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Transformative learning for sustainability: a case study of the Future17 Sustainable Development Goals Challenge Program

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Abstract

Purpose – This case study aims to describe the pilot phase of the Future17 Sustainable Development Goals Challenge program. This program is led by the University of Exeter (UK) and Quacquarelli Symonds (QS) and is designed to promote interdisciplinary teamwork, intercultural learning and digital competencies for addressing the United Nations Sustainable Development Goals (SDGs).

Design/methodology/approach – Future17 integrates interdisciplinary teamwork experiences, learning in an intercultural environment and doing so through digital collaboration to address sustainable development challenges set by partner organizations. To deliver the program, Design Thinking is deployed as a pedagogic approach for developing Communities of Inquiry that are focused on promoting change in real world contexts. The authors use student feedback data from the pilot phase evaluation to identify key learning points from the program.

Findings – First, interdisciplinary learning enabled students to move well beyond their disciplinary home through challenging ontological, epistemological and methodological constraints in addressing sustainability. Second, intercultural approaches to learning fostered a sense of self-awareness, cultural competencies and empathy. Third, whilst digital collaboration was enabled by the program alongside the use of Design Thinking approaches, practical constraints (such as time zones and technologies) proved challenging.

Research limitations/implications – Developing global collaborative programs for sustainability education has several benefits for student learning, experience and career development but there are logistical and technical challenges for learners that can act as barriers.

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Originality/value – This case study provides an overview and initial evaluation of a cross-continent transformative education initiative, which seeks to connect academic researchers, students and businesses, NGOs and charities to tackle sustainable development challenges.

Keywords Transformative education, Design Thinking, Inter-disciplinary learning, Inter-cultural learning, Digital competencies

Paper type Case report

1. Introduction

The Sixth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC, 2022) emphasizes the critical role that education must play in tackling the most prominent environmental sustainability issues of this century. Indeed, universities are now incorporating sustainability education as standard practice into new modules and programs of study which focus on the acquisition of knowledge as a tool for promoting change, with considerable focus on the United Nations (2023) Sustainable Development Goals (SDGs). However, universities face the challenge of working predominantly within disciplinary structures, with a focus on conventional modes of learning and intracultural, rather than intercultural knowledge generation and exchange (Wals and Blewitt, 2010). Such conditions are unlikely to deliver transformative sustainability education (Tyagi *et al.*, 2025) and as such, current pedagogic methods reduce the capacity for both students and universities to contribute directly toward tackling the interconnected challenges of our time that are encapsulated by the UN's SDGs.

In response to this situation, this case study describes a global education initiative called Future17: Sustainable Development Goals Challenge Program (Future17), which has been collaboratively developed between Quacquarelli Symonds (QS) (provider of services, analytics and insight to the global higher education sector) and the University of Exeter (UK), and partner universities across the globe. Future17 focuses on enabling students to develop tangible, solutions-based outcomes that emerge through connecting businesses and organizations and student teams to develop innovative approaches to tackle sustainability challenges. The program was launched as a pilot in January 2022 after a period of planning and onboarding between the program delivery leaders (QS and the University of Exeter) and three initial partner universities (Chinese University of Hong Kong, Stellenbosch University and University of Sao Paulo). Future17 aims to use global student collaboration as a model for addressing SDG-themed challenges posed by a global, cross-sector portfolio of organizations, to develop employability skills in a transformative education context. It does so by focusing on developing interdisciplinarity, intercultural learning and digital competencies for collaboration through the application of a Design Thinking pedagogy (Figure 1).

In this case study, we describe how Future17 works and we use insights from student evaluation data gathered from the pilot phase of the program to examine Future17's role in contributing to global sustainability collaborations within higher education (HE), and between HE institutions (HEIs) and nonacademic organizations. Specifically, we aim to explore the extent to which Future17 has the potential to deliver transformative learning for sustainability by focusing on three underpinning learning infrastructures used to develop Future17: interdisciplinarity, intercultural learning and digital competencies.

Figure 1. Future17 principles and process
Source: Authors' own work; ©University of Exeter

2. Case study context: education for sustainable development and transformative learning infrastructures

Formal education that focuses on sustainability has existed, in some form, for over half a century in Western contexts, notwithstanding extant indigenous knowledge across the globe (Wals and Blewitt, 2010). Indeed, as Papenfuss *et al.* (2019) note, there have been successive waves of Western curriculum-based sustainability education, beginning in the 1960s with concerns over acute environmental pollution and population collapse brought about partly by resource exploitation, all the way through to the United Nations' Decade for Education for Sustainable Development from 2005 to 2014 [United Nations Educational, Scientific and Cultural Organization (UNESCO), 2025]. Yet, Papenfuss *et al.* (2019, p. 4) note that:

> […] if our record of solving sustainability challenges is a proper gauge of the sum effort of sustainability education, there is scant reason to cheer. Most attempts to solve urgent, large-scale sustainability challenges have failed.

In response, scholars of education for sustainable development have begun to examine the role that transformative learning approaches might play in helping to achieve the sustainable development goals (Burns, 2018; Kasworm and Bowles, 2012). In brief, transformative learning has its roots in Mezirow's (1978) idea of perceptive transformation, with four early dominant areas of interest being forms of emancipatory learning, critically reflexive pedagogies, developmental learning and a focus on extra-rational knowledge (Dirkx, 1998). These have been developed by social scientists to focus on three elements: *how* people learn (process), *what* people learn (outcomes) and how learning can be *supported* (conditions) (Aboytes and Barth, 2020). Accordingly, transformative learning is designed to move away from instrumental, rationalistic, mechanized, formulaic and dualistic forms of education toward interconnectedness, relationality and an appreciation of subjectively celebrated ways of knowing (Burns, 2018).

From a sustainability perspective, transformative learning has been regarded as particularly important not only because of the apparent failure of conventional learning approaches to lead changes in environmental behaviors from individual to institutional but

also because it adopts a holistic framework (O'Brien and Howard, 2016). This has led to calls for greater integration in learning approaches that can more deeply challenge unsustainable practices (Burns, 2018; Enkhtur and Yamamoto, 2017). It was within this pedagogic context that the Future17 program was developed by QS and the University of Exeter, building on the latter's *Transformative Education Initiative* (University of Exeter, 2023), which seeks: "To use the power of education and research to create a sustainable, healthy and socially just future. Through the Transformative Education Framework, we will use the power of education to transform our students' lives so that they, in turn, can transform the world" (University of Exeter, 2024, n.p.). However, to reach a position where the shifts described by scholars such as Burns (2018), Enkhtur and Yamamoto (2017) and O'Brien and Howard (2016) could be achieved, Future17 needed to have an underpinning design that tackled some of the challenges pedagogic literature suggests act to restrict transformative learning for sustainability. Our review of the literature suggested that removing barriers for interdisciplinary understanding, intercultural learning and effective digital collaboration are key priorities for creating a transformative learning environment. It is these three priorities that formed the basis for developing the Future17 program's learning infrastructures and in the following paragraphs, we provide a short overview of these priorities as identified by previous scholarship and which form the conceptual basis of this case study.

