

Fostering Circular Competencies in Design: From Uncertainty to Agency

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Abstract: *This paper examines the concept of Intertwinia as a representation of new possibilities and futures in sustainable design, juxtaposing it against the often-misused term of sustainability in the corporate world. Our investigation draws upon Tony Fry's notion of "sustain-ability" to challenge traditional discourses on sustainability, advocating for a new paradigm that recognises the finite nature of resources and the significance of ethical design interventions. We focus on the pivotal role of design educators in equipping students with the necessary capabilities to affect change in a circular economy. By highlighting the importance of incorporating a circular mindset within design education, we present two courses at the Copenhagen School of Design and Technology. One course aimed at developing circular fashion product designers, capable of enhancing material longevity; the other course focused on designers as "change agents" who can guide companies towards sustainable and circular business models. The research reflects on the integration of hands-on design competencies within the curricula of the two courses, in alignment with two different frameworks for sustainability competencies. Our findings illuminate the ways in which specific educational elements foster sustainable competencies, preparing students to become agents of change in the design profession and a circular economy. Through this reflective process, the paper discusses the challenges and possibilities in design education, providing insights and inspiration for future curricular development.*

Keywords: *Circular Design Competencies, Sustainability Competencies, Design Education, Sustainable Fashion Designer, Circular Change Agent.*



Introduction

The concept of Intertwinia evokes future possibilities and untested connections. To ensure that the potential of Intertwinia can be realized, as the intertwining of deliberate design competencies to create a sustainable society, we must challenge the conversation around sustainability. The vagueness of the term has meant that, rather than paving the way for a fairer or more ethical world, sustainability is often co-opted by corporations to offer empty slogans and clichés, usually framed as part of their Corporate Social Responsibility commitments.

In this paper, we will be drawing on Tony Fry's hyphenated definition of *sustain-ability*, which connotes the "ability to constantly learn, work on and improve that which is vital to, and for, the 'being of being'" (Fry, 2020, p. 7). Fry hyphenates *sustain-ability* to show how it is different from "the political discourse on 'sustainability'," which tends to posit "economic development ... as the agency of delivery of sustainability" (Fry, 2020, p. 7). For design educators, it is particularly crucial to focus on how students can gain the *abilities* necessary to enact change post-graduation, as the transition from a linear to a circular economy requires a blend of knowledge, innovative thinking and hands-on skills. A recent report by the UN Environmental Programme concludes that "sustainable and responsible resource use and consumption is a key enabling factor for the success of virtually every international agreement and initiative aimed at carving out a better future" (UNEP, 2024, p. 2). We are far from seeing a global circular economy (Circle Economy, 2024a), and the design profession needs to take on a greater role in driving the green transition. However, "for the most part, designers are not yet using their skills and knowledge to deliberately support the green transition in the way that they should and could" (Design Council, 2021, p. 6). Peter Stebbing (2015) argues that the design profession is plagued by the unfortunate notions that, a) the future of the planet is not a design concern, b) resources are infinite and c) designers' responsibility ends at the moment of purchasing. In Stebbing's words, here echoing Fry's conception of *sustain-ability*, we need a shift from designers designing for "quantity of having" to "quality of being" (Stebbing, 2015, pp. 29–30).

To drive this shift, two types of designers are essential: 1) circular product designers focused on materials and longevity; 2) designers working as sustainability change agents to guide organizations toward sustainable visions and circular business models. In this paper, we explore how design educators can foster these two types of designers, as we reflect on two elective courses carried out within two different two-year Academy Profession Degree Programs (AP) at the Copenhagen School of Design and Technology (KEA). Designers as *change-makers* should be capable of connecting disparate entities to facilitate sustainable transformation (Design Council, 2021). This aligns with Sanders and Stappers (2014) who envisage designers as toolmakers, equipping, for instance, citizens and companies to co-create a common future. Educators must instil in students the notion of *sustain-ability*, as underscored by UNESCO's call for transformative education for a peaceful and sustainable future (UNESCO, 2020). Thus, design educators need to do more than encourage students to imagine new possibilities; they need to guide students to act now—to find workable design solutions that will help humanity escape our current global stalemate on climate action. Overcoming this paralysis requires turning "knowledge into action for sustainable development" (Brundiens et al., 2010, p. 309). As such, students need specific sustainability competencies. When referring to 'competencies' we use the definition by Wiek, Withycombe, and Redman (2011, p. 204), who state that a competency is "a functionally linked complex overview of knowledge, skills, and attitudes that enable successful task performance and problem solving." Comprehensive research exists on sustainability in higher education both in terms of identifying essential competencies and pedagogical approaches¹. However, despite largely agreeing on frameworks for sustainability competencies, actually implementing these in courses and programmes is challenging and has yet to be achieved (Wiek and Redman, 2022). Present research discusses the benefits and challenges of transforming theoretical understandings of sustainability and circular design competencies into practical, real-world educational elements to engage and prepare graduates help industries enact real and sustainable change.

The paper is structured as follows: First, we present the two sustainability competencies frameworks that the research builds upon. Then comes the research design. This is followed by the two main sections describing, analysing, and discussing each elective course in relation to the frameworks. The Circular Design course focuses on sustainability within the fashion industry and is concerned with creating circular product designers. The Green Change Agents

¹ See, for instance, Brundiens et al., 2010; Wiek et al., 2011; Remington-Doucette et al., 2013; Lozano et al., 2017; Brundiens et al., 2020; Sumter et al., 2021; Oonk et al., 2021; Libertson, 2023; Hyytinen et al., 2023.

course engages students in real-world issues by collaborating with two start-up companies. This course focus on how designers can motivate and guide others towards enacting sustainable changes. In the final section, we reflect on how the two different educational approaches can direct a path forward, which will hopefully serve as inspiration for others.

