Development and Delivery of a Sustainable Development Unit in UK Universities: A Higher Education's Guide for Future Sustainability Leaders

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In 2016, the University of Bristol launched its institution-wide, interdisciplinary Education for Sustainable Development (ESD) initiative. *Bristol Futures* (BF) is formed of two parts: a free online course available to university students and the public, and an optional, credit-bearing unit available to all undergraduate students. This initiative encourages learners to understand the role that everyday behaviours have in creating and mitigating global environmental challenges. This paper profiles the *Sustainable Futures* (SF) pathway: one of three pathways within the BF initiative. SF offers innovative education to students that illuminates the role of their core discipline, and its relationship to others, in solving sustainable development challenges. In doing so, it encourages them to become engaged citizens and agents in both understanding and addressing the challenges that humanity faces, whilst giving them a broad educational experience which enhances their future employability. By adopting a challenge-based, post-disciplinary approach to global challenges (and therefore Education in Sustainable Development (ESD)), and through the combination of a range of learning and teaching methods including multimedia platforms, blended learning and flipped classrooms, Bristol University's model of teaching ESD in the Anthropocene is presented. This work demonstrates the fusion of the key characteristics that has allowed for the BF curriculum to enhance student learning, and provide interdisciplinary engagement with complex challenges in a way that forms Sustainable Development leaders of the future.

Education - Sustainable development - Curriculum - Global challenges - Blended learning

1 Introduction

We are now in the era of the Anthropocene (Crutzen 2002) where humans are char acterised as a "force significant enough to reshape the face of the Earth" (Clark et al. 2005). In 2015 the United Nations (UN), following a long history of discussions around Sustainable Development (SD), established the 17 Sustainable Development Goals (SDGs) (United Nations 2015; Sachs 2012). These goals reflect our societies' biggest concerns and aim to address humanity's biggest challenges such as poverty (SDG 1), inequalities (SDG 10) and climate change (SDG 13).

One key role that Higher Education Institutions (HEIs) have to play in this era of the SDGs is in relation to SDG 4 (Quality Education). As educators, we foster the leaders and SDG champions of tomorrow. As a result, it is imperative that these graduates have an excellent understanding of the complexity of sustainability, the urgency of global challenges and, most importantly, the impacts these challenges will have on different societies. One way to help address this is by increasing student engagement with sustainability within the HE curriculum and ESD. HE institutions must strengthen this link between Education in Sustainable Development (ESD), society and SDGs in order to ensure that graduates are appropriately equipped to tackle a variety of challenges, reflected in the different SDG targets.

With both student and institutional demand for more ESD-related courses and programs increasing, this paper presents, in detail, the development and delivery of an award-winning, blended learning ESD unit at the University of Bristol: the Sustainable Development Unit (SDU). It provides information to encourage and enable other HEIs to replicate this unit, or develop their own. Such knowledge exchange between HEIs can be critical, as it can allow for less time spent in the development stage of such initiatives and more time on the delivery. This in turn can mean that more graduate cohorts are graduating with the skills needed to address societal challenges. Finally, this paper presents a detailed evaluation of the unit from the perspective of students and staff alike, which can help other educators to benefit from the learnings made during the development and delivery of three runs of the SDU.

The University of Bristol was one of the first UK universities to commit to the SDG accord on 9th September 2017 (SDG Accord 2020), and on 17th April 2019 it became the first UK university to declare a climate emergency (BBC 2019; Walsh et al. 2020). The Institution has committed to delivering high quality, research-led teaching that aims to provide students with the knowledge and skills that will enable them to become future problem-solvers of these global challenges (Tierney et al. 2015; Michalopoulou et al. 2019). However, SD is not only an "end result": it is also a means to enable society to address contemporary challenges. Therefore, any endeavour that sets out to explore the SDGs or local or global challenges must do so through the same frameworks it tries to explore. For this reason, the SDU was created with respect to, and in accordance with, the SDGs.