In terms of *interdisciplinarity*, there is clear evidence that the entrenched culture of siloed approaches to education, manifested through discipline-specific programs in universities, prevents an unlocking of transformative approaches (Price *et al.*, 2021; Rodway-Dyer and Barr, 2024). Researchers have argued that universities themselves need to be transformed to enable education for sustainable development, arising from the ways in which disciplinary training and pedagogic conventions have developed over decades and the impacts these have on outcomes (Howlett *et al.*, 2020; Vincent *et al.*, 2015). There are two key elements to these outcomes. Firstly, as Eagan *et al.* (2002) highlighted over twenty years ago, sustainability presents formidable challenges in terms of problem identification, diagnosis, analysis and action because of the diverse range of skills required to consider ecological, social, economic, cultural and behavioral dilemmas. This has much to do with reconciling opposing ontologies, epistemologies and methodologies which all frame problems and their interpretations differently. Indeed, the challenge is not to find ways to make differing disciplines work together in harmony through a multi-disciplinary approach, but rather to develop a collective set of understandings from different disciplinary perspectives that focus on the realism of the problem, rather than the unmovable principles of disciplinary practice (Mokski *et al.*, 2023). This is particularly brought into focus by the UN's SDGs, where the breadth of scope highlights the need for integrated perspectives (Annan-Diab and Molinari, 2017). Secondly, a set of practical skills are required to develop collective understandings and negotiate knowledge that can at times be disruptive and discomforting. This is about knowledge within, but also beyond the academy, fostering a keen awareness of the needs of diverse stakeholders, from businesses to publics and organizations. The skills required are therefore less about following a prescribed disciplinary route and more about agility, flexibility, empathy and an ability to: "[…]cope with uncertainty, poorly defined situations and conflicting or, at least diverging norms, values, interests and reality constructions" (Howlett *et al.*, 2020, p. 306).

We therefore argue that a second component of infrastructure that is needed for transformative learning for sustainability is the ability to learn collectively and to be able to do so with empathy, understanding, respect and through shared goals. Within the literature, *intercultural learning* has gained prominence in the last twenty years, as higher education institutions have expanded their international offering, both in terms of student exchange

programs and recruitment to campus-based courses for nonhome entrants (Guillén-Yparrea and Ramírez-Montoya, 2023). Indeed, there has been considerable discussion concerning the "global readiness" of graduates within an international employment market and the graduate skills needed for employers to operate globally (Kang *et al.*, 2018). However, attention has also turned to the role that intercultural learning has in ensuring that students can be engaged global citizens for the future, with a focus on enhancing understanding, wellbeing and tackling major global challenges (such as anthropogenic climate change, poverty and inequality) (Sommier *et al.*, 2022).

In their commentary on intercultural learning, Morais and Ogden (2011) highlight the importance of global competence as the main outcome for successful intercultural learning and argue that this has three components: (1) self-awareness through a personal a recognition of limitations and context; (2) intercultural communication skills that make for successful encounters and (3), global knowledge and a wide interest in world events. Kang *et al.* (2018, p. 684) also add that: "Global competence is defined as the comprehensive capability to live, communicate, and work in a multiculturally interconnected world", therefore stressing the importance that global competencies are essential to life, not only work.

The third piece of infrastructure to support transformative learning that is deployed on the Future17 program relates to *digital competencies*, notably the ability of students to effectively collaborate online to address a sustainability challenge. The role of digital competencies in higher education is receiving increased attention (Vishnu *et al.*, 2022), where there are both opportunities and potential pitfalls for digital learning surrounding sustainability. On the one hand, digital learning can help students and academics to overcome siloed and culturally engrained thinking through greater levels of interaction and creativity; but we also need to be wary of how particular pedagogies may introduce unseen biases and newly engrained ways of working. Accordingly, a broad sense of digital literacy, or what Erstad *et al.* (2021) and Langset *et al.* (2018) refer to as digital competence, is key.

In terms of online collaboration specifically, Blayone *et al.*'s (2018) analysis of digital competencies for online group work highlights the role of the Community of Inquiry (CoI) approach advocated by Akyol and Garrison (2011), Garrison (2015) and Garrison and Akyol (2013). In this approach, learning is democratized and participatory, and therefore devolved from an academic to learners online. Blayone *et al.* (2018, p.282) describe CoI's key characteristics as:

- promoting deep learning;
- generating reflexive thinking and forms of agility to respond to change;
- fostering "[…]active collaboration, freedom of expression, and deliberation vital for effective entrepreneurship, innovation and social development";
- using experience as a valid way of building new knowledge; and
- using a problem-based approach.

In Future17, the practical approach to digital competency development mobilized Blayone *et al.*'s (2018) use of CoI through adopting a *Design Thinking* perspective. Design Thinking is a broad term encompassing a range of approaches to overcome creative obstacles when addressing a problem (Lal, 2021) and is often used "[…]whenever it is necessary to find solutions to problems quickly or to increase empathic ability" (Lee and Park, 2021, p. 325). The focus on empathy is particularly significant, with arguments in Design Studies focusing on the need for those developing new products and services to fully appreciate the needs of consumers (Köppen and Meinel, 2014). Traditionally, Design Thinking has therefore found a home within product design, where designers make use of several steps to look differently at

problems (Cross, 2023). Design Thinking typically includes five steps: empathize, define, create or ideate, prototype and test (Deitte and Omary, 2019). In brief, these are characterized as follows (Dam and Siang, 2024):

- *Empathize*: understanding needs and the context of a consumer or organization through "seeing their world, leaving your assumptions 'outside,' and being able to understand their feelings".
- *Define*: using empathetic insights to define and detail what the problem is and how to characterize its main elements.
- *Create or ideate*: creatively develop innovations to approach and solve the problem.
- *Prototype*: develop products, services and interventions that can put ideas into practice.
- *Test*: work with consumers and organizations to test these prototypes.

Crucially, Dam and Siang (2024) highlight that Design Thinking, whilst having these five steps, is not intended to be used as a linear process but is intrinsically iterative, with elements of empathizing, ideating and testing leading to new insights and new ideas. They also highlight several other key elements of Design Thinking that are important to highlight. First, that through the process of empathizing and defining a problem, powerful stories can be told that: "[…]are framed around real people and their lives and are important because they're accounts of specific events, not general statements. They provide us with concrete details which help us imagine solutions to particular problems" (Dam and Siang, 2024, n.p.). Second, Design Thinking is intended to disrupt conventional modes of thinking and problem diagnosis to "[…]understand and challenge our natural, restrictive patterns of thinking and generate innovative solutions to the problems our users face" (Dam and Siang, 2024, n.p.). Third, through empathetic processes and the iterative nature of testing, ideating and prototyping, Design Thinking attempts to identify what Dam and Siang (2024) refer to as more 'ambiguous and peripheral' factors that contribute to a problem rather than those more likely to emerge as part of a linear process. Finally, those engaged in Design Thinking are constantly encouraged to question their assumptions and act on new knowledge to iterate new ideas.

