed. This chapter presents the process used for the redesign of the Cultures module, a Year 2 module offered to all students enrolled in the BA (Hons) Product Design programme at the University of Lincoln, United Kingdom, one of the seven BA courses offered at the Lincoln School of Design. This work shows that introducing a robust design culture on Sustainability contributes to a higher quality of undergraduate design programmes with new teaching material and pedagogical methodologies, along with in giving students the chance to be an essential part of holistic and lasting learning processes conceived to converge learners' needs and design skills required by markets.

Keywords: Design Culture; Higher Education; Product Design for Sustainability; Service Design for Sustainability; Teaching and Learning Strategy.

1. Introduction

Many authors argue students are increasingly asking for sustainability to be included as a study subject in design programmes (Varadarajan, 2010), whereas Manzini and Jégou (2003) remarked on the need to act interdisciplinarity and synergistically. This not only because Sustainability is a key theme for present and future agendas, but mostly because there is an interplay between top-

down drivers from cultural and societal values, and bottom-up pushes fuelled by companies, market demands, and people's wish to consume new artefacts in a more conscious way. According to Vezzoli et al. (2018), Design for Sustainability is defined as a design practice, education, and research that contributes to Sustainable Development; after over thirty years of academic progress, it becomes a field characterised by a certain complexity (Ceschin and Gaziulusoy, 2020) with a variety of approaches that increase the chances of tackling the complexity of present times and foresee future living scenarios.

There is no doubt that sustainability is paramount for present and future society, and the Design discipline is entrusted with bridging the gap between cultures, markets, and people. Relevant pedagogic signals suggest that design students are now more aware of their potential to shape a better society through the sustainable artefacts that they can ideate, and this wish is stronger every day. It is not possible to discuss the value of teaching Design for Sustainability without considering the need to develop a strong design culture around it because any rhetoric triggers discussions about the methods and the essence of the Design discipline itself, which does not entail the mere translation of technical skills, but involves more delicate cultural actions aimed at training a new generation of thinkers with sustainable mindsets (Narasimhan and Kumar, 2010). Hence, before discussing 'how' a sustainable artefact can be made (re: product-centric approach), students must be invited to reflect on 'why' the society needs it (design culture). Understanding Sustainability requires a system-wide perspective to guide the interpretation of problems and conceptualization of solutions (Manna et al., 2022) and all design programs should shape local curricula having global foci (Manzini, 2010).

Since 2011, the University of Lincoln in the United Kingdom has recognised sustainability as one of the strategic values on which to base its growing strategy. This was reflected in a focus on research, curricula development, teaching, and the quality of campus. As a rapidly

growing institution with over 14,000 students, the University of Lincoln acknowledges that direct and indirect anthropic activities may have a dramatic impact on the living ecosystems (University of Lincoln, 2020a), and the entire community is called to a wider sustainable culture among the students' cohort to produce positive and lasting impacts on the teaching and learning strategies. This angle echoes the multidisciplinary visions of Sustainable Development promoted by the United Nations (United Nations, 2015; 2017) and recommended for academics (Keynejad et al., 2021).

A sustainable campus, a sustainable culture, and more effective collaborations for the change are the three pillars on which the University's sustainable strategy is articulated (University of Lincoln, 2020a). This led teaching staff to integrate a wide range of sustainability-related topics in many modules, both undergraduate and postgraduate, including the ones taught at the Lincoln School of Design, where sustainability is independently addressed via seminars and student-led initiatives.

The BA (Hons) Product Design programme is one of the seven undergraduate programmes currently offered by the Lincoln School of Design. It is a small and vibrant programme characterised by a student-centric philosophy and structure where learners can freely explore a wide range of topics through lectures, seminars, and studio-based activities. The programme aims to enable students to become skilled thinkers and creative designers with an understanding of target markets and consumer experiences. This philosophy was setting a new module wholly focused on Design for Sustainability—the 'Cultures' module. The programme positively meets the University's policy 'student as producer' set for undergraduate students (University of Lincoln, 2017), a research-informed teaching where students are at the centre of the learning process, and through which they can contribute to the University's cultural debate with first-hand experiences, simulations, and cultural discussions.

The Culture module is the first piece of a wider strategy of improvement aimed at increasing the programme's international competitiveness, reputation, and cultural quality of teaching modules with interdisciplinary contents designed to project students into modern avenues for the development of innovative skills needed to tackle the complexity of present times.

2. Aims

This chapter illustrates the strategy used to redesign the Cultures module, a 33-week core module offered to all Year 2 students enrolled in the BA (Hons) Product Design programme and the first design module completely focused on Sustainability offered at the Lincoln School of Design. The culture on Design for Sustainability within an undergraduate programme is here considered as a strategic value to improve the students' learning curves and tackle contemporary teaching challenges.

