

The Design Compass®: Evaluating a new tool for sustainable product design with students

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Abstract

The Design Compass is an online tool to support the development of commercially viable products whilst navigating environmental sustainability and social impacts. Undergraduate Product Design students from Falmouth University and the University of Chester used the Design Compass throughout a taught module. The project saw cross-institutional collaboration between students, academics, and the Design Compass developers, Bang Creations Ltd. Qualitative research focused on feedback provided by the students on their experience of using the tool, their design process and outcomes developed. The study provides a positive indication of the benefits of the Design Compass in a learning and teaching context, and advantages over other eco-design tools. Student feedback was also helpful in providing suggestions for improvements for the tool. Some of these suggestions have already been implemented by Bang Creations in a later iteration of the Design Compass.

Introduction

The Design Compass is an online tool to support the development of commercially viable products whilst navigating environmental sustainability and social impacts. It has been developed by B-Corp design consultancy, Bang Creations Ltd. They have already used an earlier version of the tool to develop products such as the Alora sustainable baby crib (Bang Creations 2025). More recently they have partnered with Falmouth University and the University of Chester to develop the Design Compass further.

This paper reports on an initial pilot study to explore the value of using the Design Compass in higher education. To gather feedback on the usability and effectiveness of the Design Compass, the tool was integrated into 2nd year taught modules on the BA(Hons) Sustainable Product Design course at Falmouth University and the BA(Hons) Product Design course at the University of Chester. Both courses had independently worked on live project briefs supported by Bang Creations in the past, but this project presented an excellent opportunity to extend the collaboration as a cross-institutional approach.

Background

When developing new products, or improving existing designs, tools such as the Life Cycle Design Strategy (LiDS) wheel (Brezet and Van Hemel 1997) and the Okala Ecodesign strategy wheel (Okala 2012), are used by designers to explore opportunities to reduce environmental impacts across the life cycle of the product. For global sustainable development, the 'Three Pillars of Sustainability' (Brundtland 1987) highlight the need to consider the interrelated social and economic impacts as well as environmental impacts.

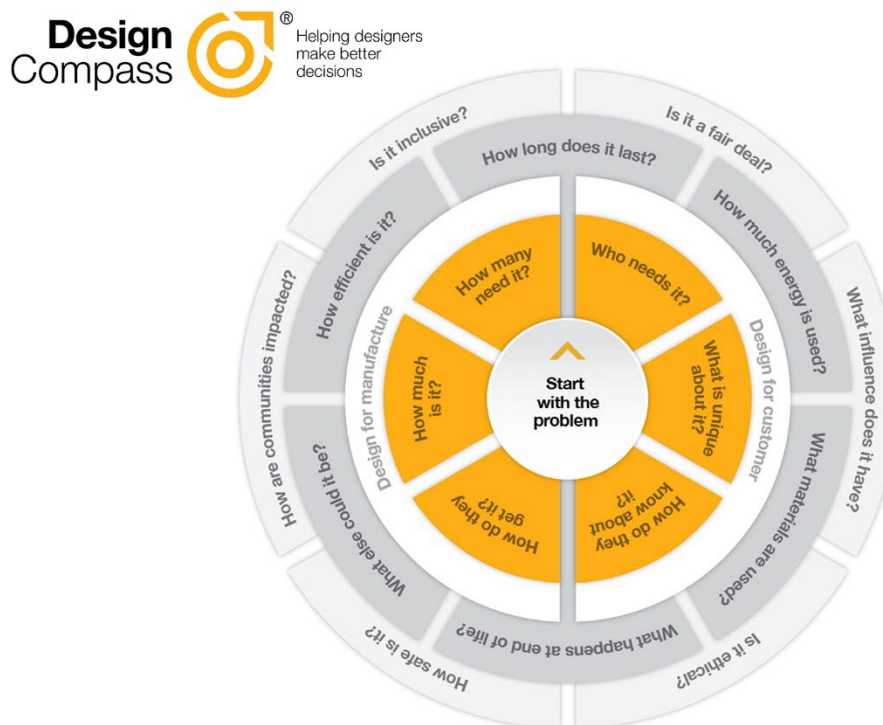


Figure 1: The Design Compass.