Sustainability competencies frameworks

Based on Wiek, Withycombe and Redman’s preliminary investigations into sustainability competencies in higher education (2011), Brundiens et al. have identified eight key sustainability competencies: *Systems-thinking, Futures-thinking, Values-thinking, Strategic-thinking, Interpersonal, Implementation, Integrated Problem-solving and Intrapersonal* competencies (Brundiens et al., 2020). Brundiens et al. link these key sustainability competencies with basic academic competencies and topical knowledge (Figure 1). They suggest that the *Integrated Problem-solving* and *Interpersonal* competencies underpin the other competencies. The *Intrapersonal* competency—which corresponds to what UNESCO (2017, p. 10) calls *self-awareness competency*—reflects attitudes, motivation, and intentions and is placed above the other competencies with arrows pointing in all four directions (Brundiens et al., 2020). Brundiens et al. conclude that sustainability competencies should be part of any curriculum, reiterating UNESCO’s holistic perspective on environmental education (UNESCO, 2020)—or as stated by González-Gaudio and Gutiérrez-Pérez, “All education must be environmental; otherwise, it is not education” (2017, p. 131).

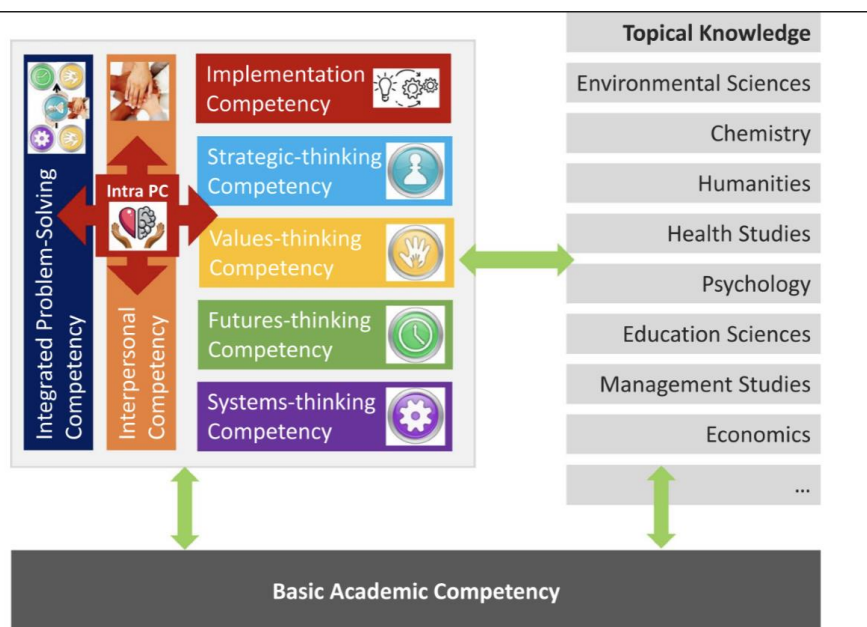


Figure 1. Framework linking key sustainability competences with basic academic competencies and discipline-specific knowledge. Intra PC refers to Intrapersonal Competency/Mindset. (Figure 4 in Brundiens et al., 2020)

Also drawing on Wiek et al. (2011), Sumter, Koning, Bakker, and Balkenende have developed the Circular Design Competency Wheel (Figure 2), which comprises nine essential circular economy skills: *Circular System Thinking, Design for Recovery, Design for Multiple Use Cycles, Circular Business Propositions, Circular User Engagement, Circular Materials and Manufacturing, Circular Impact Assessment, Circular Economy Collaboration* and *Circular Economy Storytelling* (Sumter et al., 2020, 2021).