There are many variations and applications of Design Thinking, including the rethinking of social innovations (Kimbell, 2011), applications in medical science training (Deitte and Omary, 2019) and most prominently in business and management (Micheli *et al.*, 2019). Within the context of the UN SDGs, Design Thinking has been considered a key means of developing solutions to complex sustainability challenges by the United Nations Development Program (UNDP, 2017) and it has also been suggested as a mechanism for promoting nature-based learning (Dawson, 2022) and in collaborative curriculum design (Shé *et al.*, 2022). Accordingly, Design Thinking provides an opportunity for developing pedagogic approaches for approaching sustainable development challenges that focus on empathizing with complex problems in ways that promote the agility and reflexive thinking that Blayone *et al.* (2018) have argued is so important in developing Communities of Inquiry.

3. Future17 program details

The insights presented in this case study are compiled from the pilot cycle of the Future17 program, which ran from January to June 2022. Future17 was co-founded and its governance led by QS and the lead academic institution, the University of Exeter (UK). The program was developed in response to the rising demand that both parties recognized for equipping graduates with the digital, intercultural and interdisciplinary collaboration skills needed to

tackle sustainable development challenges. Indeed, both parties wanted to promote a way for students and universities to contribute toward innovative sustainability solutions for businesses, charities and NGOs. The program therefore partly builds on other initiatives in global higher education to provide more interdisciplinary and intercultural experiences for students studying sustainability, and to do so within more 'real world' contexts. Examples of such initiatives include the International Programmes in Sustainable Developments (University of Applied Arts, Vienna, 2025), which has a focus on Masters-level global collaboration for sustainability learning; the GREEN Program: International Education for Sustainable Development (United Nations Department of Economic and Social Affairs, 2025), which seeks to engage students in entrepreneurial learning for sustainability by bringing them together with key global organizations; and a wide range of university providers that offer sustainable development learning opportunities through study abroad with both other university partners and nonacademic organizations (Woo *et al.*, 2024).

Future17 is available as a credit-bearing module in some universities, and as an extra-curricular offering in all universities. Students on undergraduate and postgraduate (taught and research) programs are eligible to apply, although first year undergraduate students are not eligible. All students apply to be part of the program on a competitive basis, with students submitting an application form that involves addressing questions about how Future17 will benefit them academically and practically. Academics from partner universities are also invited, in a voluntary capacity, to support the program, acting as mentors for project groups in a dual network once these are formed. Once accepted, students and mentors are allocated to a team to work on one of a variety of projects sourced by QS. This is undertaken based on surveying individual student interests and expertise using a MS Form questionnaire in relation to the available projects, and then making allocations to ensure groups have an appropriate mix of students from partner universities, disciplinary backgrounds and genders. The projects offered in Future17 are designed to be action-orientated exercises that create implementable outcomes for the partner (details of the projects offered during the pilot phase of Future17 are described in section 4). Students then undertake a four-week online induction that is focused on the use of Design Thinking (Hoolohan and Browne, 2020) as a technique for addressing real-world challenges before entering an intensive eight-week period of online work to address their allocated challenge. The program culminates with each team's presentation to academic mentors and project partners, along with their written output.

In terms of managing Future17, each university nominates an academic lead, supported by a member of professional service staff to help administer the program locally. To oversee the academic co-ordination of the program, the lead university partner (University of Exeter) has an academic program director and full-time project manager. For QS, their project lead recruits project partners from the business, charity and NGO sectors, frames the project briefs, handles marketing and future recruitment of partner universities, and engages with the academic leads, academic mentors and students during the delivery of the program. QS also provides a certificate to students upon successful completion of the program. Future17 cycles run over a four-month period (September to December and February to May) and are designed to accommodate semester patterns from the northern and southern hemispheres. The pattern of a cycle is as follows. Firstly, students enroll onto an online learning platform (delivered through Future Learn) and are guided through a four-week process in which they are introduced to the concept of Design Thinking in relation to sustainability and the SDGs. Secondly, students are placed in challenge teams for the collaboration phase which lasts eight weeks. During this time the teams work on specific challenges with project partners, which in the pilot cycle included Axel-Springer (2025), Camplus (2025), Diversey (2025), People of Impact (2025) and the United Nations Principles for Responsible Management Education (2025).

Finally, the challenge teams present their work as part of a collaborative assessment based on a design pitch. These presentations bring together the learning from phases one and two of the Future17 program.

3.1 Induction in Design Thinking for student participants

Our first consideration when developing the academic program for Future17 was providing students with a common induction that placed emphasis on the importance of a solutions-focused approach, rather than a conventional academic focus on identifying challenges and working through prescribed methodological pathways. Fundamental to a Future17 learning journey is an understanding of Design Thinking, and the ways in which seeing challenges through this lens can help us to think afresh about key sustainability challenges. Moreover, as part of this induction process, it was crucial to enable students to develop effective group-based digital competencies to enable them to effectively collaborate online.

Held within the Future Learn platform, a four-week online learning course for the Future17 Program was developed to provide a broad introduction to Design Thinking for Future17 students. Assuming little or no prior knowledge and experience of working with Design Thinking, the four weeks were developed to take students through a set of questions, prompts, articles, and a mini–Design Thinking challenge. Table 1 outlines the general content of each week of the induction course.

Table 1. Weekly content for the Future17 induction course

Week 1: Welcome to Future17 *Who are you and what excites you about this program? What does sustainability look like in your context?*	Focus on introducing the program, outlining the content for the induction, and providing a space for people to introduce themselves using the discussion forum function on Future Learn. Towards the end of this week, learners are asked to share some examples of sustainability from their own local areas
Week 2: Collaborative working *What can you offer to a team? How can we develop more sustainably?*	Beginning with some examples of how collaboration has resulted in sustainability innovations, next the group thinks about team working competencies and how a range of roles are required for collaboration. Finally, this week examines the SDGs and examples of diverse ways of thinking about design and economics
Week 3: Introducing Design Thinking *What is Design Thinking? How might Design Thinking be used locally?*	Using the example of a local café, students are guided through the Design Thinking pathway and provided with specific tasks for each step. Examining a real-world example of a business in their own context, students are challenged to observe, research, and test their innovations for a sustainable café. By the end of the week, they are introduced to each step of Design Thinking and try it out in their own context
Week 4: Building teams and prototyping ideas together *What elements are important for teamwork? How can a range of ideas work together?*	In this final week the participants delve into what innovation means and how it is achievable by working together in a design team. Building on week one, they think more critically about which elements improve teamwork. This week, a prototyping task helps to cement the idea that teams can make use of a diversity of visions and approaches. By the end of this week, project teams are formed for the collaborative challenge phase of the Future17 journey

