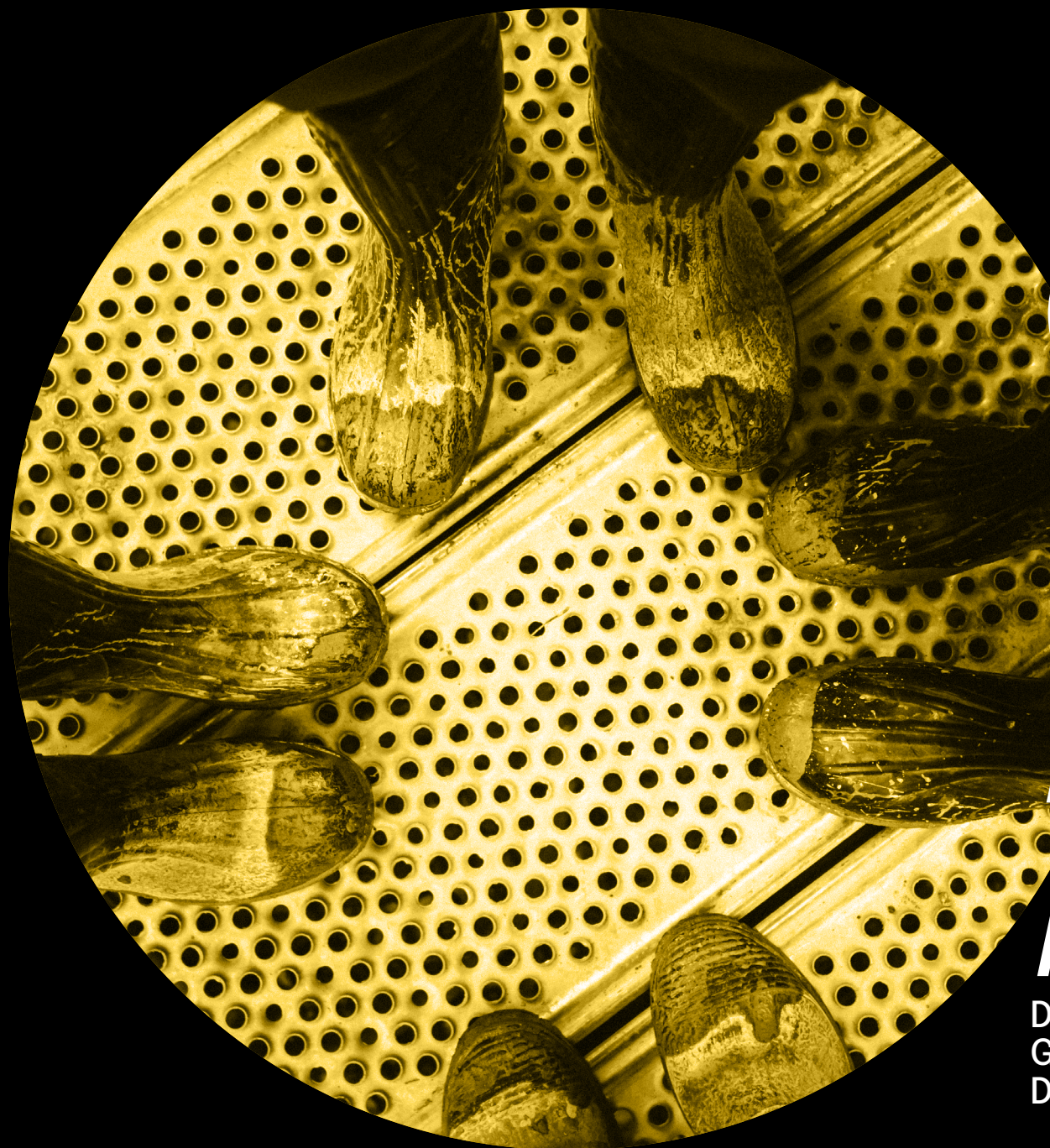




Circular Economy principles *in educational practices*

Design Factory
Global Network
Deep Dive

A''
Aalto University
Design Factory

**DF
GN** Design
Factory
Global
Network

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1 Introduction



Foreword

This report is the first official DFGN Deep Dive. DFGN Deep Dives are a new format for the Design Factory Global Network to explore what is happening across our member institutions and make those insights visible.

This Deep Dive is an inspirational showcase of an emerging issue. Instead of engaging the entire network, one-hour interviews are held with representatives of only the most relevant Design Factories.

The Design Factory Global Network is a network of around 40 innovation hubs based in universities and research institutions in 25 countries across five continents. Each Design Factory serves as an experimentation platform for interdisciplinary, problem-based learning, bringing together students, educators, researchers, and industry partners on real challenges. The network's mission is to reshape education and build the diversity of skills needed to operate in rapidly evolving environments.

When we asked the network what topic to explore first, Circular Economy came back as the clear answer. What does it actually look like to embed circularity into how students think, make, and design? And what can educators learn from each other? Fifteen Design Factories joined. Each contributed an interview and a survey. The result is not a catalogue of plug-and-play practices, but an exploration of patterns across very different contexts.

The report opens with the reasons educators gave for embracing Circular Economy thinking, followed by an exploration of what the concept means in practice. It then moves into the practices themselves: how educators create conditions for learning, scaffold the design process, generate and evaluate ideas, and support making. Student experiences and acquired capabilities follow, before closing with a look at what practitioners are looking forward to and a list of recommended resources.

We hope this report sparks conversations, inspires you to develop your own practices, and connects you with the practitioners whose work resonates most.

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Reasons & definitions *of Circular Economy*

Four reasons why we embrace Circular Economy & keep pushing it further

Reason 1.

Circular Economy thinking can help solve the problems created by bad design

We can undo the damage

Many Design Factory representatives cited societal responsibility as their primary reason for bringing Circular Economy thinking into their educational practices. The damage done by poorly considered design, to the environment, to communities, to the planet's systems, felt too significant to ignore. Across the network, a shared conviction emerged: Circular Economy thinking is not an optional add-on, but a necessary reframing of what design is for.

“It's a matter of survival now - we have to do it, it's not even an option. Additionally, its disruptive and transdisciplinary nature supports everybody to contribute from their own area of expertise and knowledge to solve these problems.

Diana Riveros, Juan Ramirez, & David Serje (Cali DF)

Tired of solutions that don't actually solve anything

Some educators had grown frustrated with the kinds of solutions their students kept producing. Laura Bellorini and Mireia Sierra Andrés (Fusion Point) found themselves seeing too many similar ideas, driven by an overemphasis on health, which pushed them to steer students toward Circular Economy as a more generative space. For Laura

Wirtavuori (CERN Ideasquare), the frustration crystallised into a new practice entirely:

“We heard repeatedly, ‘So, we are going to create this app and this app is going to solve United Nations Sustainable Development Goals 5, 10, and 11.’ And we are like, ‘No, an app isn't going to solve complex problems.’ And it wasn't the student's fault, because how this product development process starts from a user-centric perspective is unlikely to lead to very breakthrough ideas.

– Laura Wirtavuori (CERN Ideasquare)

Reason 2.

Circular Economy makes better designers

Circular Economy is not a checklist - it's a starting condition

Various Design Factory educators grew frustrated watching sustainability treated as an afterthought. Manuel Walter (inno.space DF Mannheim) put it most bluntly: consumption has to go down, and students need to understand that from the start. Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) lamented that students typically try to make their designs sustainable only once a product was designed by swapping a material or switching to cardboard packaging. His fix was the Open Source Circular Economy Model, and what he observed over time was a shift:

“Designers often see sustainability as aesthetics. They develop their product, and just before production, they want to make it sustainable. But when they understand that this framework helps them develop more complex ideas and integrate sustainability from the beginning of the design process, they see the possibilities.

– Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá)

Just because the world doesn't work this way, doesn't mean it can't

Bringing Circular Economy thinking into design is also an invitation to question the norms that produced the products and systems we take for granted. Laura Wirtavuori (CERN Ideasquare) encouraged students to think bigger and consider the planet more in a context where they could not rely on search engines or language models. Vikki Eriksson (Aalto DF) built conscious reflection into her course:

“We rarely create formal safe spaces for people to really reflect on how they feel about the norms that have been developed. I always get excited when students get to that point where they go, ‘Yeah, but the world doesn't work this way.’ And I'll say, ‘Yes, it doesn't, so that is the wonderful complexity in which we exist, in which you're going to have to exist and work. The thing is, you don't need a panini press in your life. You can survive happily without toasted bread, but we like it, it's nice, comforting, right? We've created a world of products that caters to our desires but that has come at a cost.’

– Vikki Eriksson (Aalto DF)

Reason 3.

Circular Economy is easier when the wind is at your back

Sometimes the institution has your back...

Not every educator had to fight for space to bring Circular Economy thinking into their work. For many, the institution had already done some heavy lifting. Laura Bellorini and Mireia Sierra Andrés (Fusion Point) found that ESADE's institutional commitment to sustainability, embedded across programs and infrastructure alike, made their own shift toward Circular Economy feel like a natural next step. Elina Miķelsone (RTU DF) described something similar at RTU, where sustainability was simply part of the university's identity:

“In our university strategy, one of the main elements is ‘Sustainable Innovation’, not just ‘Innovation’ on its own. So, it is normal life for us, it is not something extra that this event is about sustainability. I need to be honest, all events in the last three years have had sustainability at the core.

– Elina Miķelsone (RTU DF)

For Diana Riveros, Juan Ramirez, and David Serje (Cali DF), that institutional foundation ran even deeper, rooted in the Jesuit character of their university and two papal encyclicals, *Fratelli Tutti* and *Laudato Si'*, that place care for people and planet at the centre of the curriculum. For Laura Wirtavuori (CERN Ideasquare), the alignment was more philosophical: thinking bigger is so embedded in the culture of CERN that it made sense for IdeaSquare to pursue the same ambition in design.

...and sometimes it's the funder or the partner

External support played a role too. Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) initially established her sustainable design

programme through Erasmus+ funding, which also brought in the recycling facility partnership that became the programme's defining feature. Laura Bellorini and Mireia Sierra Andrés (Fusion Point) pointed to the EU's ATTRACT project as a catalyst, which pushed them to link systems thinking, sustainability, and technological feasibility from the start of the design process.

Industry partners could also be catalysers. Müge Kruşa Yemişcioğlu (METU DF) recalled a UN Development Project challenge around a ghost space, a massive building that had been built but never fully utilised. Ciana Martin and Farnoosh McDonagh (Forge DF) were approached by a film festival organisation in Ireland that wanted a fully sustainable award designed by local designers, a brief that sustainability made possible rather than complicated.

Reason 4.

Students are lining up for Circular Economy

Embracing Circular Economy principles also turned out to be a way to attract more students. Manuel Walter (inno.space DF Mannheim) stumbled into this almost by accident:

“There was no industry need or anything but we had different courses or different challenges in our Product Development Project with the local green industry cluster and they asked us how to reuse industrial waste from other companies. The students came up with a marketplace for industrial waste and this was my starting point to dive deeper into the Circular Economy idea. With some leftover funding, I decided to set up the 4R course. It was a good way to bring people into our makerspace, so it was a win-win situation for the environment and for the maker space.

– Manuel Walter (inno.space DF Mannheim)

Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) found that sustainability gave her programme a distinctive identity, with their two-week sustainable design programme becoming the only one of its kind in the market. Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) discovered a different pull: the open source nature of his Circular Economy framework attracted students who wanted to contribute to something that would be shared with the world, with three or four choosing to develop their thesis around it in the past year alone.

Industry-linked Circular Economy projects drew students in for more pragmatic reasons too. Ciana Martin and Farnoosh McDonagh (Forge DF) found that students desired longer, deeper engagements with real partners, and that sustainability was increasingly the reason industry came to them:

“Even in terms of the legislation coming in with the Extended Producer Responsibility and the Digital Product Passports. For students' employability, it's such a big part of all of our industry now. It's a real benefit if they have that as part of their education once they graduate.

– Ciana Martin and Farnoosh McDonagh (Forge DF)

Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre) arrived at a similar conclusion from a different angle: in light of shifts in China's architectural industry, their students needed a competitive edge, which led them to reposition their course programme around systems thinking and ecosystem design.

What does Circular Economy actually mean?

No single definition - and that's okay

Ask ten educators what circular economy means and you'll get ten answers. Sustainability and circularity are concepts that are constantly evolving, disappearing and reemerging, and that's okay. What matters is staying aware of what is being gained or lost in the process, and why.

Christine Thong (DF Melbourne) felt that reinvention of terminology was actually vital, because it allows educators to relate to different people and different contexts. This way, Circular Economy earns its place in a crowded landscape of competing frames such as futures thinking, systems design, and behaviour change. Laura Wirtavuori (CERN Ideasquare) observed that sustainability, circularity, regenerative design, and planetary design often are guiding assumptions in educational practice without being named explicitly. Ciana Martin and Farnoosh McDonagh (Forge DF) pointed to disciplinary diversity as another complicating factor: in a makerspace hosting sculpture, graphic design, and fashion students, a single definition on the wall simply would not work. What all of this points to is not a problem to be solved but a condition to be embraced.

