(Re)designing a module to embed Education for Sustainable Development (ESD)

Document Version:
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(Re)Designing a Module to Embed Education for Sustainable Development (ESD)

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"By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development."
- United Nations Sustainable Development Goal 4, Target 4.7

Introduction

During the autumn semester 2021, a review of the BSc Food, Quality & Safety (FQSN) programme was undertaken involving academic staff, current students, programme graduates, placement providers and employers, and industry representatives. This coincided with the publication of the Independent Strategic Review of the NI Agri-Food sector (Kendall, 2021) which identified that "sustainability will become agri-food's licence to

trade". Reinforcing the review team's conclusion that sustainability had to be foundational to the redesigned FQSN programme, this presented a timely opportunity to design and create an innovative new module that would ensure future graduates have the necessary skills, knowledge and understanding to become true change advocates, tackling the sustainability challenges currently facing both local and international agri-food industry. From this, BIO1311 Sustainable Food Systems was born.

Serendipitously, the authors had an opportunity in early 2022 to be part of the Learning Design and ESD Bootcamp delivered by UNESCO and the Open University (OU). Beating out 62 other institutions, we were one of only 10 English-speaking teams that were successful in their application to take part. The overall aim of the course was to embed the Sustainable Development Goals (SDGs) and Education for Sustainable Development (ESD) through transformative pedagogies and active learning methods in a module of our choice. While some teams used a hypothetical module, we chose to apply this to the embryonic Sustainable Food Systems. The team (comprising two academics, an educational developer, and a student), along with two mentors assigned from other HEIs, collaborated synchronously and asynchronously over 12 weeks, working through the Bootcamp Toolkit. The aim of this article
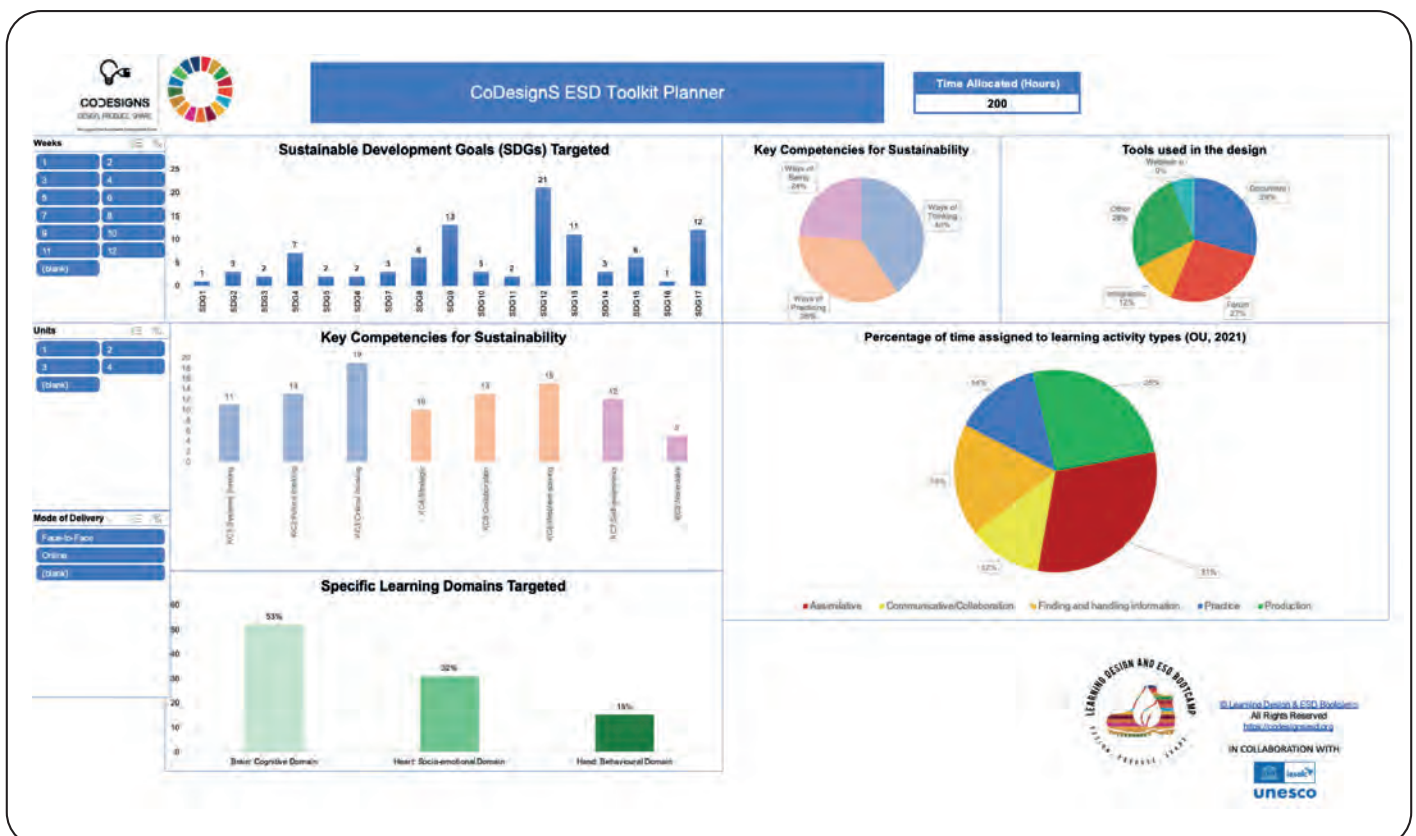