Source(s): Authors' own work

The induction course design was led by colleagues from Lestari Environmental Education (2025), an environmental education consultancy with expertise in transformative and experiential learning. To help students become familiar with the different steps in Design Thinking, the induction material focuses on taking an everyday space and posing the following as the challenge to students: *How would you design an inclusive, international, sustainable* café*?* This challenge is used to focus on the first three Design Thinking steps: empathize, define and ideate. As an example of the material developed for the induction, Box 1 contains an activity to help students to explain and work with the idea of

Box 1. Example of future17 induction activity from week 3 on Design Thinking

Two people on a grassy hill
Source: Unsplash (freely sourced)

Empathize – What Needs are There?
As we embark on a journey into Design Thinking, it's tempting to rush into the challenge and to begin to consider the solutions before we fully understand what the conditions of the problem are.
This is where the first stage of Design Thinking comes in. It's crucial to put to one side any preconceptions you may have of the challenge you are confronted with, and ideas of solutions you already have. This is because part of what this process offers is a chance to think afresh about problems; and it's difficult, if not impossible, to do that if we already think we have the answers to those problems.
Empathy is the ability to understand and share what another person is feeling and helps maintain social bonds by enabling people to comprehend and respond appropriately to others' needs.
What does this mean in a Design Thinking context?
Well, this is about understanding the specific needs of others to help guide the design process. It is often achieved through research and observation.

Observation Task:

- We invite you now to get out there and enjoy this chosen space!
- Spend some time with the challenge of how to design a sustainable café by observing within the café.
- Ask questions and challenge yourself.
- Think about things from other's points of view.
- Make some notes about what people want from a café space and how those needs are currently met.

(Tip: Keep your notes safe. You'll need these in the define phase)
In the next activity we'll be speaking to some of the potential café users about their needs.

User 'empathy' Interview Task:

As part of the empathise phase of Design Thinking it's important to understand the potential needs and concerns of the users of the Future Café. We can gain some insight by speaking with people.

- For this task you will need to identify someone to speak to for ten minutes.
- First come up with some questions. Three or four will be enough.
- Write them down on a piece of paper.
- Consider what you want to know in order to help define your challenge.

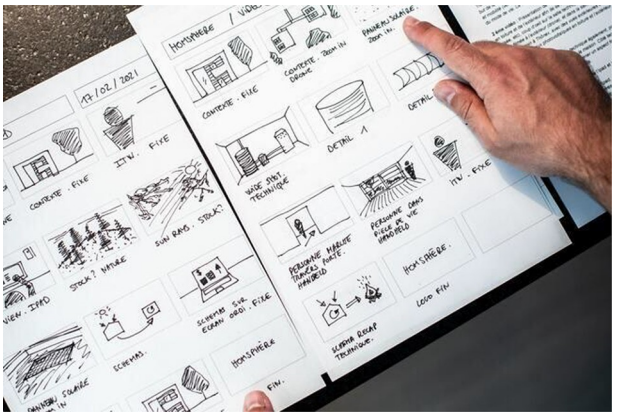
(Remember you can share your questions in the discussion below, and look over other's questions to get some inspiration.)
Next, make the arrangements to speak with someone, and find a place to carry out the interview.
During the interview, remember the following rules:

- Try not to ask 'leading' questions which suggest an answer to the participant.
- Don't judge what people say.
- Listen closely and attentively
- Take lots of notes.

(Tip: Keep your notes from the interview safe. You will need these along with your observations in the next stage.)
Remember you can use the discussion below to share your questions and read other's questions.
Share with your team Now that you have some initial observations and the answers to your interview questions, share your research with your team on MS Teams

empathizing with this problem. The purpose of choosing a café example is to provide most students with an accessible site where they could "get out and away" from their screen and into their local area to put Design Thinking into practice. Students are encouraged to initially dwell in the space, observe, ask questions and empathise with those around them – for example, to consider what existing users want from the café. Students are then encouraged to pursue this process through having an informal conversation with someone in the cafe and to ask questions that would help them to better appreciate the challenge they were working with. Students are encouraged to

Box 2. Prototyping using storyboarding a part of Design Thinking



Hand pointing to a particular frame in a drawn storyboard
Source: Unsplash (freely sourced)

Storyboarding

In this step we're going to have a go at an early form of prototyping called storyboarding.

The idea is to use images to depict how your solution will work in the real world.

In this case we have been thinking about a café which meets as many of the sustainable development goals as possible.

In Week Three you spent time thinking about the Future Café and worked through the first three phases of design thinking: empathizing, defining and ideation.

For the prototyping phase we will bring all the ideas generated during the define and ideation phases together to visualize how the Future Café will be.

The following questions might help:

- How do people interact with the products, the staff, other customers and the space?
- What behaviors are encouraged through these interactions?
- What products are on offer, and why do they matter?
- What's unique and special about the Future Café which will make people want to come back?

Drawing a storyboard Task:

Draw cartoons or simple images in a storyboard form (on paper, or using computer software if you prefer) that represent responses to the above questions. *Don't worry, no-one will be judging your artistic abilities, so rough sketches are fine!*

Once ready, take a photo, or save the storyboard as an image. We will be sharing what you have come up with in the next step[…]

Source(s): Lestari and University of Exeter

share their experiences and reflections of this empathetic process in the Future Learn platform. Similar processes are repeated for the *define* step, with students prompted using questions such as: "Who are you solving this challenge for - what will they gain from the solution? Are there any losers? How might the solution affect local people, the

Table 2. The six key elements of working in an innovation team, based on Puttick *et al.* (2014)

Element	Description
Leadership	How the team is led and managed, including by the team's director, and political sponsorship and buy–in
Team	The size, skill set, dynamic and culture of the staff, as well as specific recruitment and staff development strategies
Methods	The tools, techniques and approaches that the team uses, as well as the outputs produced
Resources	How the team is financed, including leveraging funds from external sources, as well as how resources are allocated and spent
Partnerships	The key relationships with government, and external agencies, groups and citizens
Impact measurement	The use of data to inform strategy development, as well as evaluation frameworks to measure impact

Source(s): Adapted from Puttick *et al*. (2014)

environment, the economy?" And for the *ideate* step, students are prompted by the following:

> During ideation it's crucial to bring everyone's ideas out with a focus on diversity of ideas.
>
> The guiding principle here is quantity over quality. New and interesting ideas are generally more helpful than tried and tested "standard" ideas. It's not crucial that the ideas you come up with here are tried and tested. In fact, the more out-of-the-ordinary they are the better for ideation[…] we encourage you to "go-wide" with your ideas – meaning to look for ideas in the margins and to celebrate the weird and wonderful!

In the final part of the induction, the prototyping step of Design Thinking is explored and this encourages students to use storyboarding techniques as a way of translating their ideas into practical options via visual methods. Box 2 details this exercise, which continues to use the idea of developing a sustainable café. In addition, the final part of the induction introduces students to group working practices and highlights the role of six elements of working in an innovation team developed by NESTA (Puttick *et al.*, 2014), which are described in Table 2. These are used to prompt student discussion in their groups in response to this task: *Think about each of the six elements above and discuss here what you feel are the most appropriate considerations to the development of your own innovation teams*.