“Circularity will go and something else will come back. And I'm okay with that. I'm not going to say that one concept is superior to another. However, since coding is really easy now, students prefer to produce soft prototypes, thinking less about the concept, the human side. So that's a core problem. Circularity is being affected by that. But it will come back.

– Müge Kruşa Yemişcioğlu (METU DF)



That said, some frameworks help...

If there is no single definition, there are at least some useful handles. Several educators gravitated to the sustainability pillars of environmental, societal, and economic impact as a core organising framework.

“ *I use this definition of the sustainability pillars a lot. It makes so much sense to explain sustainability as environmental, societal and economical. And you need the three to make things work in this broader perspective. I use it a lot in everything. In class, when assessing projects, I incorporate all elements.*

– **Laura Bellorini and Mireia Sierra Andrés (Fusion Point)**

Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre) explicated a different reason for valuing the pillars: their overlapping nature made clear that Circular Economy could never be reduced to a checklist, but was always a complex network of interconnected causes and outcomes. For educators working in makerspaces, such as Manuel Walter (inno.space DF Mannheim) and Ciana Martin and Farnoosh McDonagh (Forge DF), the Rs offered a more tangible entry point, introducing Circular Economy through 3R, 4R, 6R, 9R, or, in the case of Elina Mikelsone (RTU DF), 60R frameworks.

... and many predate the term entirely

For some educators, Circular Economy is not a new idea, it is a description of practices that communities have always observed. Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) noted the irony of academics presenting repairing products as ‘the new way’, when this kind of practice has always existed – showcased by local repair businesses for fashion accessories or electronics, one of which is just 200 metres from his house. Rather than presenting circularity as a new theory, he argued, educators should focus on global ideas that are already practiced locally.

Vikki Eriksson (Aalto DF) encountered something similar when her students, tasked with redesigning an electric toothbrush, stumbled upon the miswak, a chewing stick with clinically proven cleaning effectiveness. Their instinct was that a shaped twig had no place in a modern product. However, the teaching team encouraged them to pursue it anyway, complete with the research and the process. It was a lesson in shifting perceptions of what something should be and taking traditional solutions seriously.

Ultimately, all roads lead to systems thinking

Almost all respondents connected Circular Economy principles to systems thinking at some point. The link was not incidental. For most, systems thinking was what gave Circular Economy its depth. Laura Bellorini and Mireia Sierra Andrés (Fusion Point) said it simply: “Circular Economy is systems thinking in practice, requiring students to consider the life cycles of all actors in a network, not just the product itself.” Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) built this into a concrete exercise, asking students to redesign products using three component types: a permanent central component with a long lifespan, a recyclable or reusable component with a medium life cycle, and a compostable one for short-cycle parts. The key shift was getting students to stop thinking in single-product terms. While originating from a product-centered focus, the model also supports rethinking services and transforming policies in relation to the product-service systems connected to each component’s lifespan.

For Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre), systems thinking emerged naturally from their ecosystem design approach, where students immerse themselves in the full network before proposing anything. Diana Riveros, Juan Ramirez, and David Serje (Cali DF) emphasised the importance of showing students the consequences of using or not using parts of a solution, both for the environment and the community. It is this expanded field of vision, beyond products and users towards whole systems, that the practices in the rest of this report are designed to support.

Beyond Circular Economy...

... Regenerative Thinking

For Sanna-Maaria Siintoharju (HAMK DF), the urgency was personal: the changes she witnessed in her own lifetime (less snow, more floods, shifting landscapes) pushed her to explore what she could contribute. Her work, however, does not centre on Circular Economy thinking; instead, she specialises in **Regenerative Thinking** ⁷, emphasising design approaches that seek to restore, heal, and strengthen living systems rather than merely reduce harm. At the same time, she emphasises that Regenerative Thinking cannot exist without the solid groundwork provided by Circular Economy principles – regeneration builds upon circularity but ultimately aims to go further.

Regenerative Thinking, in essence, means being net positive towards nature in everything we do. It encompasses holistic worldview, systems thinking, place-based approach, and biophilia (a warmth and caring for nature and others). She describes it through her own land:

“We have been farming rye and oats – very Finnish. But due to climate change, I have now found apricots growing here, which are not a natural species in Finland. This shapes how we treat our soil: paddock rotation, crop rotation, no tilling, no artificial substances. It goes more towards organic farming, and it requires a mindset shift. The main principle, whatever the area, is to be net positive towards nature. If you take timber from a forest to build a house, you plant a new tree. There is no regeneration without Circular Economy and sustainable development. If we take something from nature, we have to return it.

– Sanna-Maaria Siintoharju (HAMK DF)

Because Regenerative Thinking builds on a systems thinking foundation, students first need to understand how systems work before they can meaningfully engage with Regenerative approaches. It is a long learning journey, and not an equal one across disciplines – the concept lands differently depending on what students already know and do:

“For example, architects should design buildings taking into account how the sun moves, how the wind blows, where natural shadows fall, and at which angle to place the building to reduce the energy usage. Here in Finland, we have to think about how to lower the need of energy with passive building or passive construction. Additionally, we need to take care of rainwater harvesting or collecting gray water, for example to flush our toilets instead of using drinkable water. This is a hot topic nowadays in architecture. When I’m talking to farmers, they are talking about planting and paddock rotation. They can’t take the whole paddock for animals, so they divide it into sections because they want all the paddocks to have enough time to grow the grass. And when I’m talking to doctors or nurses, we get into tissues or cells renewing or cell regeneration. So it’s a different point of view.

– Sanna-Maaria Siintoharju (HAMK DF)



She uses her own 1967 house that gets very hot in summer due to large south-facing windows as a live design brief for construction students. Faced with heritage protection constraints, students could not make major changes, yet almost all immediately reached for high-tech solutions like replacing the windows or installing a heat pump. The regenerative solution was low-tech and nature-based: adding a pergola to create natural shade, with the slightly leaky windows providing natural ventilation – just as the house was initially designed.

Reflection sits at the heart of her approach. She found lectures to be insufficient – students need to embody the way of thinking and working. Inspired in part by architects in Australia who interview local elderly residents to understand the history and culture of a place, she landed on two practices that have become central to her teaching:



Know Your Roots

asks students to unpack who they are: their values, history, background, and culture. Sharing these stories in groups builds an understanding of where each person is coming from, before expanding outward to organisations, countries, and laws.

Campfire Discussions

can take place around a real campfire, or a make-believe one in a classroom – either way, students should come sit around the campfire. Then, somebody shares, for example, their cultural experiences and relation to nature while others listen, reflect, and respond.

Sometimes, she provokes discomfort deliberately, challenging students to understand why things are the way they are, including why some traditional practices are worth taking seriously, like houses in Greece and Egypt that offer real inspiration for modern architecture. The confusion, she finds, is productive. After introducing frames or narratives through which the challenge might be approached, she sends students out for a two-hour walk in the actual use context, talking with fellow students to make sense of their assumptions and the situated nature of the problem. Indeed, the aim is rarely to fill students with knowledge, but rather to give them the vocabulary to understand what they were doing and why.

Sanna-Maaria Siintoharju (HAMK DF) observed that students learned to recognise how their first solutions are shaped by existing assumptions and that only by stepping back can they identify something that genuinely considers the full circular system. The timing of the shift matters too. Sometimes, students' most significant moments of realisation might come later, even months after the course ends. Returning to a student group after an intensive working session, she found that while most remembered it as tiring, at least ten had since started reading articles about regenerative architecture on their own initiative.

Lastly, Sanna-Maaria Siintoharju (HAMK DF) offered a word of caution: if there is insufficient time to get into the topic properly, it is better not to mention it at all. Regenerative Thinking is a very big topic, and a short, simplified presentation risks doing more harm than good. Indeed, she encourages educators to give themselves and their students time with these new definitions and connections. Drawing on the work of Daniel Christian Wahl, she noted that regeneration is a shift so profound that we are only beginning to understand its implications.

... Prosperity Thinking

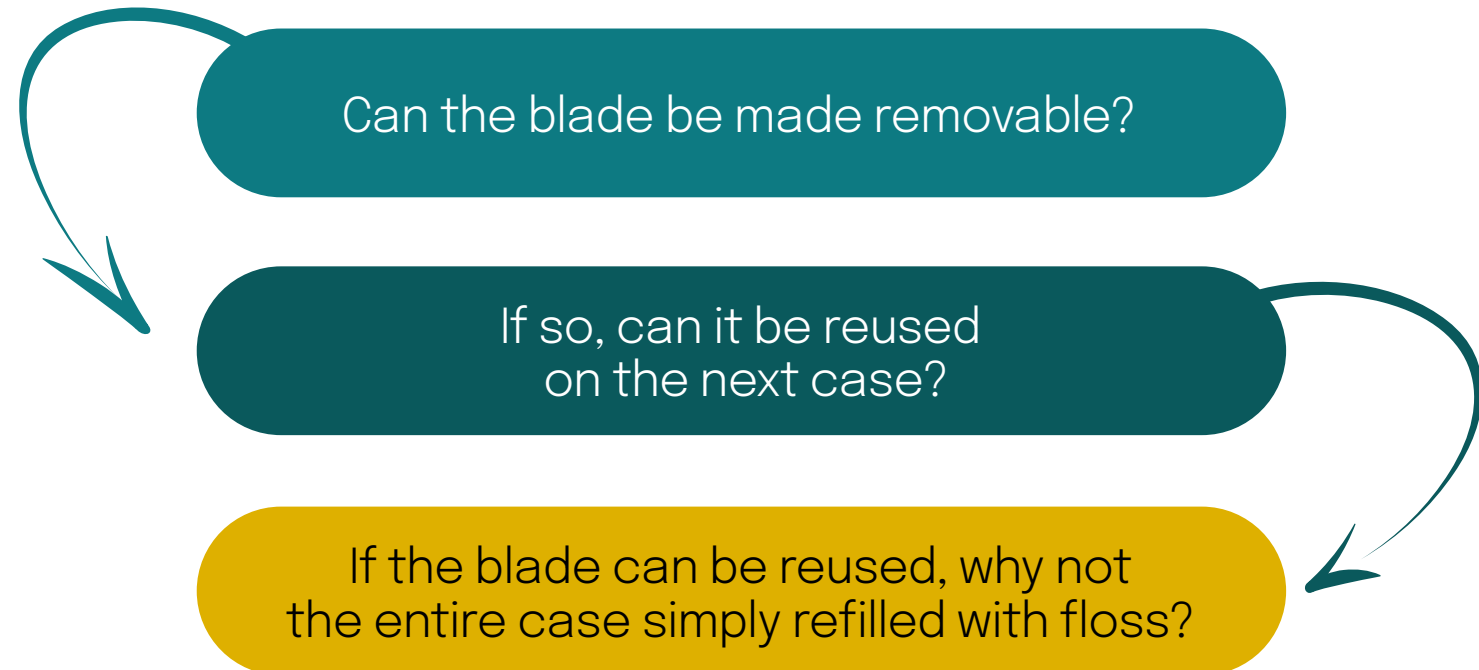
Prosperity Thinking was developed by Matteo Vignoli (Oper.Space) in collaboration with the Future Food Institute, drawing on [Kate Raworth's Doughnut Economics](#) ⁷. The starting point was a frustration with most existing design methodologies that treat sustainability as an afterthought. The methodology focuses on human and planet balance statements to consider the limits of the planet from the beginning of the design process. Crucially, it is not a circular design methodology. The aim is not to preserve the world as it is, but to propel an upward spiral toward a more prosperous place for both humans and the planet. Between 30 and 40 sustainable design professors and specialists contributed to its development.

“Many design approaches are overly human-centered, causing designers to think in product terms. When you design a plastic bottle that's recyclable, that's it for them. It's up to the users to recycle it. When we trained large bottle companies in this field, we told them, 'Okay, great, your product is recyclable, but actually, how much is recycled?' Because that's a much more interesting question. Making it recyclable does not end the designers' or company's responsibility. You need to take care of not only the product, but also the interaction of the product with the service and the systems that the product interacts with. If you have a bad system for recycling or no system for recycling, you just should not sell the plastic bottle in the first place. It's your responsibility as a company to find out if your products are going in the right direction or not. At a certain point, somebody needs to be accountable. In Europe, it's becoming quite agreed that it's the company's responsibility to take care of the full cycle.

– Matteo Vignoli (Oper.Space)

A collaboration with a flossing company shows Prosperity Thinking in practice. Floss cases have a small metal blade to cut the floss, which makes the whole case non-recyclable. The methodology prompts a sequence of escalating questions:

In conventional product development, the case is cheap enough that replacing it feels irrelevant. Prosperity Thinking rejects that logic. Convenience is not the driver. The question is always the balance between impact on the planet and impact on people.