The Design Compass (Figure 1), an online tool for people engaged in bringing a physical product to market, helps to navigate these three interrelated issues simultaneously. It differs from existing tools by emphasising design decisions to support a commercially viable product whilst navigating environmental sustainability and social impacts. The tool is comprised of three circular layers that represent design for social, environmental, and economic sustainability. Each layer is segmented into six questions designed to provoke, challenge, and inspire the development of sustainable design concepts, whilst providing actionable guidance (using written and visual prompts, and links to other resources) on how to address the challenges.

The economic layer (centre) of the tool investigates what is needed to bring a successful product to market. Here the focus is on critical business strategies relating to customers and manufacturing. The environmental layer (middle) prompts eco-design strategies that can be considered across the lifecycle of the product. Examples include exploring energy consumption, material selection, durability and reparability. The social layer (outer) probes the meaningfulness of the product and the value it can bring to society. Here the focus is on inclusivity, equality and social justice.



Figure 2: Using the benchmarking feature.

The tool is unique as it has three distinct uses: providing a structured framework for learning sustainable design strategies; generating innovative ideas and evaluating them through the questions across the three layers; and benchmarking design concepts against industry standards (Figure 2). Through the online user interface, the circular layers can be rotated so numerous combinations of three questions (relating to social, environmental and economic sustainability) can be aligned and explored together. This

feature of the tool reveals the tensions that can exist between business priorities and the needs of people and planet.

Methodology

The Design Compass was introduced to both student cohorts at the beginning of their respective design modules (see timeline in Figure 3). Fourteen students were enrolled on the module at Falmouth University and eight at the University of Chester. Product design outputs were required from both modules, and the students were given identical design briefs to tackle. The Falmouth module explores the Circular Economy whilst the Chester module focuses on developing commercially viable products. The pairing of these modules conveniently reflects the ambition of the Design Compass to help designers bring sustainable products to market. The shared brief facilitated cross-institutional collaboration but also provided comparability on how the students used the Design Compass and equivalence on the feedback generated. The brief asked the students to engage holistically with the Design Compass, by exploring lighting design concepts for the circular economy.