3.2 Mentor engagement

A second key component of Future17 relates to the support students receive from mentors. Students are assigned one or two academic mentors from one of the partner universities, acting as a point of guidance, providing resources, support, and encouraging teamwork and collaboration. Academic mentors play an important role in fostering a culture of sustainability and stimulating experimentation and innovation. Throughout the eight weeks of collaboration (and into the assessment phase) mentors monitor progress and provide feedback. They regularly check-in with students to see how their projects are progressing and offer guidance and feedback as needed.

Mentors also work closely with the challenge team's designated student project leader and support them on a one-to-one academic basis when required to ensure the whole team remains focused. Mentorship requires a strong relationship with the project partner and as

such regular meetings between mentors and partner organizations are necessary to ensure a consistent approach for supporting challenge teams. Mentors are identified and approached based on expertise or experience in the SDG areas of interest and invited to attend a mentor training program, designed to equip them with the tools and techniques required to effectively guide and inspire students. This comprehensive training emphasizes three core components: collaborative working, design thinking, and mentoring best practices. We emphasize the benefits of serving as a mentor, such as the opportunity to share their knowledge and experience with students, and the opportunity to make a positive impact on their own personal academic and professional development. The Future17 program is introduced to potential academic mentors at partner universities with the expectation of approximately 15–20 h of time. Mentors essentially act as mediators in the program, offering students support in interpreting the project partner's needs and expectations, whilst helping to set the expectations of the project partner in terms of outputs and outcomes that can be expected from an eight-week team challenge. Mentors also gather information from the students to share with the project partner, and feedback questions and comments to the student teams. Some mentors may also develop research-based partnerships with project partners, which is a clear benefit to individual academics involved.

3.3 Challenge phase: team collaboration, output production and assessment

In the final week of the induction, participants are invited to join their challenge teams along with other participants from the partner universities to enter the second, collaborative phase of the Future17 program. In this "Challenge Phase" of Future17, participants work together in their challenge teams to address a key sustainability challenge with a partner organization. These teams are allocated based on student interests and expertise, and are deliberately mixed in terms of disciplinary background and university.

In terms of online collaboration for challenge teams, Microsoft Teams (Teams) was initially used (in the 2022 pilot) as a central place for communications about the challenge, a record for meeting notes, a space for sharing resources and to track progress. Teams allowed participants to share with their challenge team as well as the entire Future17 community, to become familiar with collaborative learning approaches. Collaborative features used for each private Teams channel included setting-up meetings and collaboratively editing work using Microsoft packages, such as Word and PowerPoint. A weekly journal was also integrated in the challenge team private team's channel, where one individual was nominated to be responsible for writing up points raised during weekly project meetings, structured around key evaluative questions for the groups to explore including "*What ideas or inspiration would you like to take forward?*" "*Any challenges or feedback this week?*' and '*What goal are you working toward next week?*".

In the final week of the program, each challenge team undertakes an assessed presentation of their project at an online showcase event. The presentation is assessed by academic mentors, with input from project partners. This provides an opportunity to celebrate students' work and that of other teams and provides a further space for collaborative learning. Challenge teams also produce a bespoke output for assessment, which is also assessed by academic mentors, with input from project partners. This output is negotiated between the project partner, QS and the academic mentor(s), reflecting the needs of the partner and adherence to quality assurance processes. Once completed, all participants are invited to an online graduation gathering to feedback and offer reflections of their project journey as well as celebrate the work of the project challenge groups.

In terms of quality assurance, the lead university (University of Exeter) provides leadership on the setting and marking of assessments for Future17, including drafting

Table 3. Future17 pilot phase projects and associated partners

Project challenge focus	Partner	No. of student teams	Universities represented in student composition
Sustainability strategies in European media companies	Axel-Springer	1	CUHK, SU, UE
Spanish student market consumer analysis	Camplus	1	CHK, USP
Transitioning to a circular value chain for timber in the construction industry in Europe. The implementation of a circular economy in the construction sector. The production and logistic chain features of timber, concrete and steel	Climate KIC (knowledge innovation community)	3	CUHK, SU, UE CUHK, SU SU, USP
Project "Soap for Hope" (two teams; see Box 3)	Diversey	2	CUHK, SU, UE, USP CUHK, SU, UE
A Freirean approach for a new social economic and political model: inclusive and equitable quality education and promotion of lifelong learning opportunities for all Youth capacity building for SDG policies impact assessment	Geneva Consensus Foundation	2	SU, UE, USP SU, USP
The future of farming: a study on the regenerative farming as a solution and the role of consumers (two teams)	Green Rebel	2	SU, UE, USP SU, UE, USP
Strategy to enhance awareness of the SDGs for the student population globally	People of Impact	1	SU, USP
Digital fundraising strategy for the SDG-focused Youth Charity: 'Get EPIC With QSWM'	QS World Merit	1	CUHK, SU, UE
Sustainability education: SDG13 and its links to other SDG's Digital strategy for the Carbon Literacy Training for Educators, Communities, Organizations and Students (CLT-ECOS) course Guidebook: helping parents in a climate changing era: how to guide parents through the SDG13 Business students and greenwashing in a sustainable economy	UN PRME (Principles for Responsible Management Education)	4	CUHK, SU, UE UE, USP CUHK, SU, UE

Note(s): CUHK = Chinese University of Hong Kong; SU = Stellenbosch University; UE = University of Exeter; USP = University of Sao Paulo
Source(s): Authors' own work

marking criteria and developing quality assurance procedures, such as second marking and moderation. For those universities that award credit to completing students on the program, feedback and grades are subject to their institutional procedures. In additional, risk assessment and ethics protocols have been developed to specify the types of primary research available to students and to monitor their work using these protocols. Ethics is also

Box 3. Example of Future17 challenge project, *Soap for Hope*, sponsored by partner Diversey

Soap for Hope

An initiative by partner Diversey: https://diversey.com.sg/en/sustainability/soap-for-hope

What is Soap for Hope?

"Soap is recovered from Diversey hotel customers which are Soap For Hope program partners, and then transported to a local site where residents reprocess it using an innovative but simple cold-press method. The cold-press method makes 120 gram soap bars or 500 gram soap bars, in under 10 minutes. The method does not need electrical energy or running water, resources which are scarce in slums or poor villages. The new soap is then distributed locally, or transported to communities in need, thereby eliminating waste, improving hygiene and creating new jobs.

One of the key aspects of our program is community involvement. All projects are run directly by local nonprofits and employ underprivileged community members to do the work, giving livelihood opportunities to those who wouldn't otherwise have the chance".

(Diversey Soap for Hope website, 2024: https://diversey.com.sg/en/sustainability/soap-for-hope)

What was the challenge posed to Future17 students?

Diversey wants to expand its operations to support communities in Brazil, where there is an urgent need for improved sanitation and also secure income. It is also keen to expand its soap recycling from hotels in in the UK and European Union.

Yet there are two main obstacles:

(1) Understanding the regulatory and legal implications for soap collection, recycling and use in different national contexts.