3

Educational
practices
with
Circular Economy
principles

Creating the conditions for learning about Circular Economy

Creating space for self-discovery

Start with yourself

When knowledge about what needs to change has existed for decades, the more urgent question becomes not **what** to do but **why** we are not doing it. Manuel Walter (inno.space DF Mannheim) found that a general introduction to sustainability discussing material choices and degrading times was nothing new to students, and concluded it was much more effective to focus on what students themselves could do, even if small and in their daily lives. Vikki Eriksson (Aalto DF) built that shift into a course where students redesign an existing product from a Circular Economy perspective:

“We have an overwhelming amount of information that is telling us what we should and shouldn't do, if we are keen to keep living on this planet. And that information is verified by scientists across the globe and we've known for a while. I always go back to the first United Nations sustainability conferences in the 1970s. I keep asking myself, 'How have we not done better yet?' We know what we need to do but I've become aware that there are so many economic and political layers. So, if we want to do this, we have to start dismantling very embedded systems in how we create and how we live. It used to be about the theories, techniques, and mechanisms regarding the 'how' but over the years it's become more important to discuss 'why' we're not doing it. When we show the sustainability pillars 'people', 'planet', 'profit', it's really easy in a sustainable product design course to say, 'We're not going to talk about profit. Let's focus on the other two!' But

the issue with profit is that it created the world in which we live. I don't want this to be the most depressing three hour block in students' week where we talk about how bad things are for the first six weeks, and then spend six weeks figuring out how we can change it. But the reception from students is normally quite good.

– Vikki Eriksson (Aalto DF)

Her course is structured around 4 practices that build on each other:

1. Personal reflection

Students begin by reflecting on their own behaviours and what drives them before deconstructing an existing product through a Life Cycle Assessment (more on this practice on [page 25](#)). Not just to understand material components, but to contextualise why certain design decisions were made within larger economic and political systems.

2. Sense-making sessions

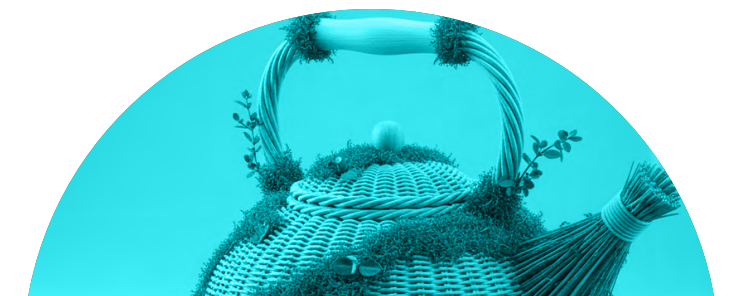
Dedicated team time after every lecture to support peer learning, navigate different perceptions, and discuss how everybody feels about sustainability.

3. Reflective assignments

Two written assignments throughout the course to encourage students to go deeper. Notably, very few seemed to have used AI, suggesting the reflections were genuine.

4. Public presentation

Final outcomes are presented at an event open to friends, families, and the wider campus. Students share not just their reimagined product but what they hope to carry forward. Several students from a recent cohort took this further and posted their intentions on LinkedIn.





IdeaSquare Planet

IdeaSquare Planet [↗](#) is a transformative learning experience developed at CERN IdeaSquare to push students to think bigger and bolder on adventures that have no right answer, no clear framework to follow, and no way to AI prompt your way out. The programme runs without lectures, frameworks, or canvases.

“In a nutshell, we take students to an imaginary exoplanet to tackle a set of challenges, and then translate those learnings back to Earth. .

– Laura Wirtavuori (CERN Ideasquare)

The format is flexible. It has run as a one-week standalone, a seven-week summer school with pre- and post-tasks, and as part of larger programmes with varying time splits between the two worlds. Participants have included high school students, working professionals, university students, and also mixed groups.

Act I. Exoplanet Adventure

The adventure is shared and discussed, and the students work freely, with educators nudging rather than directing. Teams are interdisciplinary and divided by theme, e.g. a food team, a water team, etc. However, they are not given guidance on how to collaborate across teams. That is for them to figure out, and the interdependencies surface quickly: what plants the food team decides to grow determines how much water the water team actually needs.

“There is much more imaginative freedom on the exoplanet, because usually, there are no established political systems, no cities, or city structures. There are no boundaries, so that gives the students freedom to be creative.

We explicitly talk about anticipation and challenging assumptions. If we go to an imaginary future on an exoplanet, you can anticipate that technology is better than what we actually have - it might work better, faster, be smaller, cheaper, etc. However, it has to be based on realistic assumptions, you can't invent time travel, because that is not possible. You still have to respect the laws of physics. For challenging assumptions, it could be that students are assuming that people on this planet are using money. Why are they using money? How else could that system work? Or, they're assuming the government is democratic. But is it? And why? And so forth.

– Laura Wirtavuori (CERN Ideasquare)

Resource scarcity and actor relationships come into play naturally, without needing to be named as Circular Economy concepts. At the end of the adventure, all teams present their creations and learnings, after which they return to Earth.

Act II. Return to Earth

“Coming back to Earth is linked either to the theme or the learnings. We write a different narrative almost every time. Sometimes students focus on imminent short-term survival - e.g., a mission to land on a planet with limited rations and figure out food production, water, and shelter. That's really about managing scarce resources and understanding fundamental necessities. In other adventures, the narrative describes an established society on an exoplanet so instead of short-term crisis navigation it becomes about long-term sustainability of solutions.

For example, the emergency response on the exoplanet can be applied to a different situation on planet Earth. If they've been exploring water scarcity on the exoplanet, on Earth they try to translate their solutions to a place where water scarcity is likely. If a course focuses on circularity, this whole thing could be made specifically about circularity.

– Laura Wirtavuori (CERN Ideasquare)

The return to Earth follows the same open structure: a plenary discussion, free exploration, team presentations, and reflections. During the translation, systems thinking is a key component, which allows for identifying existing supports and hindrances to implement the ideal solutions.

The Circular Economy mentor as a compass

Keep It Simple, Stupid!

Mentoring and nudging often took place in the form of encouraging simplicity. Students tend to want to make something completely sustainable or completely circular, which is often not realistic.

“All these principles are open to interpretation. People would say, ‘We are reusing it!’ – but how? For what cost? There are so many bad applications, bad examples, referring to circularity or Circular Economy. It’s unavoidable. And this also happens in the studio courses. Students are really eager to fit their projects in core ideas like circularity. ‘Yes, we follow all the R’s!’ ‘No, you don’t – and you don’t have to!’ We should not promote it like that. Instead, we should say, ‘Just relax. Just show me what you have really done in practice.’ Otherwise, it’s just promoting something that is not there.
– Müge Kruşa Yemişcioğlu (METU DF)

Even when taking the entire system into account, design solutions can be very simple and elegant. In one of her projects, students visited a factory making beverages that required constant cooling, and identified a gas being produced as a byproduct and simply discharged. They designed a pipe-based mechanism to redirect it as a cooling system for the bottles. Nothing new, just something that was already there going to waste.

Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre) described a similar nudge in their own teaching, steering students away from ambitious concepts that reimagine the entire system network and towards a small, specific design intervention instead. A tool Ryan Smith (DF London) borrowed from Design Factory Korea captures the underlying principles well: the ‘Back-of-the-napkin idea’, which asks teams to describe their concept in terms of what it is, what it does, and what it creates – and to choose upfront whether they are



optimising for feasibility, impact, or innovation. He shared an example: tasked with improving recycling at Heathrow Airport, students went to the terminal, discovered the real problem was bin confusion combined with the rush of catching a flight, and solved it with a very simple, yet impactful solution. They added signage on top of the bin that explained where the trash was going and **why**. For example, plastic would go in one particular bin so that a seal doesn’t choke on it, paper goes here because then it doesn’t go to the landfill, etc. The client was delighted – the solution was so simple and cost almost nothing.



More mentors, more perspectives

Various programs leveraged the potential of mentors to push for critical design decision-making and feasible model-making. Elina Mīkelsone (RTU DF) brings in 50 mentors across a five-day hackathon (notably, she received the World Open Innovation Conference Prize 2025 for her work on sustainable innovation hackathons, presented by Henry Chesbrough himself, the father of open innovation):

“Why are we inviting so many mentors? We believe that diverse perspectives bring different kinds of idea improvements. If we have 10 teams there’ll always be 10 mentors every day. All teams meet all mentors during speed dating: 10 mentors per day for five days is 50 mentors that they meet during the week. Maybe one person is saying ‘Your idea is dumb,’ and the other will say, ‘You can use this material,’ and another will say, ‘Never use this material.’ They get a lot of input and they have to find their own way. They are sometimes confused but this way they find some kind of truth about how to improve the end solution.
– Elina Mīkelsone (RTU DF)

Mentors are also selected by theme across the five days: product designers for prototyping, startups and enterprises for business building, influencers for presentation skills. Sometimes kindergarteners are invited for the final presentations, on the logic that solution creators should be able to share their ideas with any audience. Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) notes the role mentors play in makerspaces too, helping with onboarding, machinery use, and fixing 3D models. Ciana Martin and Farnoosh McDonagh (Forge DF) described weekly mentoring as a key lever for reducing material usage and questioning sustainability choices without hampering creativity.

Mentoring on demand

Other mentoring happened less scheduled and more on student demand. Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) described the balance:

“*You have to have your eye on the student teams and know what they’re doing, because we need to mentor them. We cannot let them go for these two or three days and let them fully do whatever they want, because they need some guidance. It’s not to do anything for them, or instead of them, but to be there for them if they need some advice. They usually do. It’s a little bit stressful sometimes, so it’s nice for them to have somebody to talk to about it.*

– **Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”)**

Müge Kruşa Yemişioğlu (METU DF) takes this even further, giving lectures or guidance almost exclusively on student demand. Only a few basic practices, such as persona creation, are provided to everyone upfront. After that, students can request topics on whatever interests them: parametric design, Sustainable Development Goals, Circular Economy. Each team has both an academic and an industry mentor, but it’s up to the team to initiate contact. The tension this can produce surfaced clearly in one project, where the academic mentor advised students to reuse and improve old refrigerators, while the industry mentor pushed for developing a new model – a preference that reflected the company’s commercial interest in selling new products. The students followed the industry mentor. It is a tension that sits at the heart of studio education in industry-partnered courses.

Bringing in external Circular Economy inspiration

Visiting communities & use contexts

Several educators highlighted the enormous value of engaging directly with users or the use context. For Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre), the Xixi National Wetland Park has become a recurring design use context. What looks like an ecological success story turns out, beneath the surface, to embody a real tension between human enjoyment and ecological health. Originally conceived as an ecological service for citizens, the wetland developed into a somewhat superficial representation of harmonious landscaping. Students visit the site to understand its complexity: energy flows, material flows, the relationship between visible and invisible infrastructures. They use this as the basis for an ecosystem map. Online surveys are not allowed.

In a Challenge-Based Innovation project for the Zambales region in the Philippines, students guided by Laura Bellorini and Mireia Sierra Andrés (Fusion Point) tackled reforestation and circular agriculture in an area where past volcanic activity left the soil nutrient-poor. Working with a local NGO and Ateneo de Manila university (whose students visited the field), they mapped the full system: soil conditions, water access, weather, government policies, community culture, and historical environmental events. Their solution combined biochar for energy production with water reservoirs to reduce dependence on rainfall, while the reforestation work addressed the region’s flood vulnerability. A reminder that circular agriculture is inseparable from the land’s ecological history.

Some interactions with the use context focused particularly on long-term impact. Diana Riveros, Juan Ramirez, and David Serje (Cali DF) shared that much of their programme focuses on service learning and real community impact. They described a project built around a community of women who recycle plastics:

“*One of these projects targeted the compacting machine that was designed for a community of women who recycle plastics. This project follows the service learning methodology, where students learn by developing a social service and providing an innovation that brings social benefits. The first-semester students developed a small scale prototype. The senior students then had two semesters and assigned budgets to build a functional prototype. As part of the course, they also supported the actual construction with companies, resulting in a functional machine that will be given to the community.*

– **Diana Riveros, Juan Ramirez, and David Serje (Cali DF)**

Before meeting the women, students participated in an empathy workshop to prepare for the emotional and communicative challenge of the encounter. During the encounter, they were blown away by how wrong their assumptions had been.

Showing, not just telling

Inspiring students to embrace Circular Economy from a theoretical point of view only gets you so far. Showing real companies, real projects, and real consequences is what often draws them in.

Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre) draw on a range of case studies, their own PhD research, the Hokkhi project on oyster reef conservation in Fujian province, as well as a project by designer Yanyan at the Floating University Berlin, which engaged with local ecology and non-human actors, a Politecnico di Milano master's project on how to become neighbours with butterflies, and an undergraduate project on bringing fire back into temporary urban space. These case studies each have different emphases.

“*Those case studies bring a lot of very specific design details to the student and also perspectives from how to bring post-human theories into everyday practice. So I think it's a good case that connects students with the conceptual level and links it with everyday practice. In their projects I have seen that they adapted the inspiration and design actions from the case studies.*

– **Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre)**

Diana Riveros, Juan Ramirez, and David Serje (Cali DF) also opened a course with a case from an earlier community project (Nasa Indigenous Resguardo) in which dairy byproducts were transformed into drinkable whey and ricotta cheese using only what was available locally. Nothing high-tech, nothing imported; showing circular solutions do not have to be complicated. Ryan Smith (DF London) points students toward companies that have made circularity core to their brand. The jacket manufacturer Barbour, for instance, will repair any zip on any coat they have ever sold. Circular economy and good marketing, he shows students, can be the same argument.