Specific module features such as structure, design philosophy, teaching and learning strategies, thematic foci, and student experience, are presented to show the value of the cultural approach used to create a new sustainable design culture that is positively improving the quality of the entire programme, and its horizontal organisation. Samples of student work on Product Design for Sustainability and Service Design for Sustainability—the two design foci proposed to students—are used to show the module's cultural impacts in relation to the new idea of Product Design promoted in the programme, which goes beyond the orthodox conception of 'designing objects'.

Finally, this chapter provides evidence underlining the benefits of teaching Design for Sustainability in undergraduate design programmes to trigger a lasting design culture able to improve horizontally and vertically the quality of teaching and students' skills development.

3. The design of the Cultures module

The design of a new undergraduate teaching module subtends to a delicate process that cannot be separated from considering the entire programme, as any improvement or change may cause systemic effects, both positive and negative. This assumption was used to establish the structure of the new module and place the teaching on Design for Sustainability in a holistic perspective. Giving students the chance to develop a first-hand design culture on sustainability was the main pedagogical value that has driven the redesign process.

This part describes the key features of the Cultures module in relation to the teaching and learning strategies for an undergraduate programme. Specifically, this part addresses the design strategy, the design culture on sustainability, the module's aims, the projects proposed to students, and the strategy used to assess the learning curves.

3.1. A strategy to create integrated teaching.

Before its reconfiguration, the Cultures module was not connected to other Year 2 modules. Whilst this intent has always assured a certain degree of flexibility to lecturers, it also produced a curricular fragmentation when related to the programme's philosophy. The first part of the redesign process was the creation of a resilient strategy to connect the module to the programme. Essentially, the module moved from a stand-alone configuration into an interconnected outline linking modules taught in Year 2 and functioning as a bridge between Year 1 and Year 3 (Figure 1).

As discussed, creating a design culture around sustainability means developing an integrated teaching strategy. Consistently with Figure 1, Figure 2 depicts the specific teaching elements included in the redesigned module, along with interdisciplinary peculiarities and themed design

Figure 1: The Cultures module in the BA (Hons) Product Design programme.

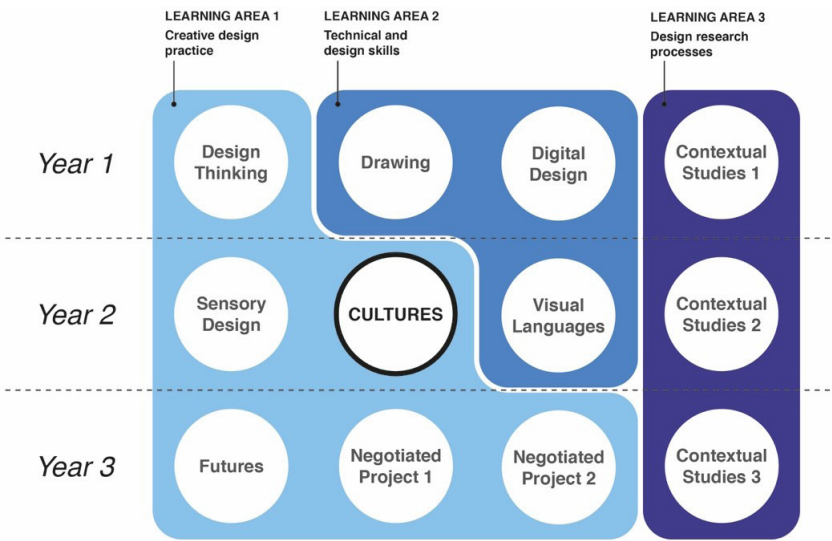
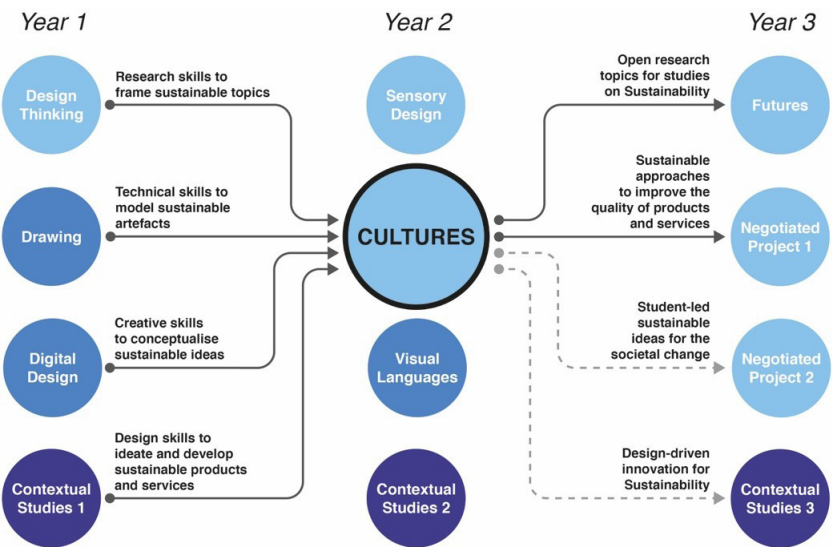


Figure 2: The Cultures module and the integrated teaching strategy connecting other modules.



elements coming from other modules. Figure 2 also shows how teaching elements coming from Years 1 and 2 have been adopted to produce a strong design legacy for Year 3 teaching.