(2) Understanding the market for collecting and processing soap for recycling.

What did the students do during their 8-week challenge?

- Analysis of regulatory and legal context, alongside market analysis in the UK, EU and Brzail, covering recycling legislation, cosmetics legislation, safety regulations and an analysis of other soap recycling programs.
- Recommendations to Diversey: means of complying with local legislation and regulatory requirements, associated costs and registrations required. Identification of potential partner hotels to supply soap in each context, including suggestions on elements of what to include in a contract, such as shipment arrangements and soap standards.

What were the key outcomes and outputs?

- Clear identification of legal and regulatory steps to take in each jurisdiction to be able to establish Soap for Hope.
- Identification of likely market and partners.
- Identification of the most likely success area – *"Diversey can become the pioneer to carry out Soap for Hope in Brazil and contribute to the vulnerable families there, as its laws permit the charity to do so"* (Diversey Future17 student group report, 2024)

- 25-page report and recommendations for Diversey on how to develop its *Soap for Hope* program in these new jurisdictions.
- Presentation to Diversey and academic mentors on these proposals.

Source(s): Authors' own work

explored in the induction part of the program, to ensure that a standard understanding of ethical research practice is applied across projects. All challenge teams must complete an ethics statement about their research and have this approved by their mentor(s) before they commence their work, with clear guidance on what types of research in and out of scope from an ethical perspective.

4. Methodology for program evaluation

As noted above, this paper focuses on the pilot phase of Future17, which ran from January to June 2022. The case study data we have collated on this pilot phase provide insights into student evaluations of their experience, using the three learning infrastructures which we argue are needed for underpinning a transformative learning experience (interdisciplinary understanding, intercultural learning and digital collaboration). The pilot phase comprised 115 students from four universities: Chinese University of Hong Kong (CUHK): 26 students; Stellenbosch University (SU): 38 students; University of Exeter (UE): 23 students; and University of Sao Paulo (USP): 29 students. Nine partner organizations provided project challenges for student teams to work on. Seventeen teams of between five and eight students were formed, with each team comprising students from at least two universities. Table 3 provides details of the project titles and associated partner organizations. As an example of a project that featured in the pilot phase, Box 3 provides an overview of the Diversey-sponsored *Soap for Hope* challenge, which aimed to support the expansion of Diversey's attempts to improve sanitation of disadvantaged communities by supplying them with hotels' soap to sell.

In the following sections, we share some of the student feedback which has emerged from student evaluation data collected during the pilot phase of Future17. We adopted an online methodology for collecting student evaluation data, given that the program is run entirely online and paper-based evaluations would have required participants to be in physical locations and data would then have needed to be uploaded for analysis. There is debate in pedagogical literature on the most effective methodology for collecting effective course evaluation data, with Plante *et al.*'s (2022) review of 19 studies from 2000 to 2020 revealing that whilst the shift to online course evaluation methods may lead to a temporary drop in response rates, the volume and constructive nature of student feedback tended to be greater online. Accordingly, our evaluation methodology utilized two qualitative feedback points. First, as part of the evaluation of the induction process, students provided online feedback on their experience of the 4-week online induction material, focused on Design Thinking (Dam and Siang, 2024) and their experience of the learning process (Sharpe, 2019). This feedback was in the form of free-text responses to several prompts at the end of each of the weekly induction sections, asking students to articulate their expectations of Future17, their responses to the induction materials, what they had learnt and their ideas for development. Second, students engaged in an end of pilot feedback session streamed from the University of Exeter, at which participants used Padlet software to comment on what they felt had gone well, what was challenging, and what could be changed to improve the program. This enabled real-time and anonymized responses to be gathered, presenting an opportunity for

Table 4. Illustrative quotations by theme from Future17 feedback survey

Deductive theme	Illustrative questions
1. Multi- and interdisciplinary perspectives for tackling SDG challenges	"I believe that Future17 will provide us all with so many opportunities to learn and grow and I am looking forward to stepping outside of my usual field of study and growing in other spheres." "I am looking forward to diversifying my skills through interactions with students from different academic disciplines." "It was great to work with a multidisciplinary team, with different backgrounds and cultures." "I'm very excited to explore the interconnectedness of sustainability across industries and especially across borders." "I am looking forward to working on these sustainable development challenges which focus on looking at practical ways of incorporating the SDGs when solving everyday problems that institutions and organizations have."
2. Intercultural learning at the global scale for tackling SDG challenges	"Hello, my name is [anonymized] I am in my [anonymized] year of my undergraduate degree of [anonymized] at Stellenbosch University. I am incredibly excited to work with people from all over the world to come up with solutions to issues regarding sustainability as these issues unite us all, regardless of culture and nationality." "The different social backgrounds of each member of the group was something that contributed a lot to the overall project and Future17 challenge." "It was great to work with a multidisciplinary team, with different backgrounds and cultures." "The cross-cultural interactions and understanding are one of the highlights of the program. Seeing how people from other countries/cultures work is highly eye-opening, and learning to work with such a diverse team is highly rewarding." "The exchange of cultures and experiences in the group, the engagement of students and mentors and all the cross-cultural learning process." "While our project partner had a lot of other commitments, we would have wanted more insight from them on the expectations and needs to be addressed from the project, rather than infer from the project information brief." "This was my team's main problem throughout the whole experience, we had support but it was mainly online data support." "It wasn't so clear [what] the expectations of the partner [were]. We didn't have many possibilities to interact and include the students in the conversations before the presentation."
3. Design Thinking induction: creating a Community of Inquiry and effective digital competences	"The introductory part of the course was an eye-opener for me. Some concepts I had prior knowledge of and some were completely new." "The skills I have practiced in this first week include critical thinking, creative thinking, communication, problem solving and optimism. These tools form part of an arsenal of tools that will assist in funneling my thoughts and ideas and conveying information coherently and concisely." "The exercise on sustainability in my area made me realize the importance of having a forward-thinking mindset to shape the execution trajectory." "This course developed my critical thinking skills, it broadened my perspective and allowed me to learn more about design thinking, which I will now apply in every situation from now on." "This week I learnt about the importance of collaboration and the different roles that individuals play in teams which was really interesting to me." "I have also learnt what other students deem important in group settings, and this will allow me to approach group assignments in such a way to create a

(*continued*)

Table 4. Continued

Deductive theme	Illustrative questions
	comfortable environment for everyone, wherever I am placed in group setting again, may it be in my classroom or just in society generally."
4. Challenges for online collaboration	"The most challenging was the first step in scheduling the first meetings with all the students, considering the different time zones. We were lucky to have the great mentors we had to help us with the communication and aligning of the project's information and bridging with the partners." "Different time zones was challenging for our team and also trying to balance between work or school, since most of the meetings were during the week." "Unfamiliar with the use of MS Teams; login difficulty with MS Teams; communication with members." "The most challenging part was clarifying the expectations at the beginning of the challenge and the use of MS Teams for communications." "Not being able to schedule meetings to the assigned MS Teams platform as a non-Exeter student wasn't great. It led our team to find other platforms - which meant we worked across many, and lost the efficiency and streamlined communication that could have been there. It would be nice to use a platform that everyone has the same access to"