Elina Miķelsone (RTU DF) embedded real-world cases into her ideation tool Greenopoly (more on this practice on [page 26](#)), contributed by her colleague Inga Uvarova, though simplified into more relatable simulative examples to make them easier to digest. Müge Kruşa Yemişcioğlu (METU DF) has adapted to the reality that long documents tend to get AI-summarised into bullet points before students ever read them. She now shares visual content, YouTube videos, and Medium articles instead: enough to point students in the right direction without losing them on the way. Laura Bellorini and Mireia Sierra Andrés (Fusion Point) shared not just cases but an invitation to participate in the international Map the System competition, signalling to students that this kind of systems mapping is valued also outside the classroom.

Step aside and let the expert speak

Sometimes the most inspiring thing an educator can do is step aside and let someone who is actually doing it take the floor. Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre) found this especially necessary once students had done enough research to feel lost rather than informed. Synthesising material into design criteria proved harder than gathering it. Inviting professors from different disciplines as experts helped students bring their projects back down to earth.

Manuel Walter (inno.space DF Mannheim) takes this furthest, structuring his entire 4R course around guest speakers, one per R. For reduce, he invited The Post Apocalyptic Inventor, a YouTuber who builds remarkable things out of materials found in trash yards. For reuse, a repairer from a local Repair Café explained the repairability of everyday devices, including the legal side. Those 'warranty void if seal is broken' stickers, it turns out, have no legal standing. For the recycling session, a waste trader came in to show how much value exists in what most people simply throw away. Manuel reflected that experts bring such deep knowledge and genuine passion that they are effectively irreplaceable.

Laura Bellorini and Mireia Sierra Andrés (Fusion Point) bring in expert panels to kick off research phases, gathering specialists from different institutions, research centres, or industry to give students a lay of the land on the main issues in a problem area. Ryan Smith (DF London) does something similar but mid-challenge, inviting experts who can shed light on specific technologies like 3D printing or AR/VR as students need them. Both he and Monika Grinevičiūtė (VILNIUS TECH „LinkMenu fabrikas“) also bring in experts specifically to introduce the principles of Circular Economy, using examples like Patagonia, which repairs garments indefinitely rather than selling replacements.

Scaffolding the Circular Economy design process

Frontloading with Circular Economy theory

Give them the vocabulary

Even the most practice-oriented educators emphasised the importance of teaching theory. Some educators described starting courses with foundational theory as standard practice. Diana Riveros, Juan Ramirez, and David Serje (Cali DF) introduce Dieter Rams' principles of good design alongside David Ullman's and Karl Ulrich's step-by-step design methodologies, providing a framework for the full product development lifecycle. Ryan Smith (DF London) applies the same logic when introducing any new design lens: for a course on inclusive car design, he had students explore the full range of interpretations first: not just physical ability, but financial ability to hire or buy a car. What students do with that understanding afterwards is up to them. Christine Thong (DF Melbourne) takes a lighter touch, offering Circular Design as one input among several rather than the underpinning of their [Challenge-Based Innovation course](#).

Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre) go furthest, frontloading their Xixi Wetlands course with post-human theory, feminist theory, and relational anthropology. Students are not expected to master these frameworks. The goal is orientation, to build a relational worldview from which students approach design work. Manuel Walter (inno.space DF Mannheim) achieves something similar through play. [The Climate Puzzle](#) is a three to four hour game covering how human behaviour, fossil fuels, CO2, biodiversity, and oceans connect to each other. After playing it, why we should recycle, reuse, and reduce feels more obvious to students in a way it did not before.

The criteria say: sustainability is not optional

Parameters give clear directions while keeping exploration open enough for students to experience creative freedom. Elina Miķelsone (RTU DF) described how explicit sustainability criteria shape her LG Sustainability Coopetition hackathon:

“The LG Sustainability Coopetition is a new style of hackathon where we are rewarding not only who has the best, most innovative solution most suitable for the market, but also the cooperation: how much have they helped other teams? We don't have any lectures about sustainability, because those are provided in all studies in the university. However, in the criteria we have these matrices where we are describing in a lot of detail how to get the minimum up to the highest sustainability points for each challenge. We create the basic criteria and challenge givers can modify them according to what they believe in. Sometimes they make them harder, sometimes simpler – we are fine with either. So from these criteria descriptions, even students from other universities learn about sustainability. We never ask, ‘Should we include sustainability in the criteria?’ It is there, we do not take it out, there are no discussions about that. It's in our backbone.”
– Elina Miķelsone (RTU DF)

Ryan Smith (DF London) noted that explicit sustainability parameters have an unexpected pedagogical benefit: students discover through iterative working just how complex the challenge really is. In the McDonald's Happy Meal brief, tight material constraints meant students kept hitting dead ends and understood quickly why Circular Economy is so hard in practice.

Must consider, but you decide how

Not all programmes make sustainability explicit in their criteria. Some embed it so deeply in the culture that it simply does not need to be stated.

“It's something that has come very much to the forefront, whereas in the past it was more an additional element. Now it nearly feels like sustainability considerations have to lead a lot of the projects. It became more of a necessity than anything else. It's not really something you can choose anymore. It has to be embedded in the way everything is being done.”
– Ciana Martin and Farnoosh McDonagh (Forge DF)

Diana Riveros, Juan Ramirez, and David Serje (Cali DF) described exactly that culture: project criteria at their institution focus on ease of use and functional specifications, with circularity simply assumed as a given. Christine Thong (DF Melbourne), in turn, described supporting a project culture with sustainability workshops, where students spend a week with planet-centric design canvases and principles so that these inform their solution – not as a requirement to check off, but as a lens they are expected to have internalised.

Scoping the circular challenge

Real clients, real constraints

Industry partner briefs are among the most effective ways to motivate students to engage with Circular Economy, because the impact of their work is more real. Ryan Smith (DF London) described a challenge that illustrates why:

“We did a really good challenge with McDonald’s about sustainable Happy Meal toys. We know McDonald’s as fast food and plastic toys – it almost seems like it’s the wrong kind of brief. However, the students were tasked with making a toy that is commercial, viable, and usable by McDonald’s, with stringent rules about sustainable materials due to international rules. That challenge brought in students from about nine different universities across the US, Colombia, UK, Spain, Germany, and Korea. Everybody was coming at it from different angles, all with a common goal: how do we make this sustainable and usable? What we discover from those challenges is that students are really keen to try and make a difference. How do we leave the world better than we found it? We realised also that these global challenges support transdisciplinary working very effectively. It doesn’t matter if you do business, design, engineering, science, or medicine – you design something together, bringing in different subject matters.

– Ryan Smith (DF London)

Ciana Martin and Farnoosh McDonagh (Forge DF) found that working with a real industry partner from initial ideation through to actual production is a strong motivator for students undertaking a three-month placement. Even projects without industry partners are chosen strategically. A lighting project run without a partner was designed explicitly as a stepping stone toward attracting a major industry player the following year. Sustainability being central to their makerspace’s identity has helped them attract partners who share the same priorities.

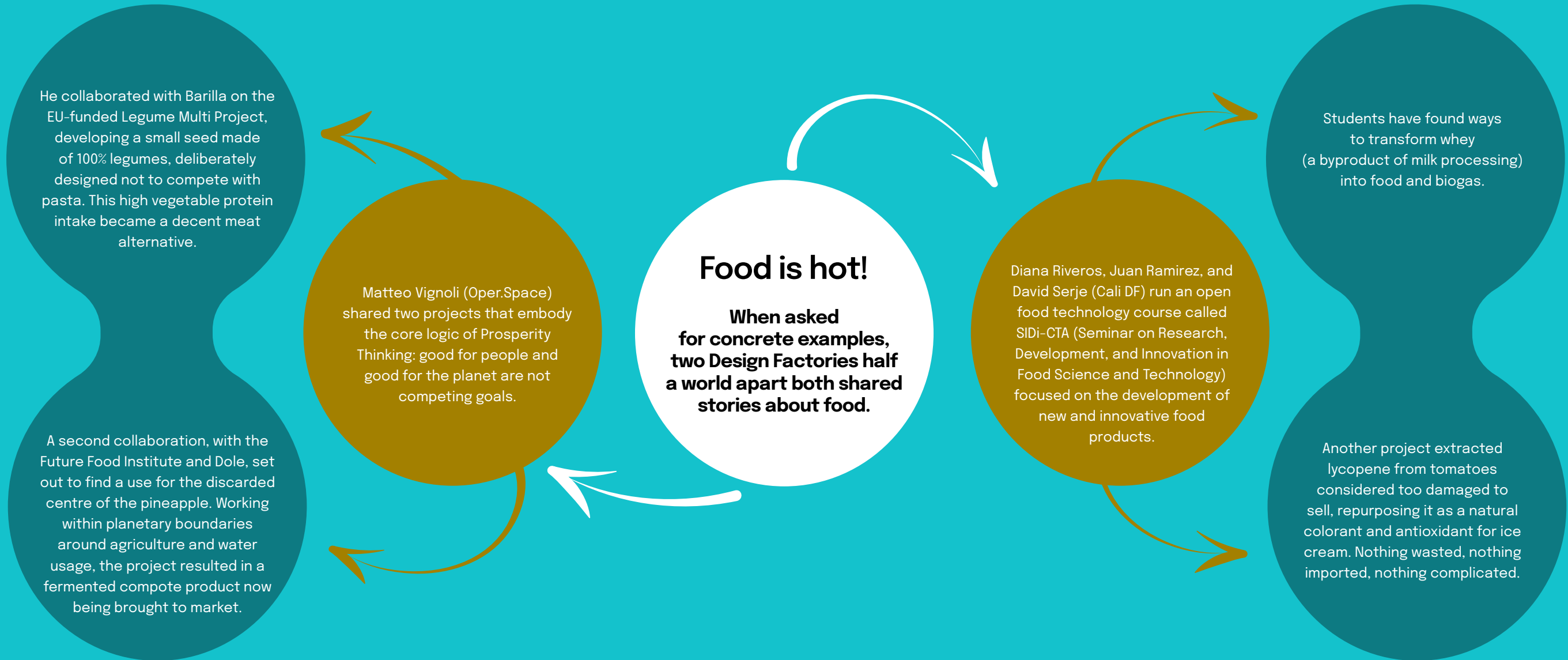
The brief before the brief

Some educators build in a phase where students construct their own brief before any design work begins, with social and environmental impact as the organising logic from the start. Christine Thong (DF Melbourne) described the matchmaking process at the heart of their Challenge-Based Innovation course:

“It’s sort of on the periphery. It’s not the core learning. The thing is, working and designing with deep technology is hard. There’s a lot of tech that’s just pushed out for the sake of it. Because something can be done, doesn’t mean it should be done. So we developed a programme where the first phase is finding a match between a societal need and a technology. Instead of going, ‘We’ve got this particular sensor, what can it do?’, we say, ‘We know that gender equality is a thing. Where on earth could this help gender equality?’ Maybe there’s no natural fit. Students need to look at challenges that are of interest to them and that they have access to. If it’s something off in a third world country and you’re here in Melbourne or New York, how on earth do you do user-centred, inclusive approaches? Then you’re just doing design to someone. So it makes sense to look at localised challenges and not push tech for the sake of it.

– Christine Thong (DF Melbourne)

Diana Riveros, Juan Ramirez, and David Serje (Cali DF) split their year-long course in two: the first semester devoted entirely to formulating the project brief, the second to executing the project and measuring its impact. The brief creation framework asks students to connect their prior disciplinary knowledge (solid and fluid mechanics, thermodynamics, fluid dynamics) with sustainability or Circular Economy practices.



From circular insight to circular idea: educators' favourite tools

Before you redesign a circular system, you have to see it

Mapping was perhaps the most mentioned favourite practice – spanning dimensions of time, space, species, and more. Indeed, before students can redesign a system, they need to see it.