Figure 1 represents the CoDesign ESD Toolkit Planner

is to outline how ESD can be embedded into an existing or new module in a straightforward and accessible way, considering all of the SDGs and related aspects of ESDs.

Learning (Co)Design

Traditional curriculum design often keeps students at the edge, with educators primarily making design decisions. Moving towards a model of both parties making decisions around what the intended learning experience should be in a curriculum or module can be beneficial because it allows for different perspectives to inform decision-making. Learning design would appear to be an area within the teaching and learning domain in which academic staff and students could partner more often (Gormley et al., 2022). Learning design is a decision-making process to design learning experiences for students (Conole, 2012).

The learning design used in the Bootcamp is based on the CoDesignS (Course Design Sprint) Framework (Toro-Troconis et al. 2020). What was most helpful about the Bootcamp was the use of the Toolkit Planner, an online document that captured and visualised each aspect of the learning design as we progressed through the process (Figure 1). The planner required us to break down every hour of student contact and self-directed learning time within the module, and map it to the relevant learning outcome, SDG, ESD competency and learning activity type (as can be seen in Table 2).

As in any module, learning outcomes are always made explicit to learners to establish what should be achieved, though who is responsible for determining these learning outcomes has traditionally been the educator. The idea of students as partners, change agents, producers, and co-creators of their own learning has been the subject of increasing interest in recent years (Dunne and Zandstra 2011). Co-creation can take a variety of forms across different disciplines and institutions, as well as at a local or institutional level.

Staff and students may collaborate to: "evaluate course content and learning and teaching processes; (re)design the content of courses; research learning and teaching; undertake disciplinary research; design assessments such as essay questions or choose between different assessment methods; and grade their own and others' work" (Bovill et al., 2016, p.2)

Co-designing our module was an important aspect of the Bootcamp. Information and feedback garnered from structured and informal meetings with students, alumni, employers, and agri-food industry personnel was used to develop learning outcomes and key module topics, ensuring the needs identified in the original programme review were met by the new module. Most crucially, the varied team the authors comprised, particularly including a student, helped ensure that content was varied, relevant and intentional to the learner interests.

The Bootcamp encouraged us to consider which of the 17 SDGs were most relevant to our subject area, but also challenged us to consider how all of them could be incorporated into our teaching. Though it was initially suspected that SDG2 Zero Hunger would the most salient of the SDGS, it was, in fact, the topics and skills associated with SDGs 9, 12 and 17 that were identified as being crucial to the intentions of the module and occupied most of the contact hours (**Figure 2**),

though all SDGs were covered at some point in the module, in varying degrees of depth.