This paper will present the SDU developed as part of the *Bristol Futures: Sustainable Futures* pathway. It will discuss how this unit was developed, how it is delivered and which SDGs and theoretical concepts it aims to present to the students, continuing the analysis of previous work (Michalopoulou et al. 2019). Additionally, this paper will present which SDGs are used for the development and delivery of this unit.

1.1 Institutional Context

In 2005, the SDU was introduced to the optional curriculum at the University of Bristol and made available to students from many disciplines across the university. The unit was taught by a multi-disciplinary team and received a national teaching award in 2007 in recognition of its innovative nature (Hoare et al. 2008). Ten years later, as part of the wider *Bristol Futures* (BF) project to enhance the

curriculum and student experience (Michalopoulou et al. 2019; Walsh et al. 2020), the unit was redesigned in a way which preserved the original interdisciplinary approach but increased accessibility to students by incorporating blended and problem-based learning approaches.

The SDU was (re-)designed with four core aims:

- To present the SDGs and, through them, develop a broad understanding of the challenges of SD and how different disciplines can provide insight into how they may be addressed.
- To invite comparisons and contrasts of experience across different SD challenges.
- To help students appreciate the problems and tensions in the application of SD ideals in practical circumstances.
- To introduce students to the experience of inter-disciplinary working focused on a specific challenge.

1.2 Pedagogy

From conception to delivery, the SDU is based on the recognition that both teaching staff and enrolled students do not just interact with and impact upon the peoples and environments in our immediate vicinity. Rather, they are connected to wider systems that affect the world as a whole. This is expressed through the interdisciplinary design of the SDU, which recognises that SD is multi-faceted, incorporating environmental, social and economic elements. This design allows for exploration of global challenges through a systems thinking approach. The design of the SDU is guided by a wider concept of global citizenship which refers to the "rights and responsibilities…duties and entitlements" (Davies 2006: 6) one has at a global level.

The SDU was designed to encourage students to take their criticality into their other units and everyday lives. The skill of criticality—and the related ability to approach and solve complex social and environment problems—is a key challenge to teach. In order to instil criticality, the course utilises the Vygotskyan principle of scaffolding, which refers to "the temporary assistance that teachers provide for their students to assist them to complete a task or develop new understandings, so that they will later be able to complete similar tasks alone" (Hammond and Gibbons 2019: 9). Employing scaffolding has been especially important as both staff and students enter each topic with different knowledge levels.

Scaffolding occurs at both the macro and micro level within the SDU and is incorporated into both the overall programme and individual topics. The flipped classroom model allows for the employment of specially designed introductory materials, followed by a lecture. The students apply the concepts in these materials to a particular scenario with support from the teaching team throughout a workshop: online or in person. Finally, students demonstrate their knowledge through discussion, or by presenting their ideas at the end of the class. Thus, the assistance provided is staggered, constantly adjusted in order to help students reach the minimum learning outcomes.

Sector research demonstrates that students respond positively to blended learning approaches (Sharpe et al. 2006). Research also suggests that students' learning improves in blended learning environments, compared to traditional lecture-style delivery (Gillette et al. 2018). "Blended learning" exists at the intersection between the Internet and the physical classroom, an intersection that can present a new range of possibilities for learning (Friesen 2012).While in-class hours may reduce in quantity, they increase in quality and students engage in more-informed discussion in the classroom (Smith 2014).

The flipped classroom approach expects the learner to engage with online material before face-to-face learning. At Bristol, digital learning takes place through the University's Blackboard Virtual Learning Environment (VLE) where resources such as discussion boards and instruction videos are hosted (Digital