Mod+RE+CO+DE framework

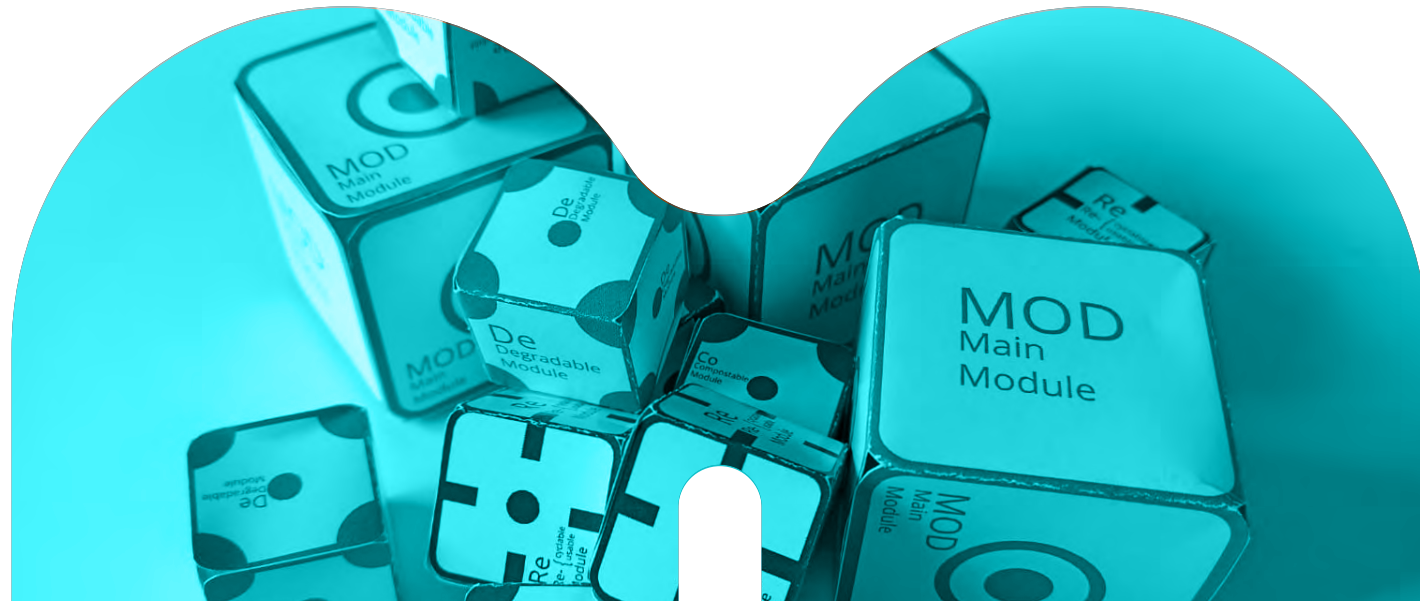
There is no shortage of tools and theories for understanding a product or service context. The skill is finding one that suits your context. Or, true to the Design Factory mindset, developing your own. Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) did exactly that, co-developing the Mod+RE+CO+DE framework together with the Open Source Circular Economy Days (OSCEDays) Network over several years, capturing which problems people encounter when engaging with Circular Economy concepts and finding open ways of tackling them. The Ellen MacArthur Foundation proved a valuable resource throughout, its materials and processes evolving over time from a focus on recyclability toward sustainable circular cities and policies. What the framework seeks is to materialise this information, making it practical and actionable for designers and students.

The framework supports shifting from focused product design toward a connected frame of possibilities, activities, and services. At its core it is a simple but powerful categorisation: every component of a product belongs to one of three types: a permanent model with a long lifespan, a recyclable model with a medium life cycle, and a compostable model with a short life cycle. Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) explains what this unlocks:

“ You have to choose one main model: maybe the structure of the product, the motor of the product, something that energises it. The components that can be recyclable have a medium life cycle, and the compostable parts have a very short life cycle. With that in mind, students understand life cycle, kinds of materials, kinds of processes, and kinds of services connected to them. For example, I have a blender and I think it can work for one or two years. If I understand that the main part can work 100 years because it's the structure that does not change, but other elements like electronics or buttons need to be changed or can evolve in a short time, that changes everything. Maybe I don't have to sell you the blender. Maybe I sell you the main model and you construct your own blender with parts you can find or design locally and make it better or evolve over time.

– Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá)

The framework follows a learning by doing approach. Students engage with the process first, with only essential explanations, and the space for discussion and reflection comes at the end. It has been taught in three-hour workshops and eight-week projects alike, and has been used across a network of eleven Colombian universities. Over time, student solutions have shifted away from product-centred thinking toward policies and system transformations. This is a clear sign for Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) that the framework is doing what it was designed to do.



Giga Maps

Several educators named Giga Maps as one of their top tools for understanding context before any design work begins. For Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre), Giga Maps support understanding and visualising the different actor perspectives in a system, heightening students' sensitivity to the interrelationships already present.

“*I emphasise the topic of collaborative ecosystem surveys, so I will ask students to identify the key modern human actors. Around these actors, they make a Giga Map. To make this Giga Map, they need to go through a design toolkit. The first set of tools is very conventional, it's called Horizontal Scanning, about market analysis tools used at the University of the Arts London. Another set I call the Five Elements design toolkit: traditional Chinese philosophy translated into design tools covering the micro, meso, and macro levels. They conduct research to understand the actors from different perspectives, from the social level, culture level, technology level, and ecological level. The use of these two toolsets is not only to support students in building the map itself, but also to create a comparison. More specifically, the purpose is to observe whether, and in what ways, relational thinking influences students' understanding of the system. Through this more complete understanding they will develop a design intervention.*

– Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre)

Circular Economy is not a single topic in this course but a structural way of systems thinking, incorporated from the very beginning by mapping energy circulation, material flows, information flows, and the behaviours and relations between actors. Design becomes a tool to reorganise existing cycles rather than simply introducing new technologies.

One student project from the Xixi National Wetland Park collaboration shows what this kind of thinking can produce at its best:

“*The student made a beautiful connection between the sensitivity of moss and certain highly sensitive people who receive sensory stimuli more intensely. Highly sensitive people, just like moss, need stable microclimates to flourish. Sometimes these highly sensitive people are marginalised in society, invisible, just like moss. The student proposed creating a series of moss city areas within the wetland, small shadowed zones where both moss and people could find refuge. They designed a participatory moss community programme including guided workshops on moss cultivation, bio monitoring and moss storytelling. Visitors, especially those who identify as highly sensitive, were invited to become moss guardians. We were moved by how deeply the student understood that conservation is not just about saving species but about cultivating relationships. They didn't design a fence around the moss, they designed a ritual of care, which is at the heart of circular design: creating a system that forms a life through connection, not control. The design intervention connected the marginalised plants with the marginalised people equally, raising both of their voices together.*

– Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre)

Laura Bellorini and Mireia Sierra Andrés (Fusion Point) took a slightly different approach, using a teacher duo to lead the mapping: one professor bringing a societal and business lens, the other a systems and engineering perspective. To ease students in, they started close to home, making the classroom itself the first system to map before scaling up to something more complex like housing in a city. Giga Maps reward the time invested in them, but that investment is real: starting a mapping exercise without sufficient time to go deep, reveal the relations, and connect the dots risks ending up with superficial systems mapping that adds little value.

Life Cycle Assessment

Some mapping exercises dive deeper into the origin of products specifically - not just the materials, but why a product is made the way it is, and then why it is used the way it is. Vikki Eriksson (Aalto DF) uses a Life Cycle Assessment to do that:

“A Life Cycle Assessment is a really established practice. We do a fairly light version of it because to do a proper Life Cycle Assessment on a product requires extensive time and resources. For us, it is a mechanism to encourage systematic thinking around products. With the Life Cycle Assessment, we take students back and forward in time.”
– Vikki Eriksson (Aalto DF)

Past

“Going back in time involves deconstructing the product and recognising the raw materials, as well as which regulations and design decisions may have shaped it. We identify where and when it was designed and manufactured. We can map governing legislations, look at global trends for relevant material extraction, identify locations of raw material extraction, components production, and assembly. This is important because students start seeing products not just as the sum of their parts, but as multiple nuanced stories. They begin to see that there is a person that has mined the rare earth mineral, in particular conditions, for a certain number of hours. The demand for products is intimately linked to the lives of many people and their work practices. That is the idea of looking back: to become much more critical about what has led to the item in front of you.”
– Vikki Eriksson (Aalto DF)

Present

Understanding the origins is only the first half. The practice then moves to the present:

“A tricky point of the Life Cycle Assessment is the usage phase. Here, we can talk about behaviour. I link it to Value-Belief-Norm theory and to Planned Behaviour theory. I aim to shift students' perceptions away from the 'object' to 'what about me' makes me buy and use a product. How do I use it? Do I leave things in standby mode? And why? We can have products with amazing energy efficiency, but those scenarios are based on ideal usage. What is important is getting people to realise that their behaviour, their norms, their values indirectly influence the environmental cost. We have a lot of candid conversations around, for example, recyclability. In Finland, it's really easy to recycle: you know how and where. We talk about what we don't recycle and why. This becomes about dismantling preconceived ideas about responsibility in the green transition. People feel, 'I'm not responsible because I'm an individual.' And that's true. Companies and governments can have a bigger impact. But they are all creating things that we as society are using and consuming. We all like to shift the responsibility. So that's what we unpack in the present.”
– Vikki Eriksson (Aalto DF)

Idea generation with a circular nudge

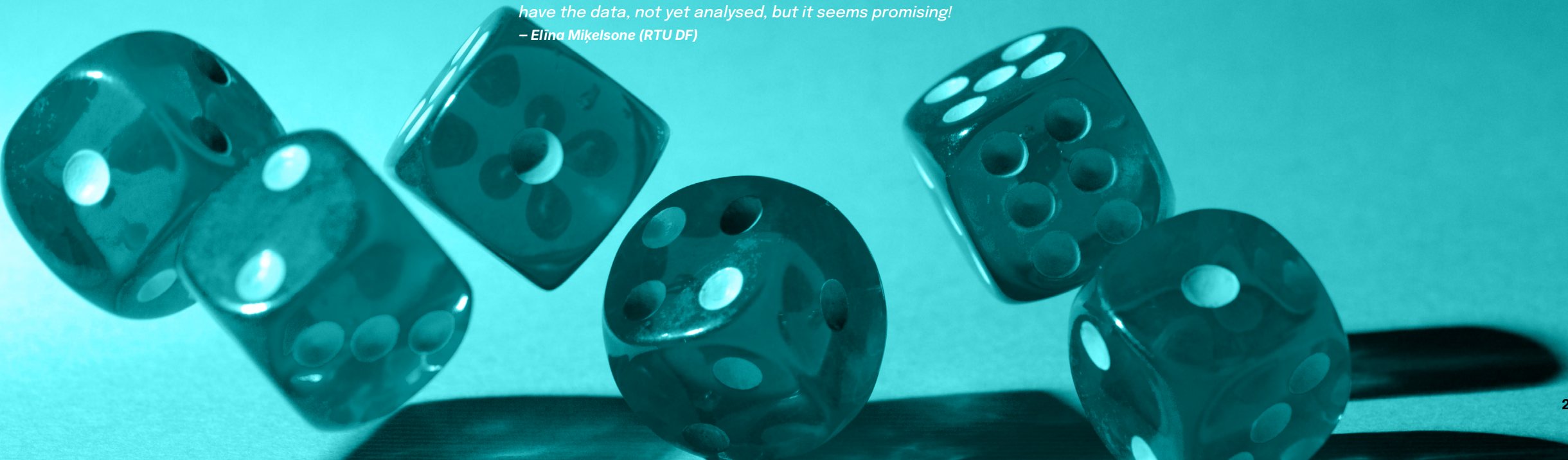
Greenopoly

Standard ideation methods generate ideas freely, but they don't steer toward sustainability by default. Elina Miķelsone (RTU DF) and sustainability researcher Inga Uvarova set out to change that. Taking Uvarova's academic paper on 60R principles as their foundation and combining it with Elina Miķelsone's expertise in idea management, they developed [Greenopoly](#) ⁷: a free board game designed specifically to generate sustainable ideas.

“Greenopoly is a tool, or a game, that supports creating more sustainable ideas. We placed all 60R principles with colour coding on the board. Players define the challenge and then roll the dice to get one of our principles. Using that principle, they write down as many ideas as they can, sometimes with a time limit. Then they roll again. They get a quantity of ideas and later select the best ones using specific idea evaluation methods. And what's interesting, I have played this game with different challenges with students and corporates, and for each principle, there are always 5 to 20 ideas. It really helps to find different angles on how to solve a challenge. However it was just a board game, and we hadn't tested its effectiveness. As researchers, we wondered whether it really worked so we acquired funding to study it. And the tests show that it worked, which we published in an academic paper. This year we created a digital board to be more sustainable in our own process. We are currently testing the digital tool. We have the data, not yet analysed, but it seems promising!

– Elina Miķelsone (RTU DF)

Initially the game included short explanations of each principle, but some proved hard to grasp from an explanation alone, so they added a table with examples. These were initially product-focused, but players still struggled to translate them to services and processes, so service and process examples are now in development. There are also plans to make Greenopoly live so other researchers can contribute new R principles, and to integrate [Kate Raworth's Doughnut Economics](#) ⁸ model because it is gaining traction in the field.



Tools that force the uncomfortable questions

Matteo Vignoli (Oper.Space) emphasised the importance of tools that support unpacking why things are the way they are before any redesigning begins. His go-to is the Iceberg Model, used as a one to two hour workshop exercise. Starting from an unsustainable event, the plastic island in the ocean, for instance, students identify the structures and mindsets that allowed it to happen, then reverse the iceberg to target the mental model directly. The beauty of the tool, he noted, is that people get into a structured conversation about systems thinking very fast. Two other tools he favours: human and planet balance statements, which force students to articulate the impact on both in a single sentence, and the Environmental, Social, and Governance framework used not as an investment screening tool but mid-design, to catch problems early when they are cheaper and easier to fix.

Christine Thong (DF Melbourne) approaches unpacking through peer feedback, having student teams list stakeholders, negative and positive impacts, and unintended consequences for each other's projects, then firing rapid questions to collaboratively reframe the challenge. In her experience this always brings a breath of fresh air and a kind of mash-up ideation. Several of her favourite ideation tools came from a colleague working at a Finnish service design company, with Regenerative Cards standing out as particularly powerful:

“The cards give the students scenarios that they are forced to mash in and make very tangible. It works well on conceptual ideas where students still need to work out the how, what, and why. It makes them think of human and non-human stakeholders, any unintended consequences, and impacts. This helps them reframe their How Might We's and forces them to consider the planet's resources in their brief. In other words, it supports creating sustainable loops.