Key Competencies for ESD

The SDGs are a call to action, and thus ESD must prepare our students to act. Alongside our SDG related content, we therefore also need to think about the non-subject related learnings. Learning and teaching practices therefore should focus on cognitive, socio-emotional, and behavioural domains (head, heart, and hands) to engage students in a transformative educational experience (Cotton and Winter, 2010; Sipos et al., 2008). Such a transformative experience relies on competency frameworks to identify the necessary skills required for students of ESD programmes (Giangrande et al., 2019).

Though variable across the literature, the most common competencies referred to are normative competency, systems-thinking competency, future-thinking competency, strategic competency, collaboration competency, problem-solving competency (Wiek et al., 2016), self-awareness competency and critical thinking competency (Rieckman, 2018). These competencies are defined in Table 1, and mapped to the cognitive, socio-emotional, and behavioural domains in **Figure 3**.

We had not initially entered into the Bootcamp with a preconceived idea

Figure 2 represents the SDGs 9, 12 and 17

The Key Competencies of ESD (Rieckman, 2018; Wiek et al. 2016)	
Normative competency	The ability to understand and reflect on the norms and values that underlie one's actions and to negotiate sustainability values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge and contradictions.
Systems-thinking competency	The ability to recognize and understand relationships, to analyse complex systems, to perceive the ways in which systems are embedded within different domains and different scales, and to deal with uncertainty.
Future-thinking competency	The ability to understand and evaluate multiple futures – possible, probable, and desirable – and to create one's own visions for the future, to apply the precautionary principle, to assess the consequences of actions, and to deal with risks and changes.
Strategic competency	The ability to collectively develop and implement innovative actions that further sustainability at the local level and further afield.
Collaboration competency	The ability to learn from others; understand and respect the needs, perspectives, and actions of others (empathy); understand, relate to and be sensitive to others (empathic leadership), deal with conflicts in a group; and facilitate collaborative and participatory problem-solving.
Problem-solving competency	The overarching ability to apply different problem-solving frameworks to complex sustainability problems and develop viable, inclusive, and equitable solutions that promote sustainable development.
Self-awareness competency	The ability to reflect on one's own role in the local community and (global) society, continually evaluate and further motivate one's actions, and deal with one's feelings and desires.
Critical thinking competency	The ability to question norms, practices, and opinions; reflect on own one's values, perceptions, and actions; and take a position in the sustainability discourse.