Education Office n.d.). Literature on the digital flipped classroom largely suggests a positive impact on learning. It can promote scaling-up of class sizes while retaining smaller discussion sizes and maintaining student satisfaction (Ryan and Reid 2016). Bergman and Sams (2012, pp. 6–7) highlight how the flipped classroom can also assist the "personalization" of education. In this way, students are catered for in a more accessible manner (Bergman and Sams 2012, p. 14). This approach allows students to conduct their learning at their own pace outside of the classroom, which allows them to manage their workloads alongside other commitments (Bergman and Sams 2012, pp. 21–23). This flexibility allows students who may have traditionally struggled with a non-flipped classroom to succeed. This can include students with caring responsibilities, or those with learning and physical disabilities. With concern for the environment at record high amongst young people in the UK in 2019 (with a YouGov poll finding that 45%of 18–24 year olds placed environmental issues as their second biggest policy concern) (Smith 2019), it is imperative that HEIs not only increase the availability of courses on environmental issues but prioritise the accessibility of such opportunities.

Students are given ownership of their learning through the flipped-classroom approach, harnessing and improving their personal motivation and engagement with course materials (Abeysekera and Dawson 2015) and their positivity towards their subject (Turra et al. 2019). Students who engage in the flipped classroom see an increase in cognitive learning outcomes and experience increased satisfaction from the process of learning (Sergis et al. 2018). This is true for students from a wide range of disciplinary backgrounds (Chen et al. 2018). Post-disciplinary education opens opportunities for these students to go beyond deepened disciplinary knowledge and bridge it into that of others for purposeful engagement with sustainability. This pedagogical edge enables a liaison for example between humanities and science students (Biagioli 2009).When disciplinary boundaries are broken from the teaching level, students begin to see their instructors less as information disseminators and more as facilitators of discussion with their peers: the true benefit of the flipped classroom approach (McLean and Attardi 2018).

2 Development

Several challenges emerge when working on cross-subject curriculum material in blended learning contexts. Challenges included the need for specialist staffing and filming abroad and domestically. At the core of these efforts was a need to foster and maintain excellent working relationships with academic, student and external collaborators. Venues, councils, and archives were also integral partners in the success and visual variety of the media content. Another challenge was the need for testing and delivery of innovative curriculum approaches for other types of digital assets. The project team supported the identification, acquisition, testing and implementation of tailored resources that balanced innovation with accessibility.

2.1 Collaboration

Development of the unit required collaboration with teams across and beyond the University. The Academic Quality and Policy Office (AQPO) was enlisted to provide guidance through the quality assurance process, while the timetabling team ensured that all unit-specific requirements were given institutional priority to allow as many students as possible to take the unit. The Digital Education Office (DEO) was a core point of contact to advise on Blackboard systems and blended learning support. The Secretary's office advised on legal requirements. Faculty administration teams supported small and large-scale activities, such as workload arrangements. The unit was hosted in the School of Geographical Sciences, which oversaw core curriculum actions such as arrangements for external examiners, registering students onto units, and collating assessment marks.

Community and international collaborations were also integral to creating the broad vision of the unit. The unit invited content contributions from the local city and international colleagues. Predominantly, this took the form of freeform video interviews and case studies, as detailed below. Furthermore, the unit worked with specialist groups, such as archives, councils, research and commercial organisations to ensure that multiple stakeholder perspectives to the SDGs were considered and integrated into the unit. Together, over two hundred people were involved in the development of the unit. In addition, interdisciplinary collaboration within the core teaching team also provided an important element of curriculum design and delivery, with colleagues drawn from the physical sciences (Chemistry), engineering (Computer Science), social sciences (Human Geography) and the humanities (Archaeology).

The student voice was considered particularly important in developing the unit. Between December 2018 and May 2019, as part of the *Bristol Futures* project, six workshops attended by over 100 students were held. Overviews of the planned units were shared with students across this consultation phase, and their comments and suggestions were adapted within the final design of the units.

2.2 Hourly Paid Teachers

Bristol Futures Hourly Paid Teachers (HPTs) are an essential component of the success of the SDU. Principles were established before HPTs were recruited, and all principles were adhered to throughout the project delivery:

- HPTs should be paid at same rate for all work.
- HPTs should be paid for all training, meetings, facilitation (online/offline), workshop delivery and workshop preparation.
- HPTs should tangibly benefit from the experience (e.g. experience serves as evidence for recognised teaching accreditation schemes).