– Christine Thong (DF Melbourne)

Provoking students to consider the planet can also happen by looking to nature itself. Elina Miķelsone (RTU DF) uses biomimicry as an ideation trigger, encouraging students to steal ideas from nature and apply them to products, services, and organisational processes. When you borrow from nature, she reasoned, you tend to create something more environmentally friendly by design.



What if it's real? Envisioning circular impact

Numbers matter: calculating what material choices actually cost

Understanding material impact remains a core component of circular design. Manuel Walter (inno.space DF Mannheim) recommended critically applying the 4R method: identifying what can really be recycled and how energy flows work as a foundation for design decision-making. Ciana Martin and Farnoosh McDonagh (Forge DF) highlighted the idea selection phase as one of the most important moments for sustainability, since this is when real material decisions are made. Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas“) focuses her programme specifically on recycled materials from scrapyards, and emphasises the importance of teaching students how scaling works:

“ We teach them how to think if you want to scale a product. We discuss how to be consistent with recycling materials, how to assure there is sufficient material if you're using more. So we teach circularity in terms of recycling and reusing, but we also get into regenerative approaches and systems thinking when discussing how materials are being produced. We're focusing mostly on recycling.

– Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas“)

Calculating material and manufacturing impact precisely is a shared priority across programmes. Vikki Eriksson (Aalto DF) has students use Granta EduPack material databases to understand where materials are produced, what alternatives exist, and most importantly their environmental cost, alongside a discussion of the pros and cons of Designing for Disassembly. Diana Riveros, Juan Ramirez, and David Serje (Cali DF) highlighted the methodological relevance of conducting comprehensive carbon footprint assessments for materials and

processes, while concurrently integrating indicators that capture social and economic dimensions. The shared conviction across all of these approaches is the same: sustainable intentions are wonderful, but numbers are what make design decisions real.

Designing for how people actually behave

The impact of a design solution is shaped just as much by how people actually use it as by what it is made of. Vikki Eriksson (Aalto DF) noted that while material components remain part of her course's explorations, the behavioural side is becoming increasingly central. Matteo Vignoli (Oper.Space) builds this into his teaching through foresight and projection tools:

“ You should start thinking from the beginning. What is the product, the system interaction, the human system interaction? Do people need training, incentivising, convincing? The human element is very important and often a transition needs to be facilitated. Maybe you need to help people do better, to waste less, to regenerate more when using your product. So it's really designing for transition. This is a very important part of Prosperity Thinking that is often insufficiently explained in regular design courses or programs.

– Matteo Vignoli (Oper.Space)

The Transition Path Storyboard, adopted from sustainable design research literature, supports thinking across different time frames to consider the solution's impact on different stakeholders. It is often used alongside power-influence stakeholder mapping, which reveals which actors are shaping the system beyond the obvious policymakers.

“ And then we need to consider the long-term future. What if everybody starts using this? How do we dispose of the product? What incentive is there to repair it? If you project this 5, 10, 15 years down the line, what happens? For example, bike sharing in a city is great if people do not destroy the

bike. In Amsterdam, you find all the bikes in the canals. When you initially designed the system, you didn't think that would happen. And that could be damaging the city as well. So we thought this kind of foresight or projection tool was a good addition at the end of the process.

– Matteo Vignoli (Oper.Space)

Elina Miķelsone (RTU DF) applies similar futures thinking tools during her hackathon, challenging students to consider whether their solutions will still work after 10 or 100 years. Diana Riveros, Juan Ramirez, and David Serje (Cali DF) focus on the full picture of consequences before and after:

“ With whey, I first show students the environmental consequences associated with its underutilization or disposal. We then examine the pathways through which it can be recovered, reused, and valorized, together with the nutritional benefits derived from its effective use. In this way, students can identify both the losses incurred when whey is treated as waste and the value generated when it is reintegrated into productive systems.

– Diana Riveros, Juan Ramirez, and David Serje (Cali DF)

Christine Thong (DF Melbourne) recently pushed the timeline for futures thinking and planet-centric tools from 2030 to 2050, forcing students toward longer-term thinking and ensuring designs are responsible and well-considered.

Fermi problems

Both Laura Wirtavuori (CERN IdeaSquare) and Christine Thong (DF Melbourne) named “Fermi problems” as one of their favourite activities for envisioning the impact of design decisions. This technique breaks complex questions into smaller, estimable parts, often solving them within an order of magnitude.

“Orders of magnitude thinking is not knowing the exact numbers, but estimating realistic ones. It requires a bit of thinking, so we often first do an exercise that has nothing to do with the students’ challenge, like, ‘How many rolls of toilet paper are used in this city per year?’ Then students try to estimate. Another example: ‘How many letters are there in all of the Harry Potter books?’ We walk through how you might think about it: how many books, pages per book, lines per page, words per line, letters per word? Then you get an answer that is often pretty close to the real number. It’s not about knowing the exact number, but the number of zeros after the first number.

– Laura Wirtavuori (CERN Ideasquare)

Once the general thinking is understood, the students can engage with a more complex challenge.

“These exercises are a good gateway into appreciating the power of this type of thinking. ‘If we’re dealing with a 5% increase in energy efficiency on laptops, what impact is that going to have overall?’ Students estimate: how many laptops are used, by whom, how much. ‘Now, what would be the impact if everyone only had one personal device?’ How do you look at that? Is it just for energy? Is it materials? So you’ve got to do some quick calculations. We did it with our students using Melbourne culture: takeaway coffee cups. Three scenarios: the disposable cup, the reusable cup you bring, and sitting in. Just quick calculations to understand impact and scale without fixating on detail. Then you start to see an overarching impact in a broader context without even introducing particular principles or frameworks within circular design. It really just shows how it could work and why it matters.

– Christine Thong (DF Melbourne)

Orders of Magnitude thinking is particularly useful because it can be applied quickly even when students are not yet clear on what they are going to design. Even when estimations are wrong, students gain a better intuition for how product systems, resources, and consumption behaviours are linked.



When Circular Economy students start building

The right tools for the right making

Setting up the space

Covering theory, increasing contextual understanding through mapping, and ideating towards sustainable solutions are all vital cornerstones of Circular Economy education. However, a makerspace can change what students think is possible. Without access to tools, materials, and production facilities, circular design remains theoretical. With them, students can prototype, test, and experience the constraints of sustainable making firsthand. Manuel Walter (inno.space DF Mannheim) describes the setup at inno.space:

“ We have a comfortable area for theory input - not tables and rows but a chair circle that facilitates conversation rather than a present-and-listen environment. In the makerspace we have everything from 3D printers to soldering irons, workbenches, hammers, and drill presses. 3D printers are not actually for repairing things, of course, but with a soldering iron and a pair of screwdrivers, you can do a lot. And you need some space where you can actually work. We have three big workbenches where students can rip apart their electronics. – Manuel Walter (inno.space DF Mannheim)

Ciana Martin and Farnoosh McDonagh (Forge DF) describe a similar setup: a fully equipped fab lab with 3D printers, laser cutters, sonic welders, and 3D scanners, where students have free rein to execute any idea they bring to it. What makes their maker station distinctive is a dedicated sustainability section, stocked with ground-up particles ready to be reused and repurposed.



This was built in from day one, with the explicit goal of making sustainable prototyping the default rather than the exception. Students arrive from a range of design disciplines (fashion, interaction, animation, and others) each bringing their own prior relationship with sustainability. The makerspace is therefore not where sustainability is introduced for the first time, but a place for upskilling where knowledge and ideas can be put into practice.

Sourcing the circular way: from the scrapyard

Having the right space is step one. The next is having access to the right materials. Monika Grinevičiūtė (VILNIUS TECH „LinkMenu fabrikas”) built her two-week programme around a partnership with a recycling facility in Vilnius. Week one happens online, covering Circular Economy theory and the context of the assignment. For week two, all participants travel to Vilnius. After learning how to use the Design Factory machinery, students visit the recycling facility to see what components are available to buy.

“Before going to the recycling facility, they already know what they can get from the facility’s big Excel spreadsheet with all usable recycled materials. Students review the list, choose what they want, and consult with mentors about whether their choices make sense. From the start, we instruct them to apply Circular Economy principles and use as much recycled material as possible, not buy new ones. When they are at the recycling facility, they know what they can take. Of course, usually they take more because they see something, some nice lights, and they change their design to include it. That’s the artsy, creative part.

– Monika Grinevičiūtė (VILNIUS TECH „LinkMenu fabrikas”)

Back at the Design Factory, students work freely: booking 3D printers, using the CNC machine, with help available if needed.

Manuel Walter (inno.space DF Mannheim) described a similar benefit from having a scrapyard next to inno.space:

“My colleague organised an expedition to the Mannheim trash hill, which was really amazing! We had the chance to see the sortier, where metals and ashes get sorted after the waste burning. A cool guy there explained where trash is stored, how it gets sorted, burned and where the difficulties are. It was really cool to see how much trash one city produces, and to

become aware how much is burned and how little is recycled still. I will definitely keep this in future programs.

– Manuel Walter (inno.space DF Mannheim)

A sidenote worth sharing: he once heard at a conference from a group of educators who had spent two months harvesting every toaster (or similar household device) they could find on a scrapyard planning to analyse the defects and repair them. It turned out 99% of the toasters were still working, so they had nothing to repair.

Supporting intentional building

Something changes when students start building. The energy shifts. Vikki Eriksson (Aalto DF) described what happens when her course reaches the deconstruction phase:

“In the second week, we deconstruct the product, dismantling it to its base components. It is an amazing opportunity for students to build as a team. We have business students who have never picked up a screwdriver, trying to manhandle a kettle while wearing safety goggles. For some it’s the first time they’ve been in a workshop. What helps students is that we start with a physical product they can touch, feel, use, break, and see the inside of. Many students have never seen the inside of anything. And then we discuss what they believe could have been the decisions that got us here. That physical connection to an object really helps the conversation.

– Vikki Eriksson (Aalto DF)

Monika Grinevičiūtė (VILNIUS TECH „LinkMenu fabrikas”) described a similar moment of creative ignition: as students start building, they already know the tools and have their components gathered, but then something shifts. They shout, get upset when things are not working, and then the creative side comes out: suddenly seeing better ways to build, or which components to use instead. Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) and Ryan Smith (DF London) both



emphasised the importance of mentoring during prototyping. Ryan Smith (DF London) teaches small-scale prototyping using only basic, reusable materials, inspired by Ford’s paper prototyping approach, to prevent students from building oversized models of everything.

Müge Kruşa Yemişcioglu (METU DF) pointed to another benefit of an active prototyping space: visibility. When staff built a wind tunnel prototype for a research project, students saw it happening. They understood that work is going on beyond the desk and the screen, turning the space itself into a shared learning environment.

Look what they made

New things from old materials

Ciana Martin and Farnoosh McDonagh (Forge DF) and Ryan Smith (DF London) both received a brief to create a fully sustainable award - in different contexts, arriving at very different solutions.

“Students were briefed to create a fully sustainable award for the Fresh Film Festival in Ireland. They started playing around with the base using a terrazzo cement made up of different particles: smashed old cds, old plastics, and other repurposed materials. The silicon moulds were built for an extended life cycle so they could be reused the following year. In terms of the actual award, they used timber which can easily be reused, and the patterns of the awards were laser cut to minimise material waste. The finished design has a 3D printed centrepiece that can be used for the awards every year.

– Ciana Martin and Farnoosh McDonagh (Forge DF)

Ryan Smith (DF London) received a similar challenge from a local business. His students went for reclaimed pallet wood: carved on one side, untouched on the other. Simple, honest, and made entirely from something that would otherwise be labelled as waste, this was very well received by their industry partner.

Other examples from across the network:

1

Another project from Ciana Martin and Farnoosh McDonagh (Forge DF) asked students to create a sculpture for the front of the university: durable enough for Irish weather, made entirely from sustainable materials. Their solution was inspired by an agricultural film used on cornfields, made from starch and fully biodegradable. All sculptures were made from this material using the sonic welders in the making station.

2

Manuel Walter (inno.space DF Mannheim) shared a challenge from a company that had developed a way to press leftover tea leaves into dense sheets strong enough to use as drywall panels. The material already worked - what students were asked to do was imagine where else and in which shape the material might find a home, and how to tell that story.

3

Diana Riveros, Juan Ramirez, and David Serje (Cali DF) are involved in a project in which students extract high-nutritional-value protein from black soldier fly larvae for the production of food and feed ingredients. This represents a robust circular bioeconomy pathway, as the larvae are reared on organic waste streams, transforming residual biomass that would otherwise be discarded. Compared with conventional livestock systems, the resulting protein is produced with substantially lower land and water requirements, as well as reduced greenhouse gas emissions. The process also generates biofertilizer, further strengthening resource recovery and nutrient recirculation within the production system.

Fixing what someone else gave up on

Repair and repurposing, often involving electronics, were a recurring theme across programmes. Manuel Walter (inno.space DF Mannheim) captured the moment when students realise what they are capable of:

“We had an amazing time in the repair shop. One student repaired his graphics cards. It was an old one and one capacitor went short, so we identified the bad component, unsoldered it, soldered a new one in, and it worked again. Even this simple exercise was a mind-blowing event for him: ‘Whoa! I can really do something! I can really repair things, that’s so crazy!’ Students are often not in touch with hardware, so they don’t know they can do this. In the reuse course, a student brought his old slatted bed base and created a wardrobe out of it, adding components he found at the dumpster outside the window. He got to see that the material was still worth something and didn’t need to get burned or landfilled.”