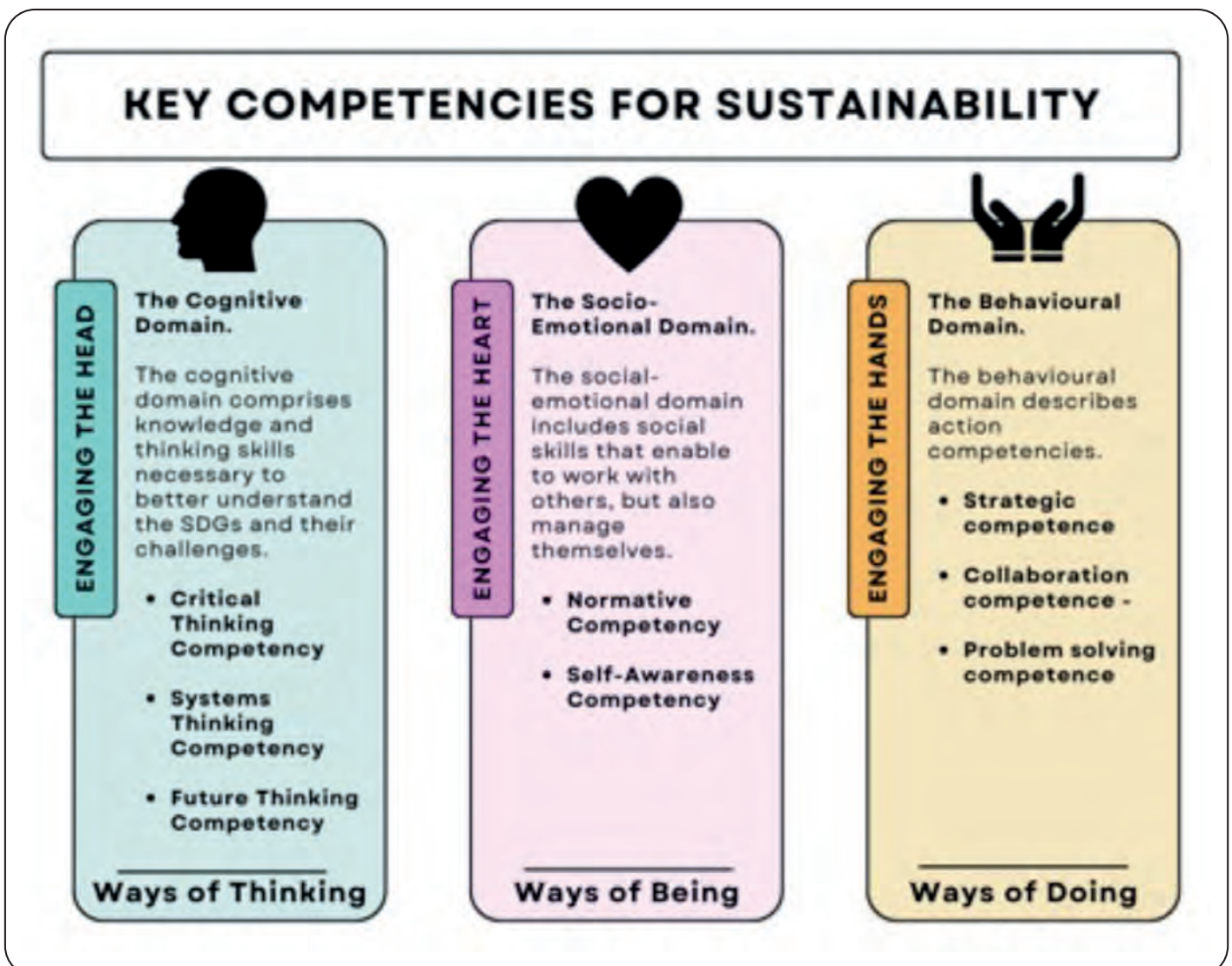**Table 1 represents the Key Competencies of ESD**

Figure 3 represents the key competencies for sustainability

of which competencies to address. As we progressed through the Bootcamp, we saw that critical-thinking, problem-solving and collaboration competencies emerged as the most prevalent ones for the Food Science module. This was determined to be appropriate for us as critical thinking is a core graduate attribute, and our industry partners determined problem-solving and collaboration were key skills for their employees.

Transformative Pedagogies and Active Learning

For active learning to be effective and transformative it cannot be seen as an add on but embedded into the curriculum design. UNESCO (2017) outlines how ESD is recognised as a key enabler of all SDGs and achieves its purpose by transforming society where transformative education covers the content and learning outcomes, pedagogy, and the learning environment itself. Transformative pedagogy according to Tasler and Dale (2021) takes place in the overlap of learning landscapes that is enabled by identity negotiation and dialogic relationships between teacher-learner-places where all of this takes place in a wider educational and cultural context with invisible socio-political actors. From the learner perspective the focus is on their biographies, expectations, and experiences as learners. The teacher's perspective is on their biographies, expectations, their experiences as learners and professional identity. Finally places where the focus is on purpose, design, ergonomics, and accessibility (ibid).