This strategy to create integrated teaching provided higher quality and solidity to the programme's pedagogy and philosophy. From Figure 2, it is also interesting to see how this offered consistency to the overall student experience.

3.2. Developing a design culture on sustainability.

According to UNESCO (2021), the power of education lies in its capacities to connect us with the world and others, to move beyond the spaces already inhabited, and to expose to new possibilities; education nurtures understandings and builds capabilities that can help to ensure that our futures are more socially inclusive, economically just, and environmentally sustainable. This idea opens up reflections on the capability to employ a proper design culture to shape the world.

The new Cultures module has been conceived to intercept both top-down University policies and bottom-up student-led instances driven by societal changes. Current UK undergraduate students already show interest around Sustainability, though this feeling is often driven by the will to face 'traditional' issues related to the environment, such as mitigation of ecological threats, waste of resources, recycling, reuse of materials, etc. Only a few of them reflect in a systemic way by linking Sustainability to living ecosystems, aware business models, and social phenomena. Whereas it is known that Design for Sustainability also addresses economic and social factors, it is often interconnected with multidisciplinary patterns within the scenario of societal complexity.

Table 1: The values of the design culture on sustainability used in the redesign of the Cultures module.

Values of the design	Discussion
Value 1: Sustainability is a learning process.	As argued by Ezio Manzini (Willis and Manzini, 2005), the transition toward Sustainability requires systemic changes and social learning process. The module promotes own design approaches in the form of 'action to experience' by employing iterative processes.
Value 2: Think global and act local.	Consistently with Value 1, the extent of impacts produced by designable solutions suggests developing multi-scalar mindsets to place the designs in a twofold dimension: local, to assess the impact of projects in the mid-term, and global, to test the scalability and potential of interventions in the long run.
Value 3: Designing sustainable effects.	Instead of design sustainable products or services that may have an impact only in the short run, designing in the way of sustainability should foster reflections on how to design lasting sustainable conditions.
Value 4: Using contextual evidence.	Sustainability cannot employ naïve data or research process, otherwise Values 1 and 2 cannot be met. Therefore, contextual data extracted through first-hand methods are used to produce contextual knowledge frameworks on which to set up the projects.
Value 5: Innovation is upon meaning.	A sustainable project is not only a project that respects the environmental, social, and economic features, it is also a meaningful project. This value follows the Roberto Verganti's angle who says that contemporary customers buy products for their meanings, rather than functionalities (Verganti, 2009).

Values of the design	Discussion
Value 6: Differentiating impacts.	The differentiation of impact leads students to reinforce Values 2, 3, 4 and 5 by developing sets of coherent solutions, rather than by stand-alone projects working only in pre-selected contexts of use. This value also promotes creative thinking and problem solving.
Value 7: Studio collaboration.	Consistent with Values 1, 2 and 3, the studio environment must foster collaboration, respect, and open sharing. A studio environment based on fair collaboration is also a strong asset that positively influences both projects and the quality of the programme.

Source: Authors

The module's design culture on sustainability educates students to be confident in facing contemporary and future issues of the society, spanning from product design to service design applications. Therefore, the focus is on the value of design practice, ethics, creative intentions and meaning, rather than just technical design skills.

3.3. The Cultures module: Aims.

The module gives students the opportunity to develop a strong design culture on sustainability and focused cultural, methodological, and technical design skills—Design for Sustainability and sub-disciplinary approaches (Ceschin and Gaziulusoy, 2020). Through a structured use of design methodologies, students can gain confidence from a wide range of cultural angles commonly employed in sustainability studies. The module has been expressly designed to intercept student needs, feed their interest and encourage problem-solving skills, curiosity, and culture

by promoting an understanding of a wide range of creative responses determined by changes in societal trends, which specifically reflect and consider the cultural messages linked to the idea of Sustainability and its impact on reflective creative practices at significant scales. It requires students to recognize and respect cultural and methodological design aspects when transposing cultural indicators into sustainable products, services, and product-service systems.