The authors agree with the growing consensus that HPTs are an underappreciated afterthought of the realities of teaching in HE, and are often exploited (see, for example, Husbands and Davies 2000; Carroll 2003; Dematagoda 2016; Hall and Bowles 2016; Webster 2017). As such, it was an ethical principle to ensure that HPTs were suitably supported and financially remunerated for their work. A high rate of pay was selected for these roles to reflect the interdisciplinary complexities and pedagogical challenges that the HPTs would encounter while teaching on these units. The type of teaching on the optional units allowed the HPTs to expand their teaching experience beyond their own subject, which would appeal to those with experience in only one discipline, and especially those applying for teaching accreditation(s). Any HPT embarking on an accreditation scheme was supported by the project staff as required. Following the interdisciplinary character of the core teaching team, HPTs appointed were drawn from numerous disciplines—including English Literature, History, Politics and Sociology, Medical Science, and Engineering.

2.3 Digital Assets

The range of digital assets used on the unit includes Online Learning Environment software provided by the institution as standard (e.g. Blackboard discussion boards, interactive blogging platforms, multiple choice quiz templates) and non-standard software that is supplied through external sources (Padlet). Equivalent, institutional-level standard software (i.e. Online Learning Environments) and the use of such software is commonplace across institutions and will therefore be excluded from discussions. Due to the complex nature of groupwork design and digital components on the unit, a technical expert was needed to support the architecture design on Blackboard. A graphics assistant supported the resourcing, refinement, and accessibility of all non-standard software and bespoke learning documentation. The SDU uses Padlet

(an easy-to-use, online bulletin board which allows instantly shareable images, video and text) in some sessions to collect comments, new content, and reactions from students during workshop sessions.

Unit directors generated in-house learning materials in the form of short articles and an editor was hired to both proofread and copy edit all assets. This ensured consistency in language used; accuracy of the writing; suitability for the learners' level; and that the tone, style and vocabulary were suitable for students from across subject disciplines. These documents were then reviewed by the graphics assistant to be standardised in terms of formatting, visual graphics, accessibility and checks on copyright to ensure all legal compliance. Some of the documents required the creation of new learning asset images for illustration and data presentation. All content materials, modes of teaching, and learning support were designed to both respond to the diverse learning needs of our students (i.e. in terms of disciplinary oversights) but also embrace the diversity of the cohort, thus drawing attention to the shared strength that can be found in such diversity. All materials were designed to be integrative, highlighting relationships and common themes (and differences) between concepts and allowing students to work through materials at their own pace.

The unit required bespoke video assets to create engaging and thought-provoking framing content in preparation for the face-to-face learning. Together, the project manager, film maker and project assistant worked as a team to create a streamlined service to the unit directors through the creative process. To begin the film-making process, academics completed a "creative brief" template. The team then provided an end-to-end service delivery encompassing storyboarding; conducting research for assets; sourcing and booking locations and contributors; scriptwriting; sourcing supporting intellectual property materials; and ensuring that all legal requirements and related paperwork were completed and recorded appropriately. The use of videos is understood to increase participation, emotional engagement, and overall course engagement by providing students with a framework to directly understand and apply the concepts discussed in previous content (Carmichael et al. 2018). Videos included interviews with scientific experts and local policymakers and included discussions of environmental policies (such as the plastic bag tax) in terms of personal anecdotes, foregrounding social sustainability content within individual experience. Numerous videos were purposefully shot with a tight frame, focused on the subject's head and shoulders – with no other materials or content presented. This is because research has highlighted that students find videos that include the teacher's images to be more engaging (Carmichael et al. 2018).