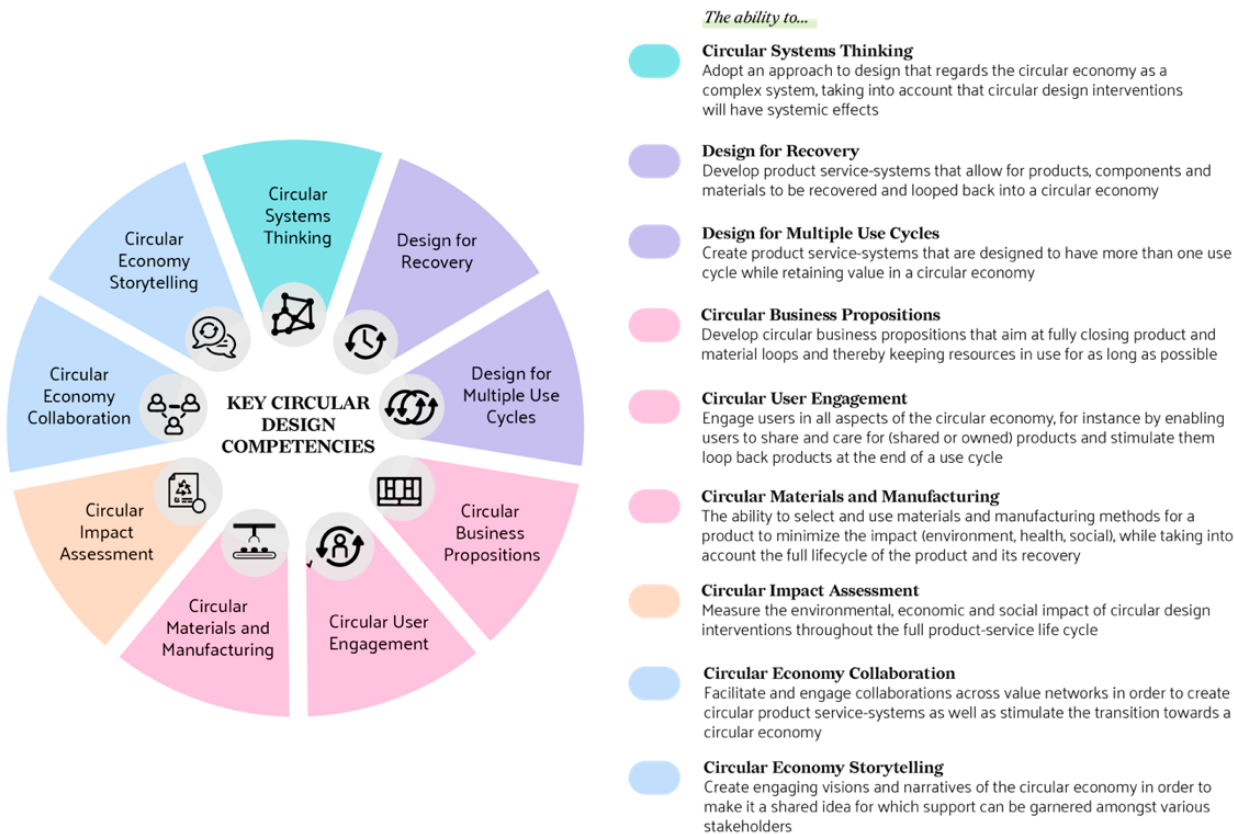


Figure 2. The Circular Design Competency Wheel illustrating nine key circular economy competencies for design (Figure 4 in Sumter et al., 2021)

We propose combining the Brundiens et al. and Sumter et al. frameworks to integrate broad sustainability competencies (Figure 1) with specific circular design competencies (Figure 2). The next section outlines how the frameworks have guided our research design.

Research design

Our research is based upon different kinds of empirical material collected during the two courses. The analysis of the Circular Design course is based on observations, photos documenting students experiments, student-generated photo records of workshop processes and products, and final exam products presented at their oral exams. Additionally, after the course, seven students participated in a qualitative focus group interview preceded by a short survey. The data used in our analysis of Green Change Agents include students’ individual reflective journals, individual written assignments, multimedia workshop materials, oral exams, and written and oral feedback from participating companies.

Using qualitative content analysis, we focus primarily on the “*informational content of the data*” (Forman and Damschroder, 2008, p. 40). Qualitative content analysis was used to analyse transcripts from focus group interviews (Circular Design Course) and students’ reflective journals and written assignments (Green Change Agents Course). To structure the data, we used both deductive and inductive approaches (Forman & Damschroder, 2008). First, using a deductive approach, the sustainability competencies (Brundiens et al., 2020) and the Circular Design Competencies (Sumter et al., 2021) were used as pre-set categories for coding the data. Excerpts were highlighted to map the frequency of descriptions pointing to developing the different competencies, thus demonstrating students’ overall engagement across the two frameworks. Second, we inductively looked for patterns leading to emerging categories to reveal connections between learning specific competencies and the educational content. Findings were supplemented by the additional empirical data mentioned above. Throughout the paper, excerpts from the data (primarily quotations from students) are included as examples and are representative of the empirical material.

The Circular Design Course

Circular fashion designers play a vital role in the transition from linear to circular design. The conventional clothing industry predominantly follows a linear model, with up to 61% of garment materials ending up in landfills or being incinerated (Circle Economy, 2024b); less than 1% of the global fibre market is sourced from pre- and post-consumer recycled textiles (Textile Exchange, 2024). For designers to make well-informed choices grounded in circularity, it is essential to distinguish between different circular product-design strategies. In this context, key competencies include *Design for Recovery*, *Design for Multiple use Cycles*, and *Circular Materials and Manufacturing* (Sumter et al., 2021), all of which are closely aligned with the core principles of the circular economy. Simultaneously, it is important to understand interconnections and identify opportunities for intervention. Indeed, interconnectedness is critical to the idea of Intertwinia and to Fry's concept of sustainability, as to become competent circular designers, students must learn to grasp the "variable relations of complexity" (Fry, 2020, p. 8) that characterise our present industrial landscape. Thus, designers must also develop the competency related to *Circular Systems Thinking* (Sumter et al., 2021).

The Sustainable Fashion Tech programme focuses on designing sustainable and responsible clothing and maintains close ties with the Danish fashion industry. The aim is to educate fashion designers who can support small and medium-sized businesses in their circular transition. The Circular Design course lasts 10 weeks and involved 24 second-year students in 2024. Overall, the course seeks to develop circular competencies that strengthen students' ability to make informed decisions with minimal environmental impact (Sumter et al., 2021). Emphasising hands-on experiences and theoretical knowledge, the curriculum revolves around circular economy principles, as they apply to textiles and fashion, incorporating crucial differences between conventional and circular methods and the complexities of the fashion industry.

The course revolved around the Ellen MacArthur Foundation's Butterfly Diagram (Ellen MacArthur Foundation, 2017, 2019) and the three principles of the circular economy: (1) eliminate waste and pollution, (2) circulate products and materials, and (3) regenerate nature (Ellen MacArthur Foundation, 2024). It also incorporated the European Commission's Waste Framework Directive (n.p.), leveraging R-strategies to prioritise waste prevention and circular solutions (Potting, Hekkert, Worrell & Hanemaaijer, 2017).