Referring to the cultural design approach, the Cultures module requires students to challenge multidisciplinary issues surrounding social interaction, meaningful design, and inclusivity for sustainable solutions in real contexts of use. It also requires understanding the need to appreciate strains on natural resources in the sustainable production of goods, as well as focused methodologies to investigate user needs and wishes, new ways of consumption driven by contemporary trends, aware business models, advanced behaviours, and systemic interdependence between production and consumption practices. The module requires students to develop focused contextual analyses where research informs idea development on a project basis and generates empathy of ethical, ecological, and human approaches to sustainable design.

In terms of research and design approaches, primary and secondary research are an integral element of informing idea developments and generating sensitivity to ethical approaches to creative design practices. The module aspires to create an awareness of Social Inclusion and sustainability aspects for contemporary solutions, which leads to the development of innovative interventions on existing and new sustainable market niches.

Finally, the module benefits from the cultural collaborations and insights provided by the Estates Department at the University of Lincoln, which coordinates all University's activities related to Sustainability (University of Lincoln, 2020b).

3.4. The Cultures module: Topics, disciplinary foci, and projects proposed.

The Cultures module requires students to work on two projects for the University of Lincoln urban campus: a physical artefact (Product Design for Sustainability, project one) and a service (Service Design for Sustainability, project two). Projects interpret the strategic brief promoted by the University of Lincoln's Estates Department (University of Lincoln, 2020b) for student-led initiatives and aim to merge relevant cultural notions and methodological skills useful to work with Design for Sustainability on different scales. The choice to use the University campus as a testing ground reinforces the students' empathy toward a place they live and consume every day. This opens up deep reflections and effective transpositions in designing the best solution for themselves. This idea is consistent with the need to get closer to the research processes and design experimentations.

The Product Design for Sustainability project—'eco-solutions supporting human activities'—requires the specific gathering and analysis of cultural-ideological associations and sustainable relations for physical solutions usable by students, staff, and visitors. The 'sustainable qualities' of designable solutions concern the creation of harmonies amongst eco-performances, production and assembly criteria, semantics, aesthetics, and analysis of human-product interactions. Students are asked to design a coherent sustainable solution that meets themed cultural attributes on a 'humanistic' and 'object' basis for experiences within targeted cultural spaces. The traditional idea of 'commercial object' is developed into the design of 'sustainable artefact' promoting contextual values, anthropic activities, and ecological aspects. The Service Design for Sustainability project—'smart services connecting people, places, and resources'—investigates value-based associations and ecological relations for intangible solutions—services and product-service systems—

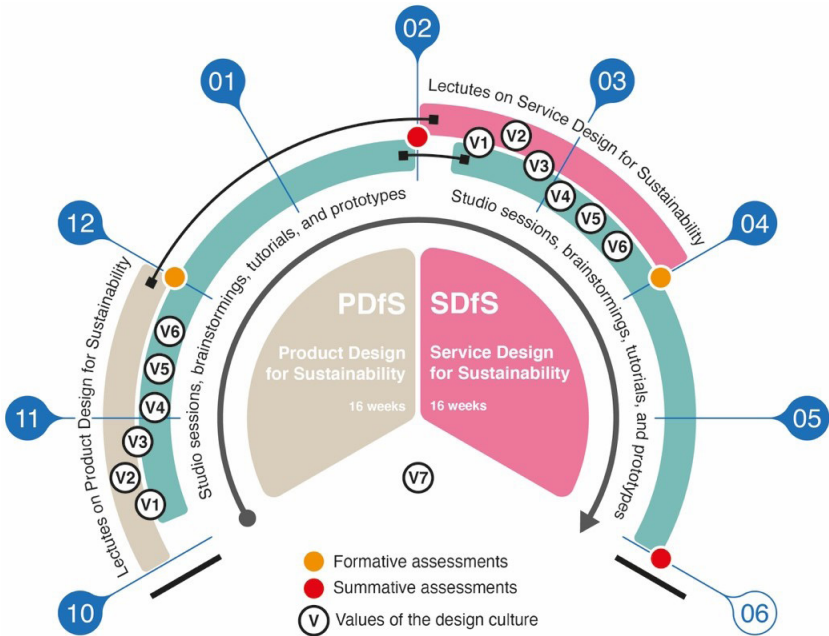
usable by all universities to improve the sustainable quality of their campuses. The 'sustainable qualities' of considered services concern the creation of innovative relations between people, activities, operational environments, and resources.

In terms of disciplinary foci, students are guided into relevant disciplinary notions through focused lectures and seminars to develop cultural design frameworks linking human activities, living ecosystems, and designable solutions. They are guided to develop their design consciousness on Design for Sustainability and an understanding of how to work using merged methodologies and learning-by-doing research approaches. The projects also aim to develop students' ability to design meaningful proposals by investigating relevant concepts and contemporary cultural issues to assess the impacts of anthropic activities in modern ecosystems.