– Manuel Walter (inno.space DF Mannheim)

Practice what you preach

Educators also shared their own attempts to make their practices more sustainable. Ryan Smith (DF London) described an ongoing shift at Brunel:

“We make books every year called ‘Made in Brunel’. A few years ago this was a very thick, heavy book, difficult to send. The books from last year are the same content but a lot smaller, more sustainable, and a lot less paper. We’re now pushing to be more digital as well, and we split this into two rather than one big one. That was actually based on our own students’ requests.”

– Ryan Smith (DF London)

Ciana Martin and Farnoosh McDonagh (Forge DF) noted the tension between sustainable ambition and creative freedom: rapid prototyping generates paper, cardboard, and material waste, and while students are always encouraged to use existing scrap, materials are still being bought. Their conclusion was that being too strict during the prototyping stage risks hampering creativity and that the physical, hands-on process is worth the cost because it generates conversations that digital prototyping simply does not.

More examples from across the network:

1

Manuel Walter (inno.space DF Mannheim) shared a whole list of creations from his 4R course: bags from old t-shirts and jeans, a lamp built from an old monitor, a kettle fixed by changing the fuse, a bread cutter repaired with a 3D printed gear. Most of his students are engineers. Seeing what is repairable may shape how they design products in the future: hopefully, they will shift away from products that are difficult to repair and toward greater durability to reduce environmental costs. And if not, then perhaps as consumers, they will recognise the value of good engineering nevertheless.

2

Elina Miķelsone (RTU DF) recalled a project for L’Oreal involving old luxury perfume bottles. Students proposed using Prada bottles to light plane landing tracks. They built a prototype in an hour. The client was speechless.

3

Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) described outcomes from her electronics prototyping programme: a reassembled bike with added music and lights, and a hologram robot with a game inside, built entirely from repurposed components. It looked rough, but it could teach primary school students about recycling, which made it beautiful in a different way.

4

Ryan Smith (DF London) shared a story of a student who repurposed laptop batteries for communities off the electrical grid. The batteries no longer worked as laptop batteries but were perfectly suited to powering smaller devices without reliable electricity.

4

What Circular
Economy students
*go through &
walk away with*

Not everyone arrives at the same starting line

Familiarity and fatigue

Sustainability as a concept has been around long enough that most students arrive with some familiarity already. That can be an advantage, but it also means educators need to push further to keep things alive. Laura Bellorini and Mireia Sierra Andrés (Fusion Point) found that the familiar concepts are no longer where the learning happens:

“Students are familiar with simple definitions of sustainability and circularity. Maybe a few years ago it wasn't that clear, but for the last three or four years, they seem to be. But still, there is room for learning. Systems thinking, we've found, they are less familiar with. And that's something they really enjoy and engage in, because every discipline has some sort of systems thinking but rarely for the larger societal systems. Engineering students, for example, are used to doing flow diagrams for technical solutions. Now they learn how to translate that into broader societal elements.
– Laura Bellorini and Mireia Sierra Andrés (Fusion Point)

Christine Thong (DF Melbourne) has noticed students' attention spans shortening over the past few years, particularly since COVID, with motivation and engagement both dipping – something that Müge Kruşa Yemişcioğlu (METU DF) also realised. On the other side of the coin, students increasingly want to do things for societal good, and there is an enormous improvement in their self-efficacy when it comes to working with technology and imagining futures. Ryan Smith (DF London) observed that economic pressure is quietly driving Circular Economy thinking right now: people are spending less, repairing more, and developing circular habits out of necessity rather than ideology. When teaching Circular Economy, he finds waste a useful entry point:

students already notice discarded materials and instinctively ask whether something can be reused.

Disciplinary differences

Students do not arrive as a blank slate, their discipline shapes how they encounter Circular Economy thinking, and some arrive better prepared than others:

Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) found that teams combining product design and electrical engineering students tended to produce the strongest outcomes – if combined with passion and motivation.

Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) also noted that the aim of the project should shape what kind of students are recruited: higher-end projects with real-world impact may need very targeted disciplinary combinations, while broader student mixes tend to deepen the learning even if the end product is less polished.

Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) noticed that non-designers struggled more with diverging and keeping many possibilities open when exploring the connections between products, services, and policies.

Laura Bellorini and Mireia Sierra Andrés (Fusion Point) perceived the biggest learning in engineering students, who are used to more linear thinking. Once they embraced systems thinking and sustainability principles, the shift was significant.

Christine Thong (DF Melbourne) found that design and social science students were relatively faster at understanding different types of societal impact compared to technical students.



Excited, lost, then... something clicks

Curiosity & excitement

Across very different contexts, student experiences follow surprisingly similar arcs - from curiosity and excitement, through frustration and confusion, towards agency and a fundamentally shifted perspective.

Students tend to arrive curious and engaged. Often this is simply because they chose to be there. Ciana Martin and Farnoosh McDonagh (Forge DF) noted that students signing up for a placement at their makerspace already know they want to work with sustainability. Laura Bellorini and Mireia Sierra Andrés (Fusion Point) described a similar self-selection at ESADE:

“ *The majority of our courses are elective courses, so students decide to sign up. The people that join have an interest towards these topics. And also, our university ESADE's mission targets sustainability, social impact, and Circular Economy. So naturally, the students that choose to study at ESADE and join the courses are students that have an interest towards that.*

– Laura Bellorini and Mireia Sierra Andrés (Fusion Point)

Once signed up, students often get more excited as they start imagining what they might be able to do within the ecosystem of the challenge, observed Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre). Even students who are not sustainability enthusiasts tend to engage quickly. Both Matteo Vignoli (Oper.Space) and Christine Thong (DF Melbourne) found that sustainability considerations feel intuitive to most students once they understand how these higher-level constructs connect to their own lives and decisions.

Frustration & confusion

The initial enthusiasm rarely survives first contact with the full complexity of the challenge. Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre) observed that an impressive analysis can become a paralysing one:

“*The students are very enthusiastic at the beginning, but after doing this much research, the possible design ideas become more restricted. When they start dealing with idea generation, some groups seem to lose their passion. A lot of groups have amazing analyses, but they struggle to translate this all into design output.*

– **Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre)**

Part of the struggle is the overwhelming volume of interdisciplinary knowledge students are asked to hold simultaneously. Every student brings a disciplinary angle, but rarely knows enough about the entire system to feel confident. Working in small interdisciplinary teams means navigating conflicting approaches on top of an already overwhelming amount of data. Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) observed that students are often used to looking only at their own specific part, whether it is electronics, fashion, or mechanics, and suddenly need to consider all levels and systems at once. While their Open Source Circular Economy framework supports this navigation, deciding where to aim design intervention efforts is always challenging.

Matteo Vignoli (Oper.Space) attributed much of the confusion to unfamiliarity with planetary boundaries. While students generally understand basic ideas about not polluting, they are less prepared for concepts like ocean acidification or the cascading consequences of food waste. These require study before informed design decisions are possible and most students simply have not been trained in this.

Vikki Eriksson (Aalto DF) described something similar: students are initially relieved to have an honest conversation about complexity and the absence of right answers, but that relief quickly turns to frustration when they start asking how we got here and how we get out. She reassures students that in the middle of the chaos it is okay not to know. It is okay to want to be better without yet knowing how. That works for most, but for students who want three or four principles to apply, the absence of a right answer becomes its own frustration.

Laura Wirtavuori (CERN IdeaSquare) noted a particular version of this frustration in the IdeaSquare Planet programme: students often struggle to self-organise in an uncertain scenario and initially go in wrong directions. Once they get into the challenge the creative freedom of the exoplanet phase is energising but when they return to Earth and real-world constraints are added back in, sustaining that motivation requires effort.



Agency & ownership

Almost universally, educators described a shift near the end of their programmes. The frustration resolves into something more settled: a sense of agency, ownership, and genuine achievement. Christine Thong (DF Melbourne) described one such experience:

“ We had this two-week intensive course at IdeaSquare with one of the Italian Challenge-Based Innovation teams and it ultimately was a really successful experience. The students were highly inspired, they connected, learnt, did, and achieved a lot in a very short period of time. The combination of people, the openness, and the way things all connected seemed to make sense. It was well received by the people participating and the people partnering.
– Christine Thong (DF Melbourne)

What students walk away with in terms of concrete skills and a shifted sense of self is explored in the next two sections.



Students can do things they couldn't before...



Design skills: thinking in systems, not products

Even when the design outcomes of a project team are not brilliant, students will have grappled with the complexity of Circular Economy principles in practice. Being able to navigate the relevant tools and overwhelming amounts of data has a lifelong impact:

“With a lot of these challenges the main point of it is the process, not the output. It's very good when they make a solution, but the process they've gone through is far more valuable to them in the future. A future employer cares more about the process than the output because they're looking at how they approach things, how they're looking, if there are any gaps in their knowledge. The solution is secondary at that point.

– Ryan Smith (DF London)

However students go through the process, they learn to think systemically, navigate large amounts of information, and apply these in a real world situation, noted Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre). They never push for the final outcome to be a beautiful concept. A simple sketch is sufficient as long as students have learned to gather and organise data obtained from Circular Economy thinking

and can repeat that process with others. Matteo Vignoli (Oper.Space) added that what matters most is students leaving with the habit of considering those kinds of tools whenever they design a new product or service. Several educators highlighted that it all starts with being able to identify the right problem, something Diana Riveros, Juan Ramirez, and David Serje (Cali DF) illustrated through their long-term course with the women who recycle plastics:

“In the beginning, the students wanted to develop a fully automated machine without a single button. And the community told them, 'No, I don't need that, I am solving this problem already another way. But actually, I sell these plastics for a given price - can you help me increase my price by 40%?' The community members could not say directly what they needed. In the co-creation spaces, the women recyclers wrote down how they felt about a product, how they felt danger of something they didn't know how to use. When we showed them an image of a machine, they felt afraid of it. Those were things you cannot measure directly, but you must consider while developing a solution. This was an important design skill that they learned: to find different ways to communicate with others.

– Diana Riveros, Juan Ramirez, and David Serje (Cali DF)

By engaging with stakeholder and context mapping, students get better at identifying different elements and the relationships between them, felt Laura Bellorini and Mireia Sierra Andrés (Fusion Point), sharpening their problem framing ability.

Sometimes students need to go through a full design iteration before they find the right scope. Ryan Smith (DF London) described students who set out to redesign a sustainable wheelchair from the ground up, adding constraint after constraint until they arrived at the wheelchair as it already existed. This informed the focus of the next iteration. Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) used the Open Source Circular Economy framework to guide students from redesigning a product toward understanding how design can change how an entire industry works.

A second design skill is learning to see Circular Economy constraints as creative fuel rather than limitations. Elina Miķelsone (RTU DF) found that students developed twice as many same-quality ideas using Greenopoly versus traditional idea generation methods in the same timeframe. Initially reluctant to try yet another tool, students quickly discovered it was pushing them toward simpler, better solutions. Monika Grinevičiūtė (VILNIUS TECH „LinkMenu fabrikas”) noticed a similar pattern: after sustainability constraints were introduced, students became more creative and started iterating more.

Making skills: discovering what your hands can do

Hands-on making and repairing programmes leave students with tangible new skills and a genuine sense of achievement from seeing a project through to production.

“ *All the students that have been involved have really loved the process. There's a big sense of achievement from seeing something that's designed right through to production. Sometimes in education you don't get beyond the designing, the ideation and the prototyping - there's often a barrier to actually get into the production phase. So that's definitely a real takeaway for the students.”*

– **Ciana Martin and Farnoosh McDonagh (Forge DF)**

Monika Grinevičiūtė (VILNIUS TECH „LinkMenu fabrikas”) shared very positive feedback from students about her two-week prototyping programme. While some found it stressful, many highlighted the experience of touching the machinery and building something with their own hands as the main benefit. Additionally, students who were hesitant at the recycling facility, confronted with a list of unfamiliar components, quickly found their confidence once they started handling materials. It turns out working with recycled parts is not so scary once you begin.

Manuel Walter (inno.space DF Mannheim) noted that students became more aware of valuable materials just lying around them. A core learning was repairing skills. For example, one student learned to solder in order to fix a DJ mixing table. More broadly, students came to understand that every device is made of components that can be fixed and replaced. A phone is not a solid block with a display; there is a speaker, a battery, an LED, etc.