In three different workshops, hands-on lab sessions (using various circular design methods) were supplemented by lectures and expert talks covering the entire circular economy value chain in textiles and fashion (see Table 1).

Table 1: Overview of the 10-week course *Circular Design*. The expert talks and readings have not been included.

CIRCULAR DESIGN	Workshop 1 (13 days)	Workshop 2 (12 days)	Workshop 3 (10 days)	Student-initiated assignment (11 days)
Main focus	Upcycling (R7 – Repurpose strategy)	Redesign (R6 – Remanufacturing Strategy)	Design for circularity (R8 - Recycling strategy)	Applying the circular design skills acquired, along with circular systems thinking
Mined materials	Pre-consumer textiles: Tablecloths	Post-consumer textiles: Men's shirts		Student selected material
Main individual assignments	Subtraction cutting Material manipulation Screen print design	Deconstruction Reconstruction Mending Patchwork	Experimenting without disruptive elements Circular economy design framework	Project plan Identifying a circular challenge User research Applying circular design methods
Outcome	Experiments 1 prototype 1 video Group exhibition	Experiments 1 prototype presented and sold at SOME 1 video	Individual catalogue of physical experiments and sewing samples.	Sketched outfit, with one style presented as a prototype Photo presentation of prototype

The three workshops explored different R-strategies (Potting et al. 2017). Workshop 1 focused on *repurpose* (R7-strategy), workshop 2 on *remanufacturing* (R6-strategy), and workshop 3 on *recycling* (R8-strategy). *Recycling* (R8-strategy) aligns with the third level of the waste hierarchy and is central to the EU's 2030 Strategy for Sustainable and Circular Textiles (European Commission, 2022), promoting durable, repairable, and recyclable products with increased

use of recycled fibres. The course culminated in a student-initiated assignment where students applied their acquired skills to tackle a circular design challenge for an existing fashion brand, producing a sketched outfit and a physical prototype. In the workshops, the R-strategies *repurpose* and *remanufacturing* stood out most clearly from traditional design approaches, which is why they been selected for further analysis.

Workshop 1: Upcycling with subtraction cutting and surface design

Drawing inspiration from the concept of urban mining, which views cities as networks of connected resource hubs (see Cossu & Williams, 2015), workshop 1 utilised *mined* post-consumer textile waste and explored principles 1 and 2 of the circular economy (Ellen MacArthur Foundation, 2024), concentrating on eliminating waste and circulating materials through upcycling post-consumer waste (R7-strategy) into clothing using subtraction cutting and surface design techniques, transforming tablecloths into garments (Figure 3 a-d). A study conducted by DeLong, Casto, Min, and Goncu-Berk (2017) examines an upcycling design process, highlighting that students tend to prefer starting with the material itself rather than traditional hand sketching. This preference also serves as the foundation for the present course. Hands-on instruction in subtraction cutting was inspired by Julian Roberts' construction method (Roberts, 2013; University of Derby, 2014a and 2014b), which inherently generates unconventional shapes. Material manipulations (Figure 3b) and screen printing (Figure 3c) further advanced the upcycling process, ensuring that the final products were unrecognisable as former tablecloths. These combined methods introduced the students to an innovative design. Subtraction cutting was used to inspire new designs and train students to spot opportunities in discarded materials—a key skill for companies shifting to circular design.

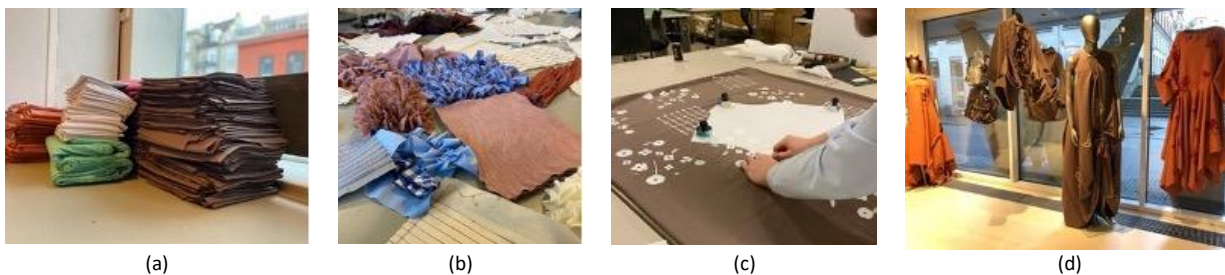


Figure 3. Workshop 1: Mined tablecloth textiles for upcycling (a); students' material manipulation experiments (b); a student working with screen print (c); the exhibition (d).

b) Workshop 2: Redesigning through deconstruction and reconstruction

In workshop 2, deconstruction and reconstruction became essential methods for *remanufacturing* (R6-strategy) post-consumer textile waste, transforming unsellable men's shirts from the Red Cross into new garments. Students repurposed elements like collars and cuffs, using mending, patchwork, and surface design to create market-ready products for social-media sales. They drew inspiration from a lecture on 1980s and 1990s anti-fashion movements.

Students used both dress stands and CLO 3D software to combine physical and virtual design methods. Dress-stand experiments (Figure 4a) enabled full-scale exploration of physical properties, while CLO 3D facilitated virtual prototyping without altering the original textiles (Figure 4b). Lee and DeLong (2018) identify remanufacturing as a sustainable alternative to disposal, reviving unused fashion stock and promoting waste elimination and material circulation (Ellen MacArthur Foundation, 2017). The students' remanufacturing of post-consumer shirts, comparable to unused stock, aligns with these principles. Students' outcomes—fully deconstructing and reconstructing shirts into new designs (Figure 4c)—align with remanufacturing principles, as described by Lee and DeLong (2016).