Active learning is any instructional method that engages students in the learning process … [it] requires students to do meaningful learning activities and think about what they are doing." (Prince, 2004, p.233). During active learning, curriculum knowledge is constructed, applied, and evaluated through activity, which might include physical, mental, and emotional acts of learning (Taylor et al., 2019). According to Pratt-Adams (et al., 2020) active learning is about providing opportunities to practise the application of knowledge. The aim is to engage students in a "series of activities which require them to produce observable evidence of their learning. Where possible, these individual, pair and group tasks aim to develop higher order thinking skills, emotional connection with content and tactile or physical engagement with the environment" (Gowers et al, 2022, p.3).

Learning Activities

Having determined our learning outcomes, SDGs, and ESD competencies, we needed to think about how exactly we would deliver these for maximum impact. The Toolkit is aligned with the OU Activity Types Framework (Table 2) used to define and visualise how learners engage with study materials, tools and technology and the study community (OU, 2021). These are: Assimilative, Communicative, Finding and Handling Information, Productive, Practice and Assessment.

Though we maintained a focus on active learning, we did find that the module had the greatest focus on Assimilative activities. We felt this was appropriate for a first-year module so that core subject knowledge would be developed in preparation for future years, but the visuals of the planner helped us avoid an oversaturation of information transmission where possible.

We also wanted to ensure that our assessment was considered authentic. While perspectives on authentic assessment differ depending on the stakeholder, it aims to "replicate the tasks and performance standards typically found in the world of work", and has been found to have a positive impact on student learning, autonomy, motivation, self-regulation and metacognition" (Villarroel et al., 2020, p. 840) and "create[s] space for students to integrate their values, capabilities, and their future aspirations" (Tai et al. 2022, p. 9). We focused on authentic assessment not only from a world of work perspective but philosophically through a lens of "transformative social change, where students connect work, well-being, and society, where the link to social and situated forms of learning is essential" (McArthur 2022, p.5). Authentic assessment naturally encourages flexibility and creativity. For example, what could have been a typical laboratory report on carbon footprinting has now become a more reflective piece, encouraging the students to reflect upon the link between their personal food choices and the wider carbon budget. The development of reflective practice is central to this new module as it is not only a key aspect of ESD but was considered a highly sought-after graduate skill by the employers consulted. For each learning outcome, we detail below examples of the activities that were used.

Learning Outcome 1: Define food systems and understand their position within a global food context.

As part of this learning outcome, we wanted students to understand the ethical dilemmas that are inherent to food systems (Kaiser et al., 2021) because, as industry professionals,

The OU Activity Types Framework (OU, 2021)	
Assimilative	Attending to information (reading, watching, listening, thinking about, accessing).
Finding and Handling Information	Searching for and processing information (listing, analysing, collating, plotting, finding, discovering, using, gathering).
Communicative	Discussing module related content with at least one other person (communicating, debating, discussing, arguing, sharing, reporting, collaborating, presenting, describing).
Productive	Actively constructing an artefact (creating, building, making, designing, constructing, contributing, completing).
Practice	Applying learning in a real-world or simulated setting (practising, applying, mimicking, experiencing, exploring, investigating, experimenting, trialling, improving, modelling, simulating).
Assessment	All forms of assessment, represented as a blend of the activity types above, but specifically designed to measure learning.

Table 2 represents the OU six Activity Types

they will have to make trade-offs between these issues regularly, and always work to reduce the impact of their actions. This, therefore, related heavily to building normative competency in students. Drama was chosen as a teaching tool because it is engaging, conveys subject knowledge in an embodied way, and also aids their personal development through confidence building (Göksel, 2022). We plan to ask students to briefly perform scenarios containing ethical dilemmas. These will be scripted by the lecturer to avoid placing the students under unnecessary pressure and ensure key points are addressed. Afterwards, we will analyse the ethical scenarios together using the Potter Box (Christians et al., 2001), allowing students to both experience the issue first-hand, and then consider their response as an emerging food professional.

Learning Outcome 2: Identify and discuss the challenges associated with the sustainable production, processing, and manufacturing of a range of food commodities and describe relevant approaches to mitigate impact.