To ensure that the video assets met the highest quality standards, accessibility and representation were prioritised. This consideration was perceived as an ethical requirement that was embedded from the inception of each video asset, rather than an afterthought. All assets were designed with high-contrast visuals to ensure accessibility for those with visual impairment. Likewise, transcripts and timecoding subtitles were produced by default for each video. Throughout the development process, the project team worked with unit directors to ensure that all content prioritised gender, LGBTQ+ and BAME (Black, Asian and Minority Ethnic) representation.

3 Delivery

The unit is organised into an introductory workshop on the SDGs, followed by five interdisciplinary, themed blocks: science and understanding; behaviour and organisational change; economy, policy and law; equality and justice; and technology and innovation (Michalopoulou et al. 2019). Students gain insight into the concepts behind the challenges of SD and learn how different disciplines and interdisciplinary approaches are used. Through engagement across all teaching and learning approaches, students develop a broad understanding of the SDGs and learn how to work in an interdisciplinary team to analyse and critically evaluate challenges and potential ways forward. Each themed block presents real-world case

studies with illustrated text documents and videos which include interviews and other dynamic content. Such content draws from institutional academic expertise and from professionals and volunteers in the commercial and charitable sectors.

The intended learning outcomes (ILOs) are broad in scope:

1 Be able to understand and define the key principles behind SD and relate these to the UN SDGs.
2 Be able to recognise ideas and concepts from their own discipline, along with those from others, in relation to different SD challenges, and critically reflect on their interplay.
3 Be able to analyse and critically discuss how contemporary SD challenges intersect with and influence our day-to-day lives.
4 Be able to work in an interdisciplinary team to analyse and critically evaluate challenges and potential ways forward in response to a specific SD case study, and present their findings.

Workshops are delivered both online and offline. This independent reading process forms the necessary background knowledge that prepares students for the offline, face-to-face workshops. Workshops begin with a mini-lecture to provide a link to the weekly content and show their relevance to SDGs. This is then followed by problem-solving activities where students work in small groups. Each group is named after an endangered animal, which serves to sharpen an awareness of Anthropocene and its impact. By pre-fixing group members, a familiarity is built, which allows groups to focus on understanding the given scenarios and solving particular barriers to achieving SDGs. Scenarios we have used in our workshops are shown in Table 1.

Table 1 Scenarios used in group activities in relation to the sustainable development goals (SDGs) that they cover

Link(s) to SDGs	**Scenario**
All SDGs	Mock international SDG summit whereby each group represents a country or organization; identifies SDG priorities and synergies; negotiates trade-offs
Variable focus, e.g. SDGs 7, 8, 9 and 10	Groups identify a suitable geographical area for a sustainability-related project, such as a wind farm or community well
SDG 12	Groups act as consultants to develop a strategy to reduce single-use plastic for one of four client organisations
SDGs 9, 12 and 16	Mock tribunal of a proposed airport expansion against a fictitious UK sustainable development law
SDGs 1, 8, 9, 10, 11 and 16	A participatory budgeting exercise set in one of six city-based environmental projects, considering the priorities of marginalized groups
Any SDG can serve as the focus	Developing a proposal for a mobile app to be used in a country in the Global South, and the presentation of a funding pitch based on this

The student groups also conduct a group project over the course of the teaching block. In this, they apply the ideas and concepts learnt online and the skills learnt in the workshops to study a specific sustainable development challenge and produce a brief for a fictitious client, critically exploring the underlying issues and potential strategies moving forward. They are expected to use ideas and concepts from at least three of the five interdisciplinary themed blocks. Students have a choice of four projects each time the unit runs and have some flexibility in how they interpret the brief. Example challenges used so far include:

- Approaches to decarbonising transport in a city by 2030.

- Approaches to reducing emissions associated with meat consumption in a given country.
- Advice to a large food manufacturing company subject to a boycott over palm oil use.
- Advice for a city or region in the Global South suffering from poor access to fresh water.

Challenges can be reused or changed each year, to match the interests of students and adapt to emerging issues.