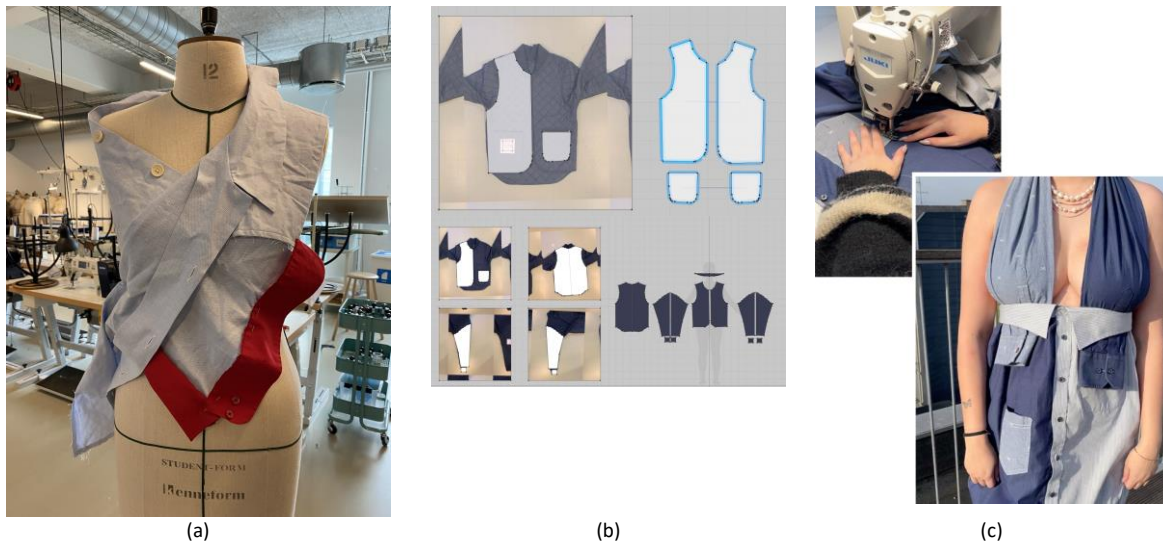


Figure 4. Workshop 2: students experiment on dress stand (a), Redesign with CLO 3D, tracing pattern pieces, and using them as foundation for new designs (b). From student Instagram video (c).

Analysis of workshop 1 and 2

The following section analyses how students developed key circular design competencies: *Design for Recovery*, *Design for Multiple use Cycles*, and *Circular Materials and Manufacturing* (Sumter et al., 2021).

Workshop 1: Upcycling with subtraction cutting and surface design

In the survey, students were asked which activities in the elective course had influenced their views on circular design, circularity, and sustainability. The responses indicated that the instructors' subject-specific lectures (six out of seven answers), the methods and techniques introduced (five out of seven), and external lecturers (four out of seven students) were particularly impactful.

This underscores the value of combining expert lectures with hands-on methods in shaping students' understanding of circular design. As one student puts it, "I found [the course] really interesting, and it gave me new ways of thinking...It gave new life to something that might otherwise have been discarded." The various experimental design methods, unfamiliar from prior coursework, appear to have disrupted existing habits and inspired more creative approaches to working with textile waste. As another student states, "I've thought a lot about it... what can you do, in terms of fabric manipulation... what can you do with the material to make it usable?" The statements illustrate how students began to apply key competencies from *Circular Materials and Manufacturing* and *Design for Recovery* in practice—for instance, by experimenting with different ways to transform textile waste into new design elements. Observations, oral exams, and final projects showed that many students challenged themselves and often embraced a new, experimental design language. Despite finding the methods for subtraction cutting and surface design challenging, the students' solutions added significant value to repurposing old tablecloths. As one student explains, "It was exciting and a good challenge, but I also found it hard to have to think in such a new way."

Workshop 2: Redesigning through deconstruction and reconstruction

In contrast to Workshop 1, the analysis of the survey data indicates that only two students felt that the methods and techniques introduced in Workshop 2 had changed their personal perspectives on circular design, circularity, and sustainability, compared to Workshop 1 (five out of seven). Personal engagement was also lower in Workshop 2, with only three students reporting high or very high engagement, compared to six in Workshop 1. The main reason given was limited time for deeper exploration not that deconstruction and reconstruction as such were uninteresting, as they found remanufacturing engaging as such.

Analysis of the videos of their final products in workshop 2, and the fact that most of the remanufactured products were sold, demonstrate that discarded shirts can be successfully redesigned into new, valuable items. During the development of the remanufactured designs, students selected shirts and methods with the aim of reducing environmental impact. For instance, in the focus group, one student shared that the course changed how she might

design clothes—favouring materials with a previous life—demonstrating the acquisition of the *Circular Materials and Manufacturing* competency.

Discussion of the Circular Design course

In both workshops, students employed video and visual storytelling to communicate their circular design processes and outcomes. Through crafting narratives for Instagram and exhibitions, students developed their *Circular Economy Storytelling* competency, enhancing their ability to professionally articulate circular design visions through concrete design concepts, thus demonstrating how discarded textiles can be upcycled into innovative products with extended lifespans. Workshop 2 illustrates how material constraints can challenge but also deepen learning. In this workshop, there were more constraints regarding how post-consumer textiles—specifically shirts—were to be used with repurposed elements. This approach was more time-consuming than working with tablecloths in workshop 1, which more closely resemble raw textile lengths. Planning such activities could benefit from allocating more time to accommodate remanufacturing processes.