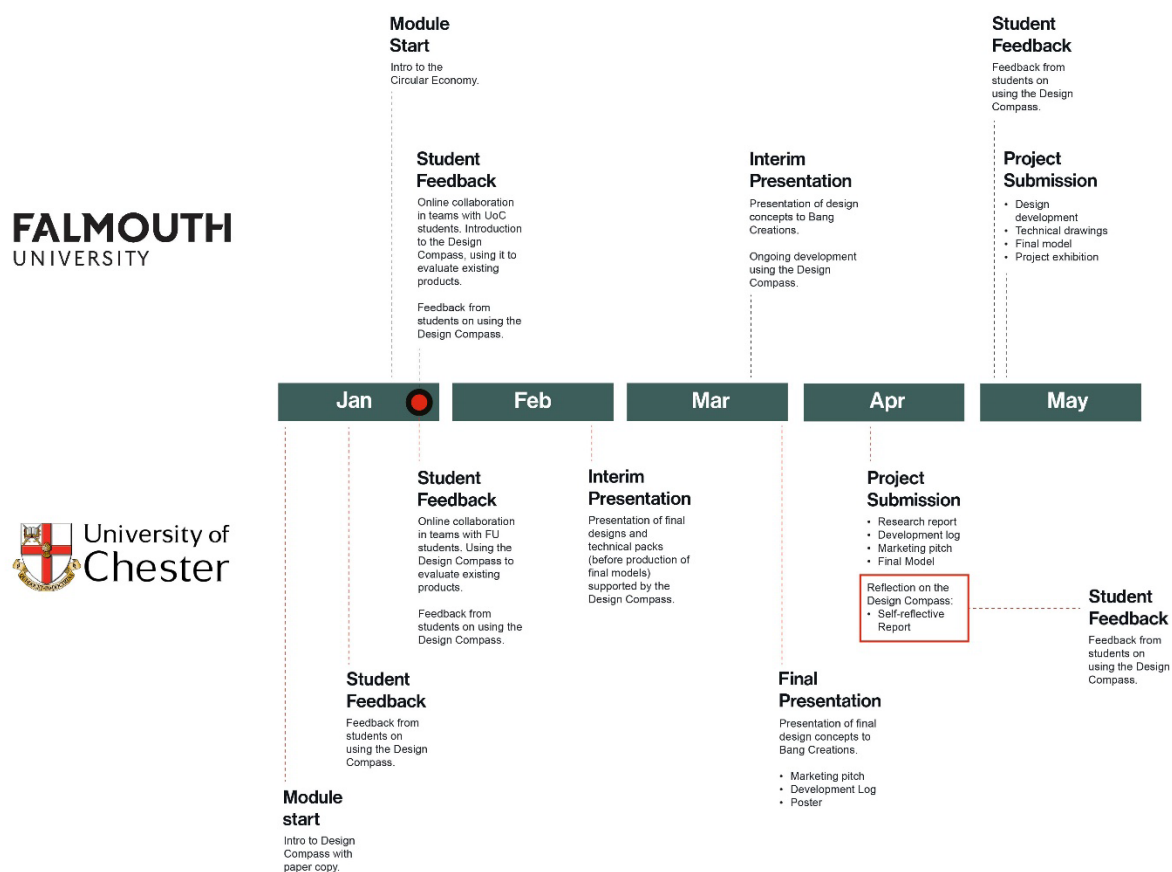


Figure 3: Project timeline for module activities.

Qualitative research was conducted at the beginning and end of the project. The student feedback reflected on the Design Compass in response to three specific questions:

- How have you used the Design Compass?
- What did you find most useful about the Design Compass?
- What would you change to improve the Design Compass?

The students' responses were collated and coded to analyse the frequency of themes reported (Huberman and Miles 1994). This quantitative approach provided a measure of the most common themes, although there is no statistical significance due to the small sample size. Another limitation in the approach was that the Chester students started their module two weeks earlier than the Falmouth students so the initial feedback on the Design Compass was only from this cohort. At this stage, they were introduced to the tool in a printed paper format. The introduction to the Design Compass for the Falmouth students coincided with the collaborative workshop where both cohorts evaluated the tool together.

At the end of the module the course teams were able to review how the students had engaged with the Design Compass through the work submitted for assessment. In particular, the way in which the students had used the tool to learn sustainable design strategies, generate and evaluate design ideas, and how effectively they had benchmarked their concepts against existing products. Further student feedback was gathered through a self-reflective report written by the Chester students.

To ensure the research was conducted ethically, all the students were provided with participant information sheets that described the project and their anticipated involvement with the research. The academics talked through the participant information with the students before they signed consent forms. As Falmouth University led the research, the project received research ethics approval from Falmouth University's Research Integrity & Ethics Committee (RIEC).

Findings

The students responded to the design brief with a range of innovative lighting concepts. There was good evidence of engagement with the Design Compass to inform the design process. Their responses to the questions were as follows:

How have you used the Design Compass?

Across all stages of the project, the students most frequently reported that they used it to 'generate ideas' and 'evaluate ideas' (see Table 1). The ability to use the tool to initiate new concepts and consider the viability of existing ideas against the three layers, was particularly highlighted.

Across the collaborative and final stages of the project, the students noted how they had used it to 'evaluate existing' products. This preceded using the tool to benchmark their design ideas against competitor products. At the final stage of the project, more emphasis was placed on using the tool to 'refine concepts'. A student noted that they had used the Design Compass, "...to help to advance some of my more final ideas, to ensure that I had thought about every aspect". At this stage too, students noted how they had 'benchmarked concepts' using the tool, for example to, "...evaluate against existing ideas and explore the market".