Source(s): Authors' own work

students to respond to other participants' comments and the feedback session content (Al Momani and Abu Musa, 2022). Students were not compelled or expected to engage in these feedback mechanisms to be able to pass the course and so participation was voluntary. Nonetheless, as Amer *et al.* (2024) and Arouri *et al.* (2023) have demonstrated, Padlet provided an engaging way of enabling students to engage and this proved successful in our case. All the data collected were qualitative in textual form, which reflected the desire to empower students to share their experiences through their own words and enable the Future17 program team to gather contextual data from students (Chintakrindi *et al.*, 2022). These two forms of qualitative data collection were reviewed and approved by the University of Exeter's Department of Geography Ethics Committee (application 512607). The textual data were anonymized and analyzed using deductive coding (Hay and Cope, 2022), based on exploring student experiences of working on a sustainability challenge in an interdisciplinary, intercultural and digital collaboration context. Using deductive coding enabled the Future17 program leaders to identify the ways in which the core elements of the program we being successfully addressed and areas where development was needed. Accordingly, our results aim to explore the ways in which Future17 was able to develop effective infrastructures for transformative learning, and to identify and reflect on some of the challenges that remain as the program develops.

5. Results and discussion

Illustrative quotations from the analysis of evaluation data are provided in Table 4 and are presented by deductive theme. In the first instance, it was clear from the data that studying sustainable development challenges from a *multi-disciplinary perspective* (deductive theme 1 in Table 4) was something that attracted students to the program, and for which there was considerable added value in being able to intensify their study of sustainability, for example:

"I believe that Future17 will provide us all with so many opportunities to learn and grow and I am looking forward to stepping outside of my usual field of study and growing in other spheres". Disciplinary diversity was also conceptualized as more than simply academic conventions associated with ontology, epistemology and methodology, but also related to the freedom that taking this approach offered for tackling complex sustainability challenges at a global scale. Indeed, the significance of cross-disciplinary working largely appeared to be implicit, with students offering a brief introduction to their home discipline, before highlighting their aspirations to connect with others to tackle sustainability challenges. Accordingly, it was largely taken for granted (in a positive way) that sustainable development required working across academic boundaries and with nonacademic partners.

However, what was stressed more strongly was the importance of reflecting on *intercultural learning at the global scale* (deductive theme 2 in Table 4). This was manifested in several ways. In the first instance, there was a positive recognition of the diversity of group composition, something which can be challenging to achieve in single institutional or in-country initiatives. A second attribute of this feedback was that diversity in student background led to greater understanding between participants (including academic mentors) through cross-cultural interaction, challenging assumptions about how sustainability is approached in different national and cultural settings. However, a third attribute of this feedback did acknowledge some of the challenges associated with working across cultural boundaries, for example: "I found it challenging to work with people from different backgrounds as well as working with topics that required joint reflection." This third theme was particularly important when the broader context of working not only with a diverse group of students but also with a project partner was explored. This was manifested in comments about uncertainty over how to manage the expectations of students and project partner organizations in terms of input from a partner and wider expectations of outputs and outcomes. From an intercultural learning perspective, this is significant because it highlights the importance of establishing expectations from the outset of a project, and the need for transparent communication. Our evidence indicates that these challenges were experienced by a small minority of the student teams but it does highlight the importance for those leading Future17 to establish transparent working practices and expectations. Indeed, it is important for partner organizations sponsoring projects to be clear about their expected outcomes, as some student teams remained unclear on exactly what the company was seeking. Accordingly, our initial evaluation data suggests that students generally highly valued their intercultural learning experience on Future17 but more work is needed to ensure that the cultural expectations of how to work with a project partner organization are clearly articulated.

The main bulk of feedback provided by students on the pilot program related to the logistics of online collaboration, aligned to the theme of developing digital competencies and, within this context, fostering a Community of Inquiry (CoI) that Blayone *et al.* (2018) highlight. Within this context, our evidence suggests that the *Design Thinking induction* at the start of the pilot (deductive theme 3 in Table 4) was highly successful in enabling students to develop their online collaborative competencies through promoting deep, reflexive and agile thinking, fostering "[…]active collaboration, freedom of expression, and deliberation vital for effective entrepreneurship, innovation and social development" and using a problem-based approach (Blayone *et al.*, 2018, p. 282). Indeed, what was striking in the student feedback was how students remarked on the novelty of using a Design Thinking approach and the importance of critical thinking in problem solving, for example: "It has been a new mindset reshaped, with many novelties, theories, and platforms to follow and share. It has been a great experience". Students also emphasized that the skills they had learnt

during the Design Thinking induction were important outside of their academic experience, with some arguing that this would shape their approach to a range of situations.

The induction also proved useful in fostering an appreciation of the importance of group collaboration when tackling sustainability challenges. Given that the groups would only meet online and for an intense period, setting expectations about how groups work and appropriate collaboration practices was important. Accordingly, the Design Thinking induction appeared to provide a sound basis for digital collaboration in terms of providing a clear, solutions-orientated process for tackling a sustainability challenge and for collaborating virtually. Yet there were three significant issues that represented *challenges for online collaboration* (deductive theme 4 in Table 4). The first relates to the induction phase where student groups meet and familiarize themselves with each other and their sustainability challenge. In the pilot phase, the allocation of students to challenges occurred at the end of the induction period, which meant that students needed to very rapidly familiarize themselves and immediately start working on their project. This was far from ideal and is reflected in the feedback data, for example: "It was also a challenge at the beginning because everything happened so fast, with little time to 'react'". A second logistical issue related to the challenge of arranging meetings over different time zones. As students could potentially be based in Sao Paulo and Hong Kong, this represented an 11-hour time difference. Whilst the pilot phase attempted to avoid placing students from these two universities in the same team to avoid such an issue, the small number of partner universities and student preferences for projects meant that this wasn't possible in all cases. Timing was therefore an issue for some students, and groups handled this in different ways. Some students appeared content to meet out of normal working hours, whereas some were not able to do this due to education, work or caring commitments. As such, a key learning point from the pilot has been the importance of recognizing these issues when allocating students to groups across different time zones and setting expectations for meetings.

The third logistical issue related to the collaboration platform used during the pilot phase. Given the short lead-in time to launch the pilot, the lead academic partner, the University of Exeter, used its MS Teams account as the basis for collaboration, establishing Teams channels for student groups and Future17 administration for academic mentors. In principle, this should have worked effectively, given this platform's flexibility in enabling group chat, meeting and file storage, alongside its integration in MS software packages. Yet the reality was that access privileges for non-University of Exeter participants became an issue. Initially this was thought to be related to students not joining using their registered e-mail address, but it became clear that even with the correct details, access wasn't straightforward. As the feedback indicates, this was a problem for some students.