Through a combination of hands-on activities (upcycling and redesign), experimental design methods, lectures, and external talks, the Circular Design course fostered both practical and theoretical competencies in *Circular Materials and Manufacturing* and *Design for Recovery*. This integration supported experiential learning and helped students develop *Circular Systems Thinking*, enabling them to reflect critically on their design processes and broader systemic impacts. Student responses support this connection between course structure and competency development. All seven participants in the survey indicated that lectures and external talks contributed meaningfully to their learning, and six students reported that course readings provided new insights. These elements offered conceptual scaffolding that helped frame students' practical work within a wider understanding of circularity and sustainability. While both workshops emphasised circular fashion design, incorporating tasks that addressed the evaluation of offcuts and leftover materials could have strengthened students' awareness even more. Designing truly circular products also involves managing potential textile waste—an aspect not required in this course but worth integrating in future courses, as sustainability must always be “posed in relation to, and against, the unsustainable” (Fry, 2020, p. 8). A study by Han et al. (2017) comparing standard and upcycled fashion design and production suggests possibilities for scaling upcycling in economically viable ways. Future courses could expand on this by embedding designs into sustainable circular business models, thereby advancing the *Circular Business Proposition* competency. The development of a circular mindset among students was a key outcome of the course. Although several students initially were uncertain and found it challenging to design within the circular economy, all eventually developed their own approach and adopted an attitude of identifying and embracing circular opportunities. When considered alongside the competencies in *Circular Materials and Manufacturing* and *Design for Recovery*, such a mindset appears to be a critical enabler of the broader circular transition.

The findings from the course underscore the importance of educational strategies that help students to develop the “ability to identify options, and judge what is an appropriate and responsible action in the ever-changing relational circumstances” (Fry, 2020, p. 8).

The Green Change Agents Course

The Entrepreneurship and Design programme aims to equip students with a range of competencies—from ideation and concept development to starting new businesses. The programme features a six-week elective course titled Green Change Agents that aims at developing students' sustainability competencies.

The Circularity Gap Report, Denmark (Circle Economy, 2023) concludes that Danes' material footprint is 24,5 tonnes per capita per year, which is more than double the global average and more than three times the estimated sustainable level of 8 tonnes. Aside from significantly lowering consumption, raising the circularity metric—currently a mere 4% (Circle Economy, 2023)—is needed. The report points at five overarching recommendations, of which the Green Change Agents course targets one: “Support and encourage SMEs on their circular journeys” (Circle Economy, 2023, p. 13). In the 2024 course, 23 students collaborated with two start-up companies. Initially, the students were introduced to the role of designers as facilitators of systemic change (Design Council, 2021) and engaged in research alongside first-year students to investigate consumer behaviours and sustainable business practices. Then, for two weeks, the students immersed themselves in working with co-design and process facilitation with the companies. The course culminates in week six with a two-part (written and oral) individual exam (see Table 3).

Table 3. Overview of the course, Green Change Agents. Expert talks, readings and the final exam week are not included.

GREEN CHANGE AGENTS	Week 1	Week 2	Week 3	Week 4	Week 5
Main focus	Circular economy and the urgency for action	Facilitation and research with first year students	Systems thinking and methods	Co-design and being an effective change agent	Co-design workshops with start-up companies
Group Assignments	Research on start-up companies. Circular Strategies Wheel, "How Might We"	Leading first semester students on data collection	Multiple cause diagram. Eco System Mapping. Playing "Re-organise game."	Assignment on becoming a change agent. Develop workshops for companies.	Workshop rehearsals with peer students. Conducting workshops with companies.
Individual Assignments	To reflect on their individual learning in reflective journals throughout the course.				

In the course, *Systems-thinking* is briefly covered through the application of tools like multiple cause diagrams, complemented by hands-on experiences such as playing the simulation game *Re-organize* (Lange, Korevaar, Oskam & Herder, 2022) and visits to exemplary sustainable manufacturing practices (Fischer Lighting, for instance). A central aim was to encourage students to become green change agents—professionally, personally, and civically—thus aligning with the *Intrapersonal* competency, which is the ability to become aware of one’s own emotions, to empathise with diverse stakeholders, and to self-motivate despite fears and doubts (Brundiens et al., 2020). This competency is often overlooked in sustainability programmes (Wiek & Redman, 2022; Libertson, 2023). It echoes the ethos that education for sustainability should foster values appropriate for navigating complexity and ecological crises (Moore, 2005; Sipos et al., 2008; Azuma et al., 2010; UNESCO, 2015; Sterling, 2017; Libertson, 2023). To strengthen students’ *Intrapersonal* competency, they were encouraged to reflect on their personal development in individual reflective journals and classroom discussions. For students to develop their *Interpersonal* competency—the ability to motivate and facilitate collaboration (Wiek et al., 2011)—they had to engage in two forms of real-world learning: a) by making elective students responsible for our first-semester students during a common research week, and b) through students designing and facilitating workshops with start-up companies. This dual approach is supported by Hanstedt (2018), who advocates for students assuming authority by carrying out real-life tasks, not merely simulating them in the classroom. The two approaches are presented in the following.