... and start to see themselves & others differently

Self-awareness: knowing the role you play

Learning experiences are ultimately about increasing students' self-awareness so they can make better decisions in their personal and professional lives. Müge Kruşa Yemişcioğlu (METU DF) described how awareness tends to spread:

“*The students become more aware, of course. Once they get into the subject, they start to dig more, look for more projects. Even if they can't understand the essence, it's still a win for me. They don't need to know the whole picture, the specific framework, the assessment criteria, the material passports, or all the details. They can access that information whenever they need it. As long as they know that it's there to look for, that's fine. And once one group gets involved in such a subject, other groups also learn. Not as deep as the first one, but the first circle, the next group or their friends, they start. It's like a ripple effect. They just teach each other, watch each other's presentations and start to understand.*

– Müge Kruşa Yemişcioğlu (METU DF)

Christine Thong (DF Melbourne) takes a similar approach, seeing her teaching as sharing a toolkit. There is never enough time to go in depth on all of it, but the aim is to make sure students know the tools exist so they can confidently navigate, engage with, and explore them when the moment calls for it. Matteo Vignoli (Oper.Space) focuses on something slightly different: students walking away with the understanding that they design also for the consequences of their design, of the production, of the material extraction. Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) similarly emphasised the importance of students understanding the longer-term impact, for now and even more so for the future.

Vikki Eriksson (Aalto DF) and Laura Bellorini and Mireia Sierra Andrés (Fusion Point) noted something more personal: students leaving with a greater understanding of the role they play in the current system of consumption. The decisions they make when purchasing a product make them either complicit in certain practices or more actively choosing better ones through where they spend their money. For Vikki

Eriksson (Aalto DF), it is about having a greater sense of agency as both a consumer and a producer of innovation. One of her students last year admitted to his group that he would never buy anything from Wish or Alibaba again. Sometimes that is enough. The aim is not to turn students into hermits living off the grid, but to help them start living a more informed life.

To understand the lasting impact of their teaching, Laura Bellorini and Mireia Sierra Andrés (Fusion Point) conducted interviews with students from the past ten years. Most commonly, those students had shifted their career paths to take social and environmental sustainability more into consideration in their job decisions.



Communication & collaboration: learning from each other

For many students, collaborative learning is the most valuable part of the course.

“*Collaboration is the most often mentioned learning by our participants. Students feel like they learn to collaborate within a team and between teams. They specifically mentioned learning to trust other people’s expertise, which keeps coming up regarding communication within their own team and between teams. Additionally, somebody who is normally a quiet person shared wanting to try out taking a bigger role in a project. And then somebody felt like they learned how to ask questions, which I think is really cool. Besides this collaboration aspect that they pretty much always talk about, it’s very broad what they say they learned.*

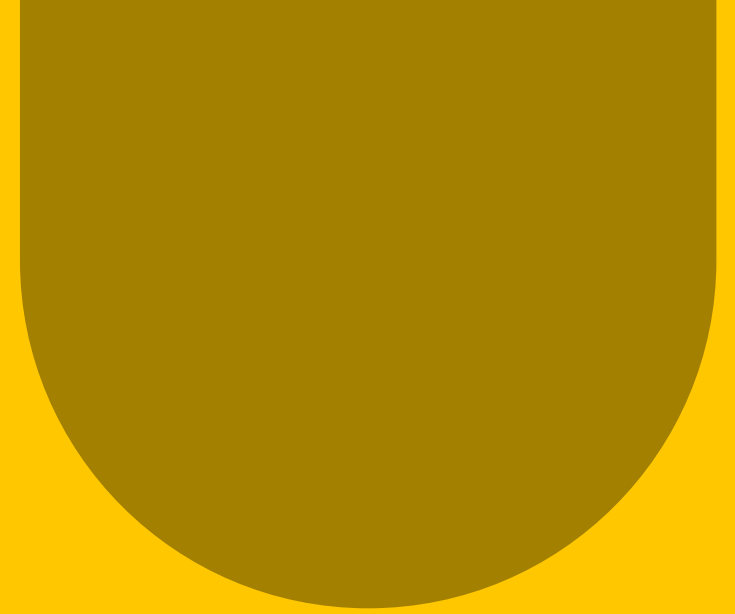
– Laura Wirtavuori (CERN Ideasquare)

Ryan Smith (DF London) found that mixing students from different disciplines was a powerful way to encourage peer learning. When students familiar with certain concepts teach their less familiar peers, both sides embed their learning more deeply. Design students might teach the team about design models, business students about Circular Economy from a financial perspective. That kind of real-world knowledge exchange tends to stick in a way that traditional classroom teaching does not. To make peer learning work, however, students need to work iteratively so that there are multiple opportunities for different knowledge to enter the design process.

Improved collaboration skills come not only from interdisciplinary mixing but from international mixing too. Elina Miķelsone (RTU DF) has students participating in her hackathon from all over the world, including outside Europe. Their perceptions of sustainability and Circular Economy vary significantly. Upcycled products that sell well in one country may never take off in another depending on cultural attitudes toward secondhand goods. These realisations are an excellent way to challenge assumptions and push students toward solutions that work across a greater range of contexts.

5

Closing



What educators are looking forward to

Deepening the practice

- Elina Miķelsone (RTU DF) is planning to make the organisation of her hackathon and other events more sustainable, to lead by example and inspire students further.
- Laura Wirtavuori (CERN IdeaSquare) looks forward to having more narratives for the IdeaSquare Planet programme, both unique adventures and more repeatable ones, and making the programme robust enough to be easily copied by others.
- Manuel Walter (inno.space DF Mannheim) is starting a course on Resource Consciousness accompanied by an exhibition titled “Echoes of Extraction” in collaboration with another university.
- Simin Tao and Jixiang Jiang (Jack) (Sino-Finnish Centre) are working on closing the gap between the depth of students’ ecological research and the strength of their design output, and on finding better ways to help students translate complex circular systems knowledge into something the public can actually engage with.
- Willmar Ricardo Rugeles Joya (DF Javeriana Bogotá) is looking forward to testing whether his Open Source Circular Economy framework genuinely connects with artisan and craft communities who have been practising circularity for generations without the academic framing.

Raising the floor

- Müge Kruşa Yemişcioğlu (METU DF) looks forward to a shift where circularity isn’t just a syllabus checkbox or a buzzword, but a natural part of the design process where students focus on creating solutions that actually work in the real world.
- Sanna-Maaria Siintoharju (HAMK DF) believes Regenerative Thinking should be part of all curricula, starting in primary school.

New tools in the toolkit

- Christine Thong (DF Melbourne) is excited about the potential of combining futures thinking with Circular Economy education.
- Diana Riveros, Juan Ramirez, and David Serje (Cali DF) are excited about the potential of technologies like AI and VR to tackle big challenges without consuming large amounts of resources in the process.
- Matteo Vignoli (Oper.Space) is planning to publish a paper and then a book on Prosperity Thinking.
- Ryan Smith (DF London) expects smart contracts to transform Circular Economy production verification soon: AI-powered systems that analyse production processes in real time and make contracts void if sustainability criteria are not met.

Beyond the classroom

- Laura Bellorini and Mireia Sierra Andrés (Fusion Point) are drawn to the idea of becoming a Living Lab, where student creations contribute to real impact and the boundary between Design Factory and society begins to blur.
- Ciana Martin and Farnoosh McDonagh (Forge DF) noted that the EU’s Digital Product Passport and Extended Producer Responsibility legislation might finally make full lifecycle tracking practical.
- Monika Grinevičiūtė (VILNIUS TECH „LinkMenų fabrikas”) is looking forward to it soon becoming mandatory in the European Union for architects to incorporate recycled materials into buildings.
- Vikki Eriksson (Aalto DF) believes we do not need better tools or more information. What we need is the willingness to dismantle the economic structures that made the unsustainable world in the first place.

Afterword

Looking back at the 15 conversations with educators around the world reveals not one particular best practice, but rather an explorative spirit to develop and embed Circular Economy principles.

Educators who visit scrapyards and wetlands, who invite kindergarteners to final presentations, who build campfires in classrooms, who take students to imaginary exoplanets and bring them back with a new point of view. The circularity they are teaching is present also in how they teach, being mindful of waste, connections, and continuously moving parts.

This report was never meant to be a catalogue. The collected practices are not plug-and-play solutions to be copied. Instead, they are best considered windows into how other educators, in other places, with particular students, partners, and external contexts, have found ways towards meaningful educational practices that incorporate Circular Economy principles.

We hope that reading this report has sparked something. Whether it is an idea to explore, a tool to try, or a question to sit with. Inspiration, however, can only go so far. Mostly, we hope this report serves as the basis for connection. Every educator in this report has shared their ways of doing something, opening their doors and allowing us a peek inside. If someone's approach resonated with you, reach out! Ask for more details and share your own experiences. These exchanges, however formal or informal, are what the Design Factory Global Network is all about.

The educators in this report are not hard to find.
We hope that you find them.

Floris van der Marel
Project lead

Further information

The educators in this report drew on a wide range of sources, frameworks, and practices in their work.

What follows is a curated selection: the academic papers, programmes, and tools they referenced or recommended during their interviews. It is not exhaustive, but it is a good place to start for anyone who wants to go deeper into the ideas that shaped this report.

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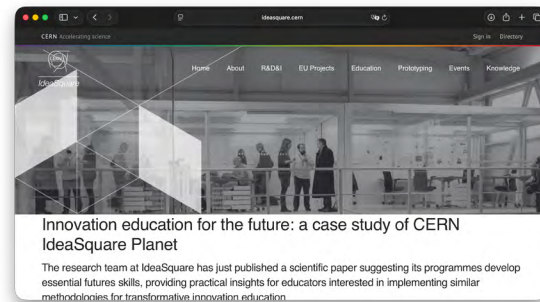
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Further information

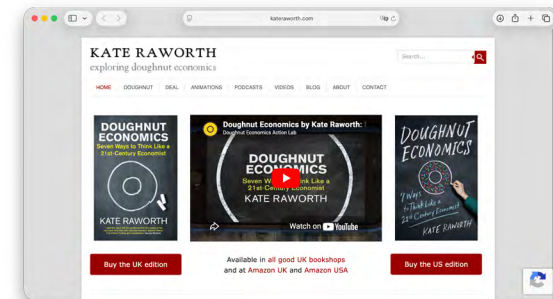
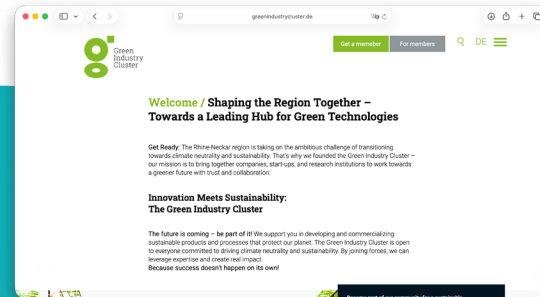
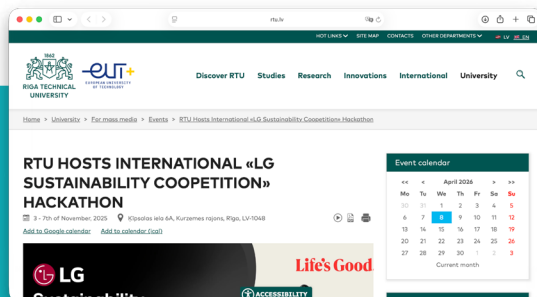
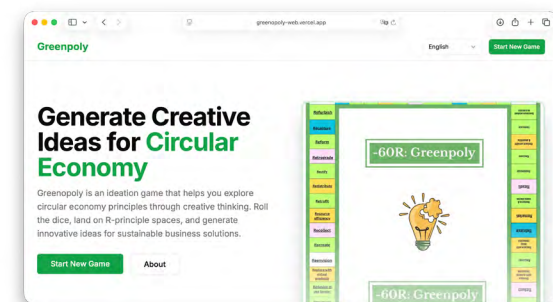
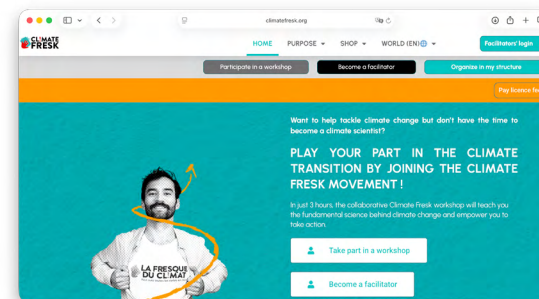
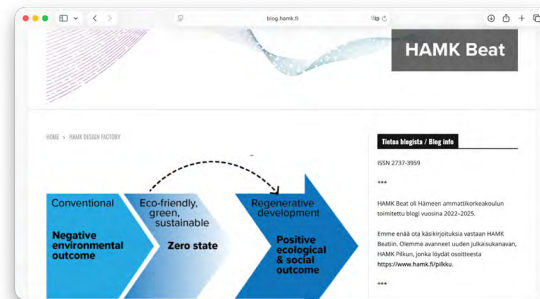
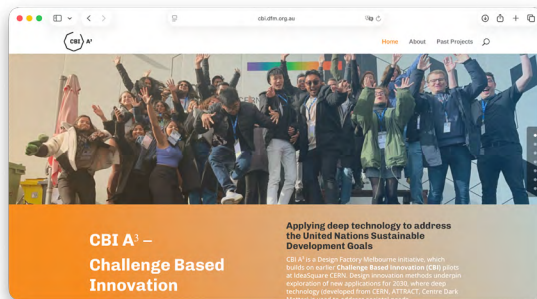
Programs & events

- Challenge Based Innovation
- Sustainability Coopetition
- IdeaSquare Planet
- Regenerative Thinking
- Green Industry Cluster



Models & tools

- Climate Puzzle
- Greenopoly
- Kate Raworth's Doughnut Economy



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