3.5. The Cultures module: Structure.

Students spend a 16-week period for each project and are guided into relevant notions and design concepts useful to properly understand peculiarities and strengths on Product Design for Sustainability and the Service Design for Sustainability domains. Figure 3 illustrates the structure and features of the Cultures module in relation to the projects.

Figure 3: The Cultures module: Structure.



3.6. The Cultures module: Skills development and learning outcomes.

The assessment of student works is a crucial aspect to consider when designing the module, as this should provide consistent feedback on which students can assess their performance in relation to the learning outcomes, including showing how to improve all aspects of their projects. To meet the University's standards and to provide high-quality feedbacks to learners, the module employs both formative assessments (Weeks 8 and 25) and summative assessments (Weeks 17 and 33).

To learn outcomes, at the completion of the module, students will be able to:

- Recognise emerging sustainable market niches for new product and service development.
- Identify research findings into consumer groups to address projects' briefs and sustainable design experimentations.
- Analyse ethical values and their implications for sustainable artefact development, and act responsibly within social and professional contexts.
- Determine innovative research-driven strategies for concept generation that match contextual analyses, scenario development, human-centred analysis, materials, etc.
- Select design findings into existing sustainable artefacts to decode potentialities to be applied in new projects.
- Work and be confident with both tangible and intangible sustainable solutions—and on how values - to develop autonomous thinking needed to converge these disciplinary areas.
- Foster cultural alliances and recognise the cultural relevance of transposing sustainable tribalism into product and service design.
- Take mature decisions to determine meaningful design directions in Product Design and Service Design domains, at all scales.
- Communicate sustainable values to wider communities through design experiences.

4. Results and student projects

Both Product Design for Sustainability and Service Design for Sustainability projects give students the chance to experience Sustainability by proposing personal reflections, empathy, and curiosity. The structure of the module and the chance to work on a familiar testing ground allow students to go beyond canonical ideas and research issues. In the first two years since its introduction, students have shown firm commitment to bringing first-hand experiences and values which reflect originality and a willingness to explore unconventional topics. For instance, outstanding

projects developed in the Product Design for Sustainability domain concerned tangible artefacts to improve the recycling processes on campus, modular relational areas to relax and study (Figure 4), 'green' objects to self-produce foods, promote biodiversity, or improve the students' mental health (Figure 5), and stackable products to protect the natural areas and the local wildlife, and artefacts to empower the production of energy.

Projects made in the Service Design for Sustainability domain opened up students' critical thinking in considering the impact of anthropic actions on the local territory. Field analyses allowed students to identify sensitive topics for their everyday life, such as relational architectures to swap tangible and intangible goods, smart applications to improve the recycling processes and develop informal economies (Figure 6), services to stay healthy and reduce food wastes (Figure 7), and services to employ student skills to self-produce primary goods.

Overall, the design culture on Design for Sustainability reflected in a stronger awareness of students' skills as well as higher impacts on Year 3.

5. Conclusion

The creation of a new design module centred on Design for Sustainability at undergraduate level, which is the first time where learners get in touch with structured academic notions on Sustainability and transition studies, causes profound examinations of the programmes' philosophy where this module is expected to contribute, as this new complexity opens to reflections that goes beyond the mere sharing of notions. This aspect is very important because is consistent with the Target 4.7-'education for Sustainable Development and global citizenship'-part of Sustainable Development Goal 4-'Ensure inclusive and fair quality education and

Figure 4: An eco-solution to study and relax (Student: Louis Wise).



Figure 5: Green pod supporting local biodiversity (Student: Charlotte Soukal).



Figure 6: A collaborative service to encourage students and staff to recycle items that can't be recycled through normal council collection (Student: Katrina Wood).