Accordingly, digital collaboration can clearly be improved in future iterations of Future17, in adopting a platform that makes communication simpler and with easy access to all participants. Nonetheless, whilst there were logistical challenges related to sequencing, time zones and platform accessibility, the groups all met their challenge within the 8-week timeframe and all students passed the program. This is testimony to the resilience and agility of students who, as the quotations above indicates, found workarounds. Indeed, as this was a pilot, it was not anticipated that all elements would run smoothly. However, it was clear that the principle of using digital collaboration to tackle sustainability challenges across universities is feasible and that overall students found this highly rewarding, for example:

> […] the team was so hard working and efficient in tackling the weekly challenges and the project proposal given the short time frame. Our mentors were also very supportive and helpful by keeping us accountable on the different deadlines and also giving constructive feedback on different parts of the deliverable.

In light of these findings, we offer the following discussion from our findings in relation to existing literature. From an interdisciplinary perspective, the focus on solutions-oriented thinking changed the emphasis for learners from working within bounded conceptual or methodological frameworks, to being able to exercise freedom to experiment with new ideas. This responds to the two major obstacles identified in the literature, namely the constraining nature of ontological, epistemological and methodological disciplining characteristics of convectional higher education practice (Mokski *et al.*, 2023) which has acted as a barrier to more integrated approaches for addressing sustainable development challenges (Annan-Diab and Molinari, 2017); and the exercise of intellectual agility and flexibility in responding to dynamic challenges (Price *et al.*, 2021; Tyagi *et al.*, 2025). Indeed, much of what the evidence shows from the Future17 pilot is that what one student referred to as a "new mindset" has emerged for them, "[…]with many novelties, theories, and platforms to follow and share".

Aligned to the provision of an interdisciplinary infrastructure, the role of intercultural learning is clear from the evidence from the Future17 pilot. This is often the most challenging piece of learning infrastructure to change because of the tendency for universities to be place-based institutions, where cultural homogeneity can be the norm (Guillén-Yparrea and Ramírez-Montoya, 2023). Indeed, whilst in-person forms of intercultural learning can be highly beneficial (such as international summer schools, student exchanges and study abroad schemes, these also involve negative environmental impacts (Sommier *et al.*, 2022). In contrast, through digital collaboration and a period of intensive learning, Future17 has attempted to engage with the requirements for intercultural learning through promoting self-awareness and self-reflection (Morais and Ogden, 2011) by focusing on a personal recognition of individual context and the honing of intercultural communication skills. The evidence from the Future17 pilot indicates that student self-awareness was high, and they developed skills that were relevant for their life course, as well as academic study (Kang *et al.*, 2018). Finally, and perhaps an area for the most improvement for Future17, the digital collaboration enabled through the program received a mixed reaction. The use of Design Thinking as an induction tool for working collaboratively toward solutions for sustainable development challenges was a success, with students able to recognize their development of critical thinking skills and an empathetic approach toward working virtually with others (Dam and Siang, 2024; Dawson, 2022). This accords with the characteristics of Community of Inquiry (CoI) that Blayone *et al.* (2018) describe, where students learn to be agile, innovative, empathic and problem-based learners. It was clear from their feedback that the Design Thinking approach had provided a sufficient challenge to promote "critical thinking, creative thinking, communication, problem solving and optimism".

Nonetheless, the logistical elements of digital collaboration were significant and related to the sequencing of groups being formed and starting their project, time zones, and the accessibility of the collaborative learning platform. These are important considerations, ensuring the need to provide students with more time to meet one another, their academic mentor(s) and project partner organization. Indeed, greater planning is required to ensure that the difference in time zones is not so great as to exclude students from participation, which is a key equality, diversity and inclusion (EDI) consideration. However, the platform being used for collaboration was challenging, with difficulties in providing access privileges, receiving notifications and therefore missing meetings. It's important to note that this does not reflect on student abilities or their essential digital competencies (Erstad *et al.*, 2021; Langset *et al.*, 2018) and in our experience the problems encountered led to students adopting agile responses to overcome technical problems, through the creation of

backchannels using social media or other platforms. Indeed, the quality of student work produced at the end of the pilot phase suggests that students were able to engage productively in elements of Blayone's (2018) CoI approach to digital collaboration through deep learning, agility and adopting a problem-based approach that was supported by Design Thinking in the induction. Yet it does raise a concern about the ability of universities to establish robust collaborative platforms globally, and to ensure that these provide the skills needed for posteducation employment.

5. Conclusion

The evaluation of the Future17 pilot phase was undertaken using two methods of data capture: online comments from students during the program's four-week induction phase, which introduced students to Design Thinking, and an end of pilot evaluation, which incorporated the use of Padlet software of capture participant responses. These qualitative data were analyzed using deductive coding. The findings indicate that the Future17 pilot has been successful in embedding an interdisciplinary approach to education for sustainable development, which has been facilitated by students from a range of disciplinary backgrounds being members of working groups. Future17 has enabled students to experience and apply different ontological, epistemological and methodological approaches, thus enabling them to step outside their traditional disciplinary working context. Indeed, Future17 appears to have promoted positive intercultural learning experiences through the focus on student group composition from different universities across several continents. These intercultural experiences appear to have promoted empathy in learning and greater understanding. Future17 has also successfully implemented a Design Thinking approach, which for some participants has been revelatory and has enabled them to focus on problem-based, solutions-focused approaches in a way that their academic studies to date have not afforded. However, the Future17 pilot did demonstrate some limitations, which were largely focused on the practical management of the program. Working across different time zones was challenging for students who may have had meetings outside of normal working hours. Indeed, the technological platform used during the pilot phase meant that access privileges, setting-up meetings and collaborating smoothly using digital means was problematic. It was recognized that both clearer expectations about collaboration and a smoother digital experience were needed.

We argue that there are some important implications for educators from this specific case study, which can be summarized in three ways. First, there is clearly an appetite amongst students to engage in interdisciplinary learning that has an applied, "real world" focus. Although students recognized the challenges of working across subject boundaries, this was regarded as a positive and with enthusiasm. Second, learning from those in different cultural contexts was seen as very positive but also challenging. It was clear that the induction element of Future17, which explored the nature of group collaboration and the importance of skills such as listening, facilitated effective intercultural knowledge exchange. Third, perhaps most importantly, there are mixed implications for developing digital competencies. Certainly, the Design Thinking approach appeared to facilitate effective collaboration but some of the virtual learning components needed more consideration, such as the impact of scheduling, time zones, collaboration platforms and setting expectations. In this way, Future17 appears to illustrate the tensions that may arise between program design ideals and the reality of managing delivery.

Overall, Future17 provides a good example of how students can be empowered through digital collaboration to tackle 'real world' sustainable development challenges that introduces new ways of problem solving, interdisciplinary working and intercultural exchange. Through focusing on three learning infrastructures, this case study has aimed to

demonstrate the potential of collaboration between students, academics and project partner organizations. There are clearly logistical challenges in making such a venture scalable but we argue that Future17 provides an opportunity to realize the transformative learning potential of directly working on global 21st Century challenges.

5.1 Rights retention

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