3.1 Assessment

Students are assessed on their learning through the submission of two assignments: first, a group project (groups consist of three to five members) and second, a reflective portfolio that evaluates how and what they learned. These evaluate their understanding and critical thinking in relation to the SDGs and local or global challenges. The reflective report is made up of three elements: two workshop learning statements; reflections on the future; and a blog article on a SD theme of their choice.

The aim of the reflective part of the portfolio is to assess:

- How well students have understood and applied the key concepts taught on the unit, and whether they have drawn from several disciplines in their answers.
- Whether the student has engaged in constructive discussion with other students within the unit's workshops.
- How much students have understood and thought creatively about the potential applicability of the concepts covered in the unit to both their own future and the futures of those who study their discipline.

The aims of the group project element of the portfolio are to assess:

- The students' ability to apply the concepts from different disciplines introduced in the unit to a specific case study of a SD challenge.
- The ability to collaborate with others, particularly with students from other backgrounds, experiences, and educational disciplines.
- The ability to analyse and critically evaluate potential ways forward, drawing on resources external to the core materials of the course.

Each student submits an individual feedback form, where they outline what and how much they contributed to the report, as well as how much they thought was contributed by their peers. These feedback forms are useful for the teaching team while marking, as well as for the students: it encourages them to reflect critically on how individuals can work cohesively, what barriers there are to collaborative working and how individuals might be encouraged or held to account.

4 Evaluation

Evaluation of the SDU considered the student learner voice, HPTs who contributed to delivery on the unit, and internal reviews with the unit directors and support team. Both quantitative and qualitative questions were posed to students and HPTs. The results of all feedback were shared with unit directors and senior project staff and used to inform future improvements on the design of the units. The design of the end of unit feedback form was altered significantly from the first to the second run in order to accommodate new avenues of interrogation that emerged from continuous improvements and refinement of both content and teaching approaches.

Table 2 Percentage of student feedback responses as the occurred from the first two runs of the SDU

Run	Statement	Disagree strongly (%)	Disagree (%)	Neither agree nor disagree (%)	Agree (%)	Agree strongly (%)
Pilot	Staff have made the subject of this unit interesting	1	3	17	45	18
2nd run		3	3	6	47	41
Pilot	I have received sufficient advice and guidance with the work for this unit	1	8	20	37	18
2nd run		0	13	6	47	34
Pilot	The material covered in this unit is intellectually stimulating	9	10	20	34	19
2nd run		0	6	13	41	41
Pilot	The unit is well organised	5	10	19	31	19
2nd run		6	3	6	63	22
Pilot	The online content blocks (videos and written content on Blackboard) supported my learning	0	10	16	46	25
2nd run		0	6	16	38	41

Anonymous student feedback was collected for the first two runs of the unit (Table 2). In total, 114 responses were collected and provide insights into student perspectives on the strengths and weaknesses of the approaches taken in the design of the unit. The pilot run of the unit captured feedback from32%of the cohort during teaching on the latter half of the academic year. The second run received responses from 78% of the cohort from teaching taking place in the first half of the academic year.[1] Students on the pilot unit were, therefore, able to situate their reflections in the context of a greater level of exposure to their home discipline.

Feedback notes positive attitudes towards all areas queried across all questions duplicated in both runs of the unit (range: 67.5–75% positive alignment). The changes made between the first and second run of the unit were successful, as each criterion shows improvement (Table 2). The percentage of students who neither agreed nor disagreed either remained static or decreased. The criteria relating to online content showed the least variability, reflecting the small-scale changes made to this material between runs. Additional qualitative questions were posed to ensure that students could highlight areas not considered by the teaching team. The most frequent observed criteria related to feedback and the range of interactions with staff. As such, adaptations made to the unit for the second run were reflected in the additional feedback questions posed at the end of the unit (Table 3).

[1] This differentiated level of student response is rooted in the different sizes of the two cohorts. Whilst the pilot run involved over 260 students, the second run involved 40. At the time of writing, we are preparing for the third cohort—involving 300 students.