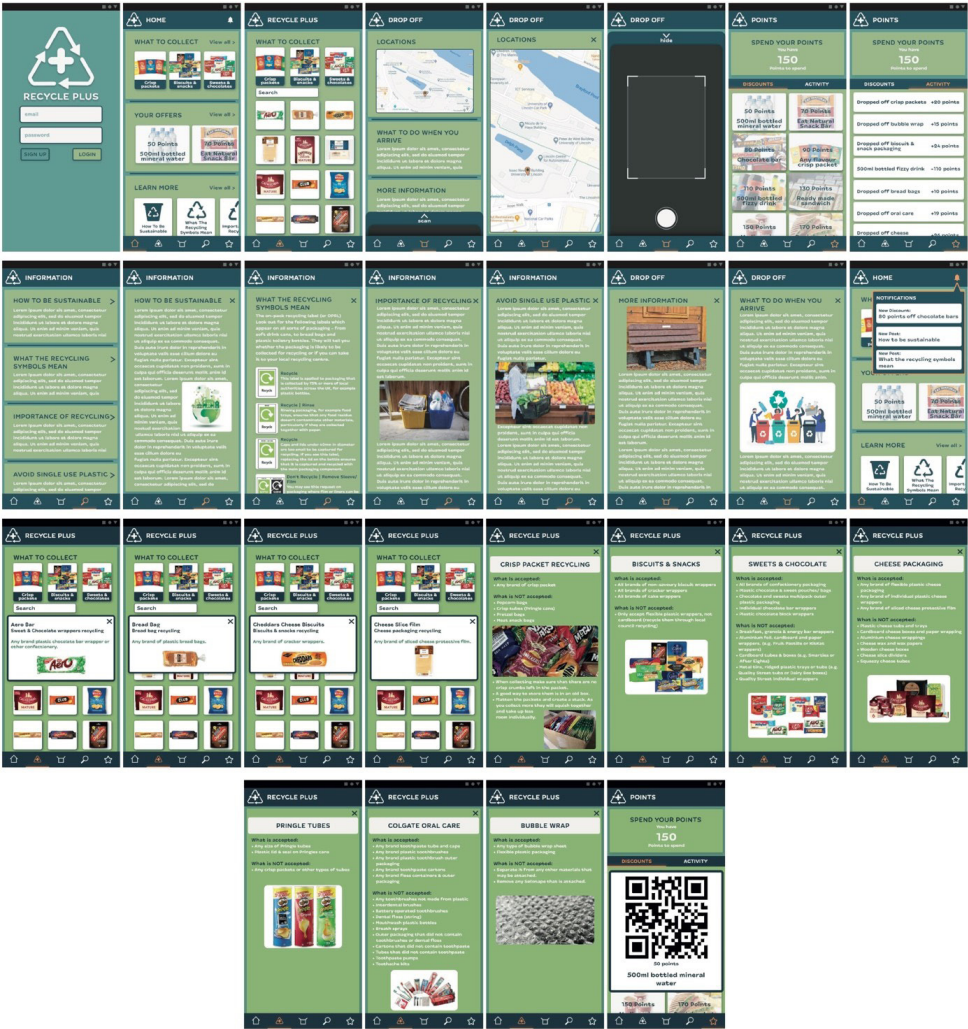
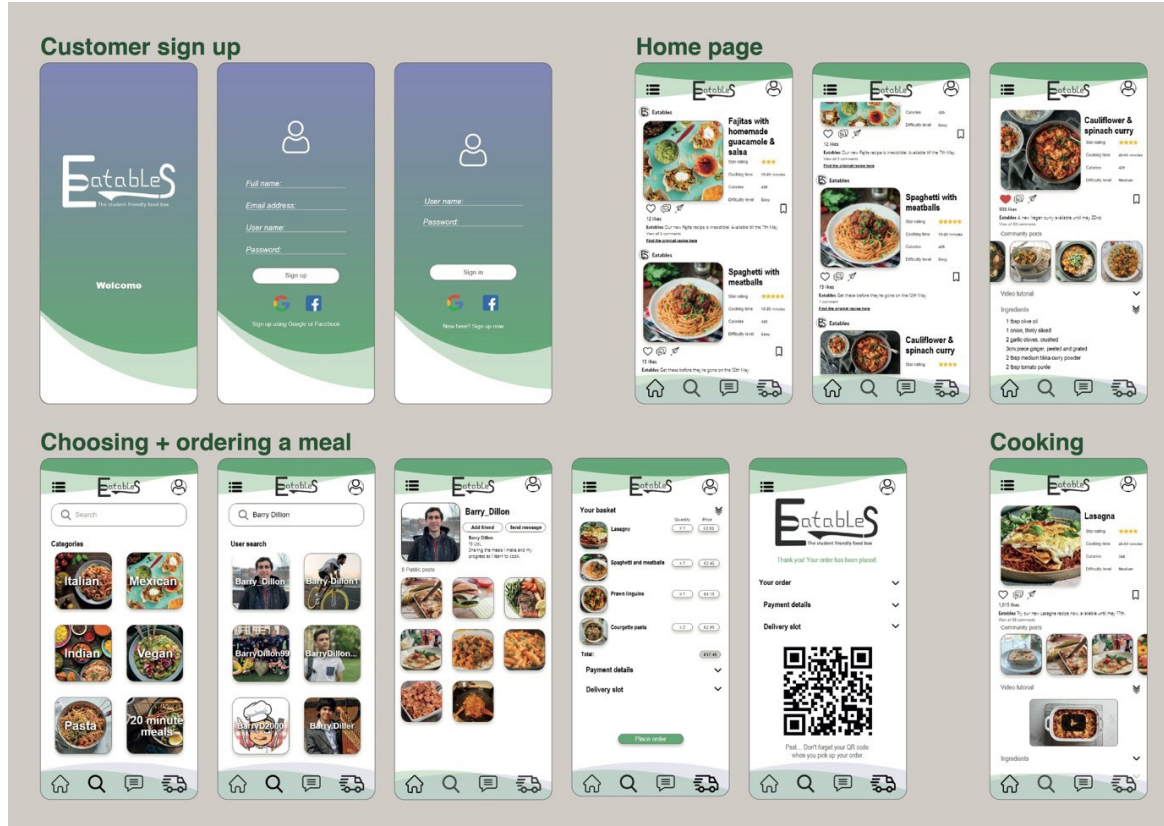