As the team progressed with the bootcamp, approaches to delivery and content were challenged as a truly student-centred focus resulted in creative and transformative ideas and approaches. Traditionally, food processing knowledge was heavily abstracted and dependent upon laboratory practicals. However, it was felt an alternative approach was required. According to Tasler and Dale (2021) when the interactions between student, teachers and place of teaching are considered there is increased potential for active learning to take place, when the setting and additional participants (such as industry personnel) can be expected to significantly add value (Sefton-Green, 2012) to the learning process. Smith (2007) reported the use of place-based learning, that focuses on real-world problem solving, can impart to the learner a sense of their own agency and collective capacity to alter communities and society.

Consequently, the incorporation of place-based learning (Cruz, 2022) in food processing facilities will provide opportunities for students to see first-hand the sustainability challenges facing the food industry and engagement with industry personnel will encourage development of systems thinking, critical thinking and strategic thinking competencies.

Learning Outcome 3: Demonstrate an understanding of new data collection, analysis, and interpretation methods and how these can be used to monitor and improve sustainability.

Employer feedback stated that our students lack a "digital mindset", which contrasts heavily against the myth of the "digital native" in higher education (Kirschner & De Bruyckere, 2017). Given that industry is capturing data at an exponential rate and attempting to analyse this data to inform business decisions and mitigate their impact, our students need to be able to work confidently with relatively new software platforms and handle large datasets. This relates to problem-solving competency, which therefore makes problem-based learning (Cardon et al., 2022) an ideal solution. It was therefore decided that setting students the task of visualising the data in the way that could describe and explain a sustainability issue would effectively address this. This would be completed following an introductory practical on understanding and working with data, and this task would form part of their assessment for this module. However, we wanted this assessment to be as authentic as possible so that it would provide an opportunity to encourage our students to negotiate how to demonstrate competencies well beyond university life (Dawson, 2021).

Therefore, we hope to obtain a dataset donated from industry, such as a factory's records of daily energy use vs average refrigeration temperature. Instead of a report that may never be read again beyond the assessors, students will instead produce a Microsoft Power BI Dashboard that

visualises the data in a way that can best illuminate the problem and aid decision-making, as they might be asked to do in a real-life setting, also equipping them with experience in an industry-relevant application.

Concluding Reflections

On completion of this Bootcamp, we were left with a number of reflections on Education for Sustainable Development, and on learning design generally. The Bootcamp was individually challenging but enriched our practice as a group through encouraging us to integrate our multiple perspectives. Working as a sole practitioner may have led to a much smoother design process, but perhaps a not as rewarding one. Learning design in this way can be a very time-consuming activity initially, but ultimately a very worthwhile one when designing any module, as it pays dividends in later delivery.

One of the key learnings that shocked us was when our mentor encouraged us to consider planning the entire module. Initially, we had only planned the 36hrs of contact time, but he asked us to consider non-contact time too, since we agreed students, especially 1st years, do not often understand what independent study should be like. This module is worth 20 CAT points. Unusually, each CAT point is supposed to represent Guided Learning Hours (GLH) of 10 hours. Therefore, our module should equal 200 GLH in total. It was easy enough to plan the 164 GLH of self-study and assignment preparation, but we realised that was excessive. If strictly adhered to, our students should be spending almost 14 hours a week in independent study. Replicated across the other two 20 CAT modules taken at that stage, then in a 168hr week, allowing time for eating and sleeping, it does not give much time for anything else. Students are not just students anymore. They may also be parents, carers, working full time and have other responsibilities or may be vulnerable themselves. We are aware

of the impact of students working too many hours in a week, but sometimes they might be the sole providers in the family home. Therefore, this experience suggests to us that we need to rethink our structures around learning, and our expectations thereof.

As we progressed through the Bootcamp, we also began to encounter some signs of resistance. Some of these were systemic. We wanted to include the forthcoming students in the co-design process, but our quality assurance processes mean that the learning outcomes and assessment were largely fixed a year in advance. Active-learning and place-based learning take time, but the timetable had no flexibility this year. Even something as simple as room layout posed a challenge. It is difficult to facilitate active learning in fixed-seating, tiered lecture theatres, but flexible teaching spaces are hard to come by.