Table 1: Coded responses collated for question 1

#	How have you used the DC? - Coded responses	Code Frequency (n)
1	Generate ideas	16
2	Evaluate ideas	10
3	Refine concept	7
4	Question prompt	6
5	Evaluate existing	5
6	Benchmark concept	5
7	Sustainable design	2
8	Track progress	2

What did you find most useful about the Design Compass?

Although the students had used it to benchmark their concepts against existing products, few of the students identified this as the most *useful* feature. Instead, using the tool to 'generate ideas' was deemed most useful across all stages of the project (see Table 2).

Table 2: Coded responses collated for question 2

#	What did you find most useful about the DC? - Coded responses	Code Frequency (n)
1	Generate ideas	10
2	Question prompt	9
3	Reframe ideas	6
4	Social layer	4
5	Evaluate ideas	3
6	Consider product impacts	3
7	Environmental layer	2
8	Refine concepts	2
9	Benchmarking	2
10	Improve design	2
11	Identify gaps	2
12	Economic layer	2
13	Widen knowledge	1
14	Creative thinking	1
15	Framework	1
16	Discussion	1
17	Intuitive design	1
18	Interactive	1
19	Beyond eco sustainability	1
20	User centred	1

Similarly, 'reframe ideas' was when it had forced the students to think differently in ways they had not expected. For example, one student noted, "I found it useful to take questions that I usually wouldn't ask towards my ideas and from that it helped me think more outside of the box". Indeed, the 'question prompts' were seen as a useful guide throughout the process. However, although the Design Compass UI provides detailed written and visual information that unpacks the meaning of the questions, there was no specific feedback from the students on how useful this information was to them.

What would you change to improve the Design Compass?

Most responses were unique suggestions for improving the UI, such as 'colour code the layers', 'optimise for smart phone', and 'customise UI colours' (see Table 3). Bang Creations have carefully reviewed these suggestions and, where appropriate, have factored them into ongoing development of the Design Compass. For example, the suggestion for a 'light and dark mode' to improve readability and reduce eye strain in varying light conditions has since been implemented.

Table 3: Coded responses collated for question 3

#	What would you change to improve the DC? - Coded responses	Code Frequency (n)
1	Colour code the layers	3
2	Light and dark mode	3
3	Wheel layout	2
4	Guidance on Benchmarking/ colour	2
5	Questions more applicable to early ideation	1
6	Remove shadows for easier cut out (paper)	1
7	Typo on paper version	1
8	Bolder key words	1
9	More colour	1
10	Open source	1
11	Optimise for smart phone	1
12	Menu font legibility	1
13	Title the prompts on Idea Generator	1
14	Rotatable layers on Benchmark	1
15	Rotate to only Customer or Manufacture on Idea Generator	1
16	Insert reference product image	1
17	Customise UI colours	1
18	Customise UI font size	1
19	Integrate all three layers	1
20	Save Benchmarks on website	1
21	Second wheel for Benchmark comparison	1

Students suggested changes to the benchmarking tool, shown through 'guidance on benchmarking/colour', which was also indicative in some of the final projects submitted. A student commented that they needed, "...more information with the benchmarking as I was unsure what colour to put on some of the questions". Another student felt it would be helpful to have a, "...second wheel for the

comparison product in the benchmark tool". These responses reflect the earlier observation that the students found the idea generation feature, prompting sustainable innovation, more useful than the benchmarking tool.

Further to the evaluation of student feedback, three other critical areas were explored by the course teams:

A framework for learning sustainable design strategies

Sustainable design strategies are a core part of 1st year teaching at Falmouth, so the students were familiar with the principles presented in the social and environmental layers of the tool. At Chester, sustainable design is introduced in the curriculum through this module, so to build their contextual awareness and vocabulary, the students needed to explore a variety of sustainable design models before adopting the Design Compass. A paper version of the tool proved particularly effective (Figure 4), helping students to connect more actively by having the compass in-sight and in-mind throughout the design process.