Figure 7: A service to mitigate the waste of food within the student community (Student: Declan Greene).



promote lifelong learning opportunities for all'–which opens up important debates to teach challenges, learning opportunities, and students' experience (United Nations, 2017).

As discussed in this chapter, the chance to qualitatively contribute to the Lincoln School of Design's offer elicited innovative interpretations on the idea of Product Design, which at the University of Lincoln is now intended as a modern discipline having a strong tradition and a capability to face the contemporary issues of the sustainable society; it is connected with new research areas by employing advanced teaching methodologies that include students into a holistic learning process pairing human values led by students and design skills required by markets. The recorded students' feedback also shows the positive impacts of this cultural change, as they feel more in touch with modern academic disciplinary debates, and through which they are more able to shape a solid reflective, creative practice.

The experience discussed in this chapter also shows that, if well calibrated to meet student needs, it is also possible to situate the new sustainable design culture within merged teaching scenarios, whereas the changes occurred aim to increase the quality of the teaching experience. At a School level, introducing the new design culture on Sustainability has positively improved the quality and reputation of the BA (Hons) Product Design programme and triggered cascade improvement processes that are involving even Year 3 modules, where topics related to the social dimension of Sustainability, such as Social Inclusion and Social Innovation, have been introduced.

6. Discussion on teaching and learning

In addressing issues of Sustainability, the projects set out in the Cultures module present students with a set of complex or 'wicked' problems that may contain multiple stakeholders and relate to a variety of systems, influencers, and potential impacts (Rittel and Webber, 1973). These briefs require students to reflect on the problem from several angles and hold multiple considerations in mind as they work to come up with a viable solution.

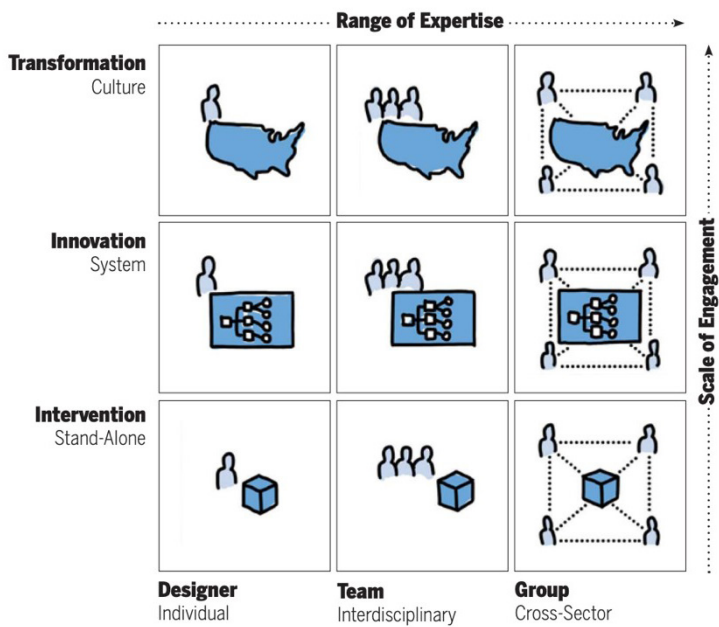
Development of skills is a tremendous opportunity. the projects provoke deep analysis and sometimes a need to question personal assumptions or 'lazy thinking'. The complexity of the briefs enables the learning outcomes involving analysis, reflection, determining, mature decision-making to come into focus. In their Design studies prior to this Year 2 module, (in school or college and earlier in the degree course) students have had experience with briefs that require a physical solution, sometimes for one client, with a clear set of needs/requirements. The benefit of stretching students and presenting them with briefs that are not so easily addressed is that they become more reflective, sensitive, and aware.

The 'live' nature of the briefs and the collaboration with the University Estates Department offer the students the opportunity to find solutions to tangible problems. This real-world connection enables 'authentic learning' to take place (Herrington et al., 2014). Assisting students to develop complex skills such as systems-thinking is strengthened by this approach, as Rieger (2021) suggests in relation to the teaching of inclusive design.