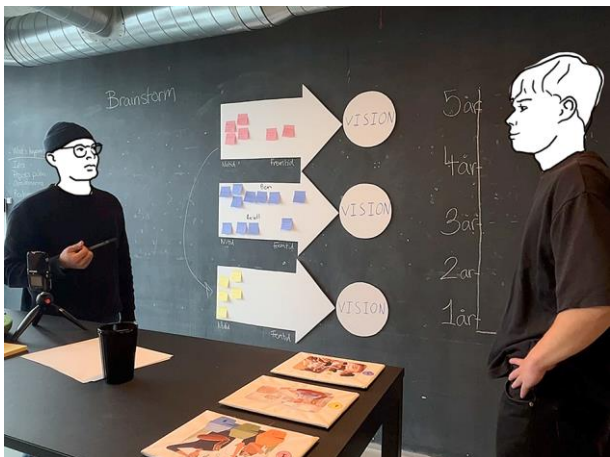
a) Facilitating research with first-year students

The 23 third-semester students were to conduct the following research tasks by engaging and leading 84 first-semester students: 1) desktop research, 2) qualitative interviews with store workers at sustainable retail stores, 3) pop-up street interviews, and 4) qualitative interviews with designers working with circularity. The assignment had a broad focus on consumer behaviour and sustainable practices. By doing qualitative research among consumers and professional designers in circular businesses, we aimed at developing the *Values-thinking* competency by expanding the students’ understanding of values and assumptions concerning sustainability among diverse stakeholders. Remington-Doucette, Connell, Armstrong, and Musgrove argue that “it is the values, preferences, and beliefs of individuals and societies that influence decisions made and actions taken regarding sustainability” (2013, p. 410). Thus, by considering one’s views within a broader context, the *Intrapersonal* competency is developed.

b) Workshops with start-up companies

The primary task was to design and facilitate workshops for the start-up companies to explore possible sustainable paths rather than providing ready-made answers or solutions. This involved creating tasks, dialogue materials, and facilitation techniques to support both imagination and critical reflection (Brandt, Binder, & Sanders, 2013). The students worked in four groups—two groups per company. The workshop activities that the students designed ranged from evaluating current business models and envisioning future sustainable scenarios to exploring multiple R-strategies (Table 4). Planning and facilitating the workshop aimed at developing the *Futures-thinking* and *Interpersonal* competencies (Brundiens et al., 2020) as well as the corresponding *Circular Economy Storytelling* (Sumter et al., 2021). By exploring possible circular directions for the start-up companies, *Design for Multiple Use Cycles* and *Circular Business Propositions* were also touched upon.

Table 4: The main activities performed in the four workshops with the two start-up companies. (Photos: Stills from students' video documentation).

Fashion Company	Furniture Company
<p data-bbox="373 302 574 327">Workshop 1 (Group 2)</p> <p data-bbox="153 329 796 405">Discussion guided by circular insight cards; pricing strategies and ways to strengthen overall sustainability efforts. Brainstorm on transitioning to more sustainable materials like eco-friendly fabrics or recycled material.</p> 	<p data-bbox="1018 302 1219 327">Workshop 1 (Group 3)</p> <p data-bbox="798 329 1442 432">Scenario challenges: Exploring product life cycle scenarios using “Circular Strategies Wheel” to identify R-strategies. Strategic Discussions: Circular strategy trade-offs and implementation. Reflection & Alignment: Linking circular strategies to business goals.</p> 
<p data-bbox="373 909 574 934">Workshop 2 (Group 1)</p> <p data-bbox="153 936 796 1012">Future envisioning: “Letter from the future” using visual strategy cards to prioritize circular strategies. Circular Strategy Mapping: Build a strategy wheel to identify urgent value chain activities, pre-, during, and post-use.</p> 	<p data-bbox="1018 909 1219 934">Workshop 2 (Group 4)</p> <p data-bbox="798 936 1442 1012">Building on workshop #1, the selected strategies were placed on a “process arrow” to explore “what, how, when, and by whom” to elicit immediate action and reflection.</p> 

Analysis

In the following, we present the results of the qualitative content analysis based on the data retrieved from the students and the company founders.

Overall, analysis of the written assignments and the reflective journals show that the majority of students experienced a transition from a state of fear and anxiety, resulting in a passive attitude towards climate change, to a more hopeful belief that they can make a difference—both as individuals and in professional settings. This indicates that the students developed the *Intrapersonal* competency through an emerging sense of agency, suggesting that they underwent a meaningful transformation regarding their values and self-perception as change agents. For instance, in the written assignment, one student wrote:

I was worried about the environment before the elective, and I doubted that my actions could have any notable influence on the enormous climate challenges we are facing. (...) This doubt influenced my behaviour, but the

elective has made me realise, that small interventions can make an actual difference, especially when being part of a larger context. (Student, written assignment, 2024)

In their reflection journals, the written assignment, and oral exams, many students expounded on the company visits and interviews with designers—for instance, noting how differently people understand the terms “sustainability” and “circularity”. Specifically, the company interviews and the visit to Fischer Lighting were significant in shaping their understanding of circularity from a company’s perspective, thereby developing the *Values-thinking* competency.

a) Facilitating research with first-year students

In their reflective journals, students commented on this experience as a “fun” and “pleasant” way to meet the first-year students; it was a tangible way for them to try out the role of facilitator, as illustrated by this quote: “When we were to decide something, I always asked, ‘What do you think?’ or ‘How do you feel about this?’ in order to make sure everybody felt included.” However, students also expressed balancing engagement with directing tasks as being a challenge. As one student wrote: “I found it easy to keep an overview and assist the new students, but stepping in to correct them was difficult for me.” This quote illustrates a key insight surrounding the predicament of motivating various stakeholders while staying on track—an example of applying the *Interpersonal* competency.

b) Workshops with start-up companies

Based on the founders’ feedback, the students accomplished the task of staging and facilitating how to explore different narratives about sustainable futures by creating a shared understanding of the circular challenges and the companies’ visions. These experiences correspond with both the students’ reflections in their individual journals and their written reports—and thereby aligns with the *Circular Economy Storytelling* competency (Sumter et al., 2020 & 2021).