Figure 4: A paper version of the Design Compass created by a University of Chester student.

Initial discussions with Chester students revealed mixed attitudes toward sustainable design. Some had a desire to engage with sustainability, while others viewed it as a superficial tick-box exercise. However, reflections at the project end evidenced a significant shift in mindset. One student admitted, "If I were to

design my product again, I would make sure to use the Design Compass all the way through rather than at the end... I learned how truly important sustainability is when creating a product in the 21st century.”

Idea generation and evaluation

The three layers of the Design Compass were discussed through group reviews of the concepts which helped students to evaluate their ideas, especially through the lens of the environmental and social layers (Figure 5). Chester student feedback on the idea generation aspect noted the tool’s ability to “spark conversations and new ideas” to “think more outside of the box” and “see where the concept was lacking”.



Figure 5: Peer review of concepts using the Design Compass at University of Chester.

The students used the idea generation feature of the Design Compass UI to produce randomised sets of questions across the three layers. For example, a Falmouth student generated four separate interpretations during the early concept development stage (Figure 6). The triangular sections represent a portion of the three layers replicated by the student in their sketchbook. They reflected through sketches in response to themes including, ‘interactive features’, ‘recyclability’, ‘repair’, ‘maintenance’ ‘long-lasting’, and ‘renewable energy’. The social aspect is suggested with ‘communities’ and ‘safety’, but this could be developed further.

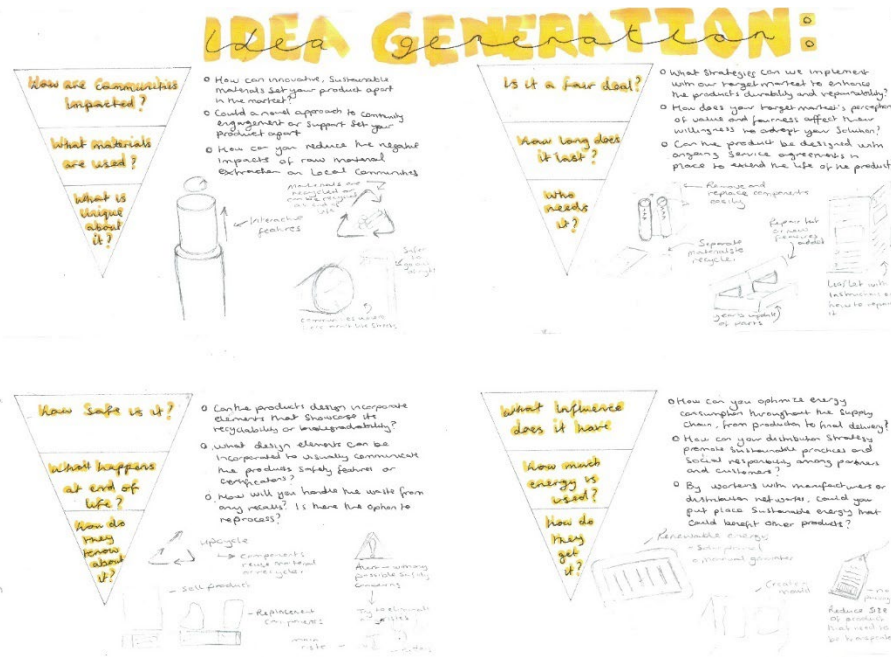


Figure 6: Idea generation prompts explored by a Falmouth University student.

In another example, (Figure 7), a Falmouth student used the Design Compass to evaluate the 'good' and (industry) 'standard' areas of their concept and prototypes. They used a colour key applied to the selected section on each layer. The sketchbook page demonstrates analysis of a concept model with annotations. This process supported better decision making, leading to the development of three main design concepts.