Irwin et al. (2020) discuss how complicated problems can be answered by solutions of varying complexity and expertise in the Winterhouse Social Design Pathways Matrix (Figure 8). This matrix shows the range

of responses that students can present within the Cultures module. All viable, but with differing levels of sophistication.

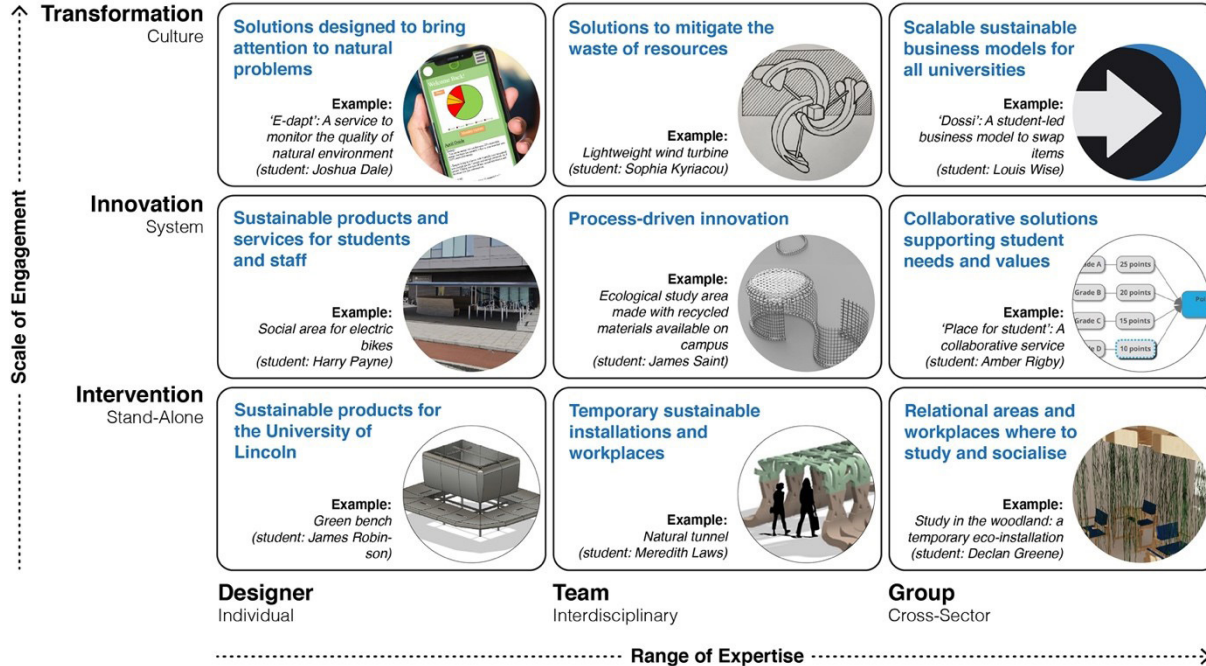
Figure 8: Winterhouse Social Design Pathways Matrix (Irwin et al., 2020).



This model was populated with examples of projects produced in the Cultures module to show the increasing level of impact and leverage as you move towards the top right corner of the grid (Figure 9).

Projects within the grid can be loosely projected onto the BA (Hons) Product Design mark scheme where a grade of 40-49% is apportioned to work that conveys “limited understanding” and “little or no attempt to relate issues to a broader framework”. A first-class grade of 70% or higher is awarded to work that shows “analytical thinking, high-level problem solving and an ability to synthesise material effectively”. It is

Figure 9: Solutions from the Cultures module.



valuable to have such a range of potential responses—and levels. The briefs do not exclude students that are operating at a lower grade point but provide ample space for higher-level work.

Exposing students to systemic, social, and cultural designs for change expands their perspective on the potential of design and increases the ambition of many. This module provides the opportunity for extremely high-level analysis, consideration of multiple variables and relationships and sensitive methods of driving transformation. On completion of this module, many high-achieving students develop their skills in systems-thinking and social awareness. Year 3 modules offer students more control over their project briefs, with the opportunity to create their own. On moving on from the new Cultures module, many students are choosing to work on service, system, and social design.

A potential development for this module teaching is to develop a multidisciplinary group aspect to the project work, a strategy identified by McCune et al. as favoured by many who teach wicked problems in higher education (2021).

Author contributions

All authors have equally contributed to the study's conceptualisation and development. The writing of the different sections is attributed to Emilio Rossi for 'Introduction', 'Aims', and 'The design of the Cultures module'; to Alexa Mottram for 'Abstract', 'Results and student projects', and 'Conclusion'; to John Stocker for 'Discussion on teaching and learning'.

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