The founders also found the workshops “well-prepared” and the content highly relevant to their business needs. Additionally, they left the workshops with some actionable ideas for transitioning into a more circular business model. However, both the feedback from the founders and the students’ own evaluation point to a missed opportunity for the students to have been more directly involved during the workshops. Creative tasks such as generating ideas together and exploring future possibilities were left to the founders alone, which both parties found influenced the workshop outcome. In their written assignments, several students mentioned that they should have participated more and challenged the founders in the process. However, the students clearly came to understand the importance of collaborating to design circular solutions, as illustrated by this quote:

The most important learning about being a change agent is the significance of being able to motivate others and mobilise action towards sustainable initiatives. I have learned that being a change agent is not just about having ideas but about presenting these in ways that engage others. (Student, reflective journal, 2024)

Discussion of Green Change Agents

Facilitating workshops with first-year students and the founders of the two companies was new and challenging for the elective students. In the research week, we, as teachers, could have supported the elective students more by offering guidance session focussing on how best to lead and manage the projects. This would probably have strengthened their leadership abilities as well as increased their learning outcomes. The students’ limited involvement in the creative parts of the workshops highlights the importance of ensuring that design students, when facilitating co-design processes, are fully equipped to contribute. Ezio Manzini (2015) operates with two “design profiles”: *diffuse design* and *expert design*, and the co-design process preferably involves both. In short, *diffuse design* refers to the basic design capabilities that everyone has to some extent, whereas *expert design* is carried out by a design professional using highly trained skills. In relation to co-design, the aim is for the professional designer to facilitate the process for non-designers in a way that fully utilises their *diffuse design* abilities. Professional designers use their design knowledge and experience to develop workshop content, activities, and materials and support the process by contributing actively to the creative and reflective processes. This requires that the design students, as change-makers (Design Council, 2021), utilise their *expert design* competencies while unfolding the non-experts’ *diffuse design* capabilities. Data from students suggests that their limited participation in the creative parts of the workshop stemmed from feeling inadequate, which they linked to their relatively limited knowledge of circularity, sustainable materials and production methods that they obtained during the course. Accordingly, when planning courses aimed at

developing design students' competencies as change-makers, it is important to find ways of building students' confidence in the topic before engaging in the real-world activities.

Further, ideally the students should have developed the *Circular Economy Collaboration* competency (Sumter et al., 2021) when facilitating the workshops. However, as Sumter et al. point out, it requires the specific ability to engage internal and external stakeholders from different areas in the eco-system. When limiting the workshop participants to the founders, the students did not in fact practice this competency, since potentially conflicting values, goals and expectations regarding the collaboration were absent. For this competency to be developed, different types of participants should be included in the workshops.

Conclusion

As design educators, we are obligated to prepare students for an uncertain and complex world. We must champion the belief that the environmental challenges we face can be overcome, and we must support aspiring designers in becoming active participants in the green transition by helping them convert uncertainty to agency. Through the courses *Circular Design* and *Green Change Agents*, we sought to achieve just that. The courses showcase two distinct pathways for design: the circular product designer and the designer as change agent. By blending lectures, expert talks, and company visits with hands-on tasks connected to real-world problems, students gained an understanding of the many challenges surrounding the shift to a circular economy. Moreover, they came to acknowledge how they, as designers, can enact change—thus, becoming sustainable.

For circular product designers, the task of designing from textile waste illuminated how circular strategies can lead to unexpected opportunities, spark the creative process, and engage designers in discovering new design opportunities. Drawing simultaneously on the circular competencies *Design for Recovery*, *Circular Materials and Manufacturing*, and *Circular Systems Thinking*, students adopted a new design mindset in which exploring circular challenges and possibilities became a welcome part of the creative process. In *Green Change Agents*, the *Values-thinking* competency, the focus of the research week, served as an important foundation for developing workshop content and activities, thus boosting the *Futures-thinking* competency. Keeping a steady focus on developing the *Intrapersonal* competency throughout the course—through reflective journaling and class discussions, for instance—appears to strengthen students' confidence, thus empowering them to become green change agents. For both design pathways outlined in this article, the *Interpersonal* and the related *Circular Economy Storytelling* competencies are essential. Concerning the circular product designer, crafting a compelling story to potential consumers may raise the demand for circular products (Business of Fashion & McKinsey & Company, 2024, p. 122). For the designer as change agent, these competencies implies the ability to engage and motivate companies to explore circular options and commit to taking actionable steps towards creating green solutions.

Based on our research, we advise against focusing narrowly on a single competency when developing course content. Instead, competencies should be viewed as intertwined and should be developed simultaneously to foster a holistic approach to sustainability and circular design education.

Participating in short 6- or 10-week courses on developing circular competencies obviously is just the beginning of the journey for emerging sustainability designers. However, by developing key practical circular competencies in relation to real-world issues, we believe that we can empower the next generation of designers to define and develop a sustainable design profession and society in harmony with our planet. In this way, the two courses presented in this article will serve as a good basis for exploring further how teachers can prepare students to make an effective and lasting impact on a design industry that must assume its fair share of responsibility for the environmental predicament facing our planet.

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