Figure 7: Falmouth University student's concept model evaluation using the Design Compass

Benchmarking design concepts

To support benchmarking activity the students investigated existing manufactured products. For example, Falmouth students were supported by the university's BSc Robotics course to help understand the electrical componentry in a lighting product. To build the skills and experience needed to design for manufacture, Chester students participated in hands-on disassembly activities. Using the design compass as a discussion tool, students assessed the relative sustainability of the products disassembled and later applied those evaluative skills to their own designs.

Figure 8 shows an example of how a Falmouth student used the benchmark tool, including reflective comments on their design concept. Presented in their sketchbook, they used the key colour to score the against the criteria. They also did a comparison with four existing products, using the idea generation feature of the Design Compass, to focus on three questions in the analysis of the product.

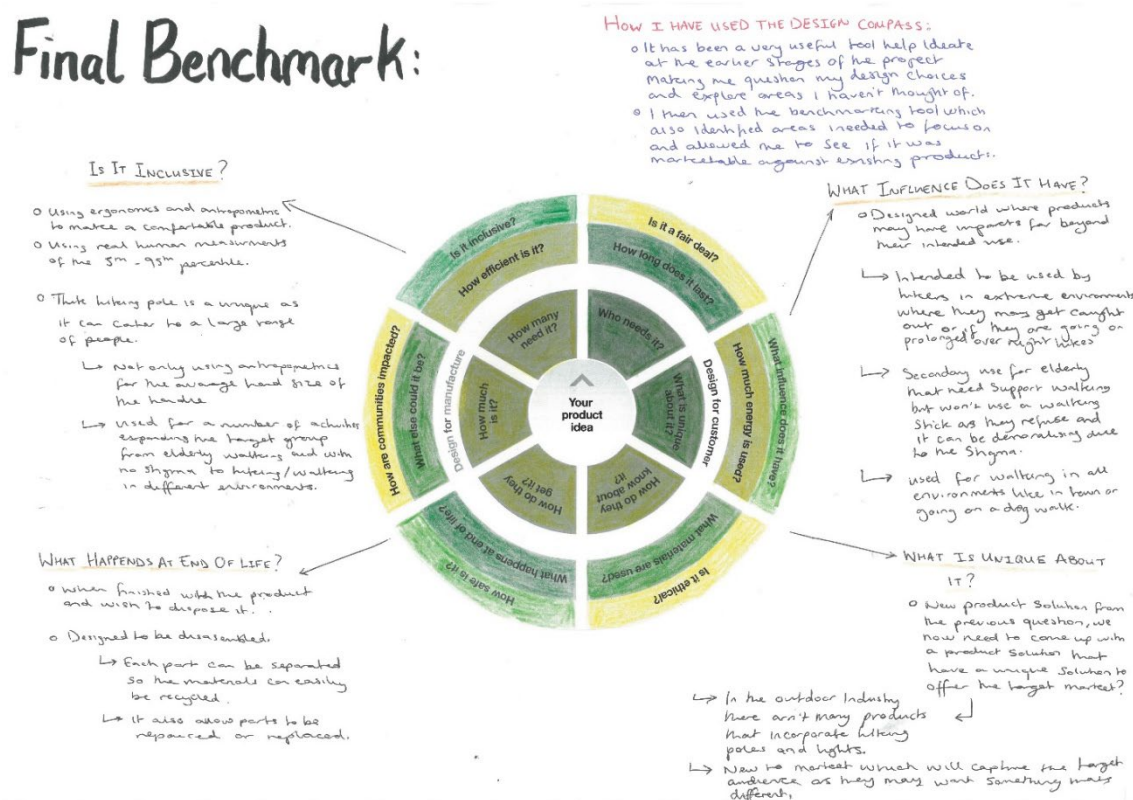


Figure 8: Falmouth University student design concept benchmarking.