Some of these were much more interpersonal. We had different knowledge, backgrounds, and opinions on teaching within the group, and reconciling this into a module was not always easy. However, this also made the final product much richer, reflecting the diversity that should be inherent in ESD. Because of the structure of the Bootcamp, we found ourselves designing sessions for our colleagues which we knew would not be delivered in the way that we planned

due to differences in teaching styles and workloads. This was disappointing, but it reinforced the iterative nature of co-design, and we were able to comfort ourselves with the knowledge that any amount of ESD embedded in the module was a victory.

And of course, this is all still theoretical at this point. The module will undergo first delivery in January 2023. Maybe our students will love it, maybe they will hate it or maybe they will just find it too much work. Student resistance is one of the top barriers to active learning (Nguyen et al., 2021).

This article aimed to share our learnings and experiences as a team that took part in the UNESCO Learning Design and ESD Bootcamp. It was challenging, personally and professionally, but was overall a positive experience which reinforced our desire to see sustainable development embedded in the curriculum at a deeper level and in a more intentional way. We have outlined how we co-designed a food science module in the School of Biological Sciences, of which the learning outcomes, learning activities and assessments were aligned with the principles and practices of ESD, notably the SDGs and the key competencies. The key takeaways from this can be applied to virtually any module, as can the challenges. It occurs to us that, though the focus is very much on staff to review their module through an ESD

and co-design lens, that the time and workload pressures staff face pose an immediate barrier to this. Therefore, it is important to highlight that, for any meaningful, intentional, and sustainable change to occur, institutional support in the form of structures, training, and workload allocation is crucial, as well as a partnership approach that draws on the expertise of staff and students across the institution, is aligned with research and operations, and engages with the public in an outward facing way.

However, the journey of a thousand miles begins with a single step, and therefore it is fitting for us to offer our quick tips on how staff can get started with ESD. We also invite you to read Alysha's vignette, demonstrating the power of students to be global citizens and active change agents, and the wealth of insight they bring as partners in the teaching and learning experience.

How to Get Started with ESD.

- **Choose an SDG** to align your content with. Include up-to-date statistics which are available from: **https://unstats.un.org/sdgs** and **https://sdg-tracker.org/**.

- **Identify a key competency** that you wish to develop in your students or, better yet, ask them which key competency they would most like to work on.

- **Look at your learning activity types.** Is it mostly Assimilative? Can you incorporate a more active approach to your session, perhaps by having group discussions or making use of the flipped-classroom design?

- **Consider your assessment.** Can it be anything other than an essay, presentation, or exam? Is there an opportunity for it to be done in groups? This builds collaboration while also reducing marking!

- **Think about how co-design can be implemented** in a very basic and risk-free way. In your first session, ask students about questions they have in the module or topics they are interested in. You could then, for example, reserve one session as "student choice seminars", and invite them or guest lecturers to give short presentations on these topics of interest.

Alysha's Experience:

Alysha Thompson, PhD student in Food Science, 1st Class Graduate of the MSci in Food Science and Food Security with Professional Studies.

Though I felt somewhat out of my depth, taking part in the ESD Bootcamp provided me with the opportunity to experience 'real life' module development. It has been truly eye-opening to see the sheer magnitude of work under considerable time pressure that goes into preparing and developing module content at university level, which students just don't see! Now I see the work that academics, educational developers, and other staff undertake for student benefit, and a co-design approach might just be the way to make it visible.

I feel my contribution to this Bootcamp has been essential to better reflect student interests and maximise overall engagement for this module, which will enhance and improve the learning environment for all students on the Food Science and Nutrition programme.

Overall, this experience has highlighted the importance of collaboration across disciplines and has equipped me with a better understanding of how to embed the SDGs into everyday learning, to form part of a future-facing developmental shift where sustainability across agri-food systems can be achieved.

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