A progression in the use of the Design Compass was demonstrated in most of the students' work. Students responded to fewer of the questions on the Design Compass in the early design stages. In later stages, they presented a richer engagement with the three layers, demonstrated through a colourful assessment of their project.

Although the students reported that benchmarking their ideas against existing products was challenging, the process facilitated critical reflection and group discussions. Regardless of the accuracy of the coloured segments, this was a valuable learning activity, and the conversations demonstrated an

increased maturity of understanding. An example of critical reflection using the benchmarking tool by a Chester student is shown below (Figure 9).



Figure 9: University of Chester student design concept benchmarking.

Discussion

The Design Compass encouraged holistic thinking by prompting students to consider not just aesthetics and user experience, but also environmental and social impacts. This encouraged a more rounded approach to design: for the Chester students who were at an earlier stage of learning about design and sustainability, and the Falmouth students who had focused less on commercial viability. Although all the students found it challenging to navigate all the environmental and social sustainability questions, the tool nurtured their understanding of sustainable design and helped them to consider the overall impacts. This also demonstrated an 'ownership' of their learning and confidence in considering the sustainability credentials of their project alongside business strategy. For example, the question prompts helped the students to think more critically about their own work, become more objective and less invested in a personal creative agenda. Module tutors felt this was helped by the questions coming from the tool, not just them.

The students found using the Design Compass to help generate ideas its most valuable feature. This was most apparent when they worked together to evaluate their concepts. Group sessions using the Design Compass's idea generation function were particularly effective in sparking discussion and new ideas. The tool provided a structured way to approach problems and move design concepts forward. The questions provoked the students into new ways of thinking, whilst the interactive feature – where three questions across the three layers align to become the focus – is a particularly playful aspect of the tool.

The tool also helped to bridge the gap between creative idea generation and the marketability of products. When Bang Creations have supported student workshops, they have observed that the

students come with strong creative ideas but often lack an understanding of what makes a product commercially viable. The Design Compass helped them consider business models and market needs from the outset, reinforcing that only marketable products progress to development.

The benchmarking tool was popular for its visual impact and was included in student presentations. However, they requested more guidance on how to interpret and justify their benchmarking choices. The benchmarking tool invites critical thinking, but without an in-depth knowledge of comparative products, some students struggled with it. The benchmarking UI offers a convenient way of colour coding the questions. Notably, in the Falmouth cohort, students who physically reproduced the Design Compass in their sketchbook, demonstrated a deeper level of reflection, unpacking their thought process on each section.

Other sustainability models used by the students include the 'Three Pillars of Sustainability' (Brundtland 1987); Life Cycle Design Strategy (LiDS) (Brezet and Van Hemel 1997); The Butterfly Diagram (Ellen MacArthur Foundation 2021); methods from the Circular Design Guide (Ellen MacArthur Foundation 2016); Okala Ecodesign Strategy Wheel (Okala 2012); and Emotionally Durable Design Nine (Haines-Gadd et al. 2018). The Design Compass differs and 'adds value' to the existing tools by:

- Integrating business strategy and sustainable design thinking into one project-focused design tool.
- Supporting sustainable design innovation through an engaging and interactive online tool, particularly the idea generation and benchmarking features.
- Integrating resources and supporting material into an online tool, directly responding to the question prompts, to provide actionable guidance to support informed decision making.

Conclusion

The Design Compass prompted deeper critical thinking and helped students adopt a systems-thinking approach to sustainable design. Academics from both courses observed improved decision-making and greater confidence when discussing sustainability strategies. By embedding the Design Compass early in the process, students shifted from abstract innovation to an emphasis on viable, sustainable solutions, fostering a more sophisticated understanding of their role and impact as designers.

The tool is designed to encourage iterative, circular design thinking and project-focused learning. Students learn best through doing, and the Design Compass supports this by challenging them at every development step. Ongoing collaboration with academia and iterative tool development will ensure it continues to support effective learning and innovation in product design.

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