On the second run of the unit, high satisfaction is observed with 76% of students reporting that they were happy or very happy with the unit and 100% noting opportunities to work with other students. Other strong areas of positive responses concerned how staff explain the subject matter (82% positive), opportunities to explore ideas and concepts in depth (81%positive), opportunities to apply learning (91%positive), clarity of marking criteria (75% positive), timetabling efficiency (78% positive), communications (88% positive), and a sense of community (81% positive).

5 Conclusion

In early 2020 the eyes of the world's population focused on Australia, where record-breaking temperatures and a prolonged, severe drought have resulted in vast bush-fires across the south-eastern states of Victoria and New South Wales. As of 21 January 2020, these fires killed 30 people (including four firefighters) and burnt over 100,000 km^2 of forest, bush and property (BBC 2020). While attributing these fires to anthropogenic climate change is a challenging work in progress (Phillips and Nogrady 2020), the experience of Australians in January 2020 is widely asserted to be a sign of a new normal in a climate-changed world (McGrath 2020). It is within this context that governments and public institutions across the globe are declaring a climate emergency and a recalibration of society's behaviour, consumption and activity—and, with it, patterns of social-environmental interaction.

The University of Bristol declared a climate emergency in April 2019. In making such a declaration, the institution not only affirmed the urgency of addressing and mitigating climate change (by becoming carbon neutral by 2030) but also acknowledge the "deep concerns of our students, many of whom are worried about what the future holds in store for them" (University of Bristol 2019b). Sustainable is an institutional priority, evidenced in the University's Vision and Strategy, its commitment to the global Sustainable Development Goals Accord and its recent award for the publicly-accessible, online *Sustainable Futures* unit (University of Bristol 2019a). It is within this institutional context that the SDU has been redesigned, refocused and made available to students across the University of Bristol. The SDU is an optional, credit-bearing and open unit. From the outset, an interdisciplinary team have committed to delivering content that both informs successive cohorts about contemporary sustainability challenges but also empowers them to develop skills of critical, imaginative, and innovative thinking about sustainable development in general and the SDGs in particular. Following scholarship elsewhere, we have found that this teaching is greatly assisted by the dedication to engaging students in critical discussions and for allowing reflection on the issues and contests that characterise the wider concept of sustainability (Kopnina 2018; Opoku and Guthrie 2018). Students are drawn from across the institution. Geographers learn alongside biologists, engineers alongside those from the arts and humanities. These students have different levels of knowledge and understanding of the subject matter discussed across the unit. As a result, there was a need to ensure that content was inclusive and open to all. With contemporary teaching across UK HEIs still highly siloed, this diversity of students created challenges to the objective to deliver cohesive, engaging content that challenges students as much as it informs them. In response to this student diversity, we embraced a post-disciplinary approach, understood as representing the incorporation of non-academic and both locally- and globally- focused perspectives. To do so, the curriculum and materials were designed to be integrative, highlighting relationships and common themes (and differences) between concepts and modes of research.

Table 3 Additional qualitative feedback questions from the second run of the SDU

Statements (second run only)	**Disagree strongly (%)**	**Disagree (%)**	**Neither agree nor disagree (%)**	**Agree (%)**	**Agree strongly (%)**	**Not applicable (%)**

Overall, I am happy with the quality of the unit	0	9	16	34	42	
Staff on this unit are good at explaining things	0	16	3	38	44	
This unit provided me with opportunities to explore ideas or concepts in depth	0	3	16	65	16	
This unit has provided me with opportunities to apply what I have learned	0	3	6	53	38	
The criteria used in marking were made clear in advance	0	6	19	50	25	
Marking and assessment have been fair	0	3	23	6	0	68
Feedback on my work has been timely	0	3	13	16	0	69
I have received helpful comments on my work	0	3	6	31	0	59
I have been able to contact staff when I needed to	0	2	9	24	30	35
The timetable works efficiently on this unit	0	9	13	59	19	
Any changes in the unit have been	0	0	9	69	19	3

communicated effectively						
I feel part of a community of staff and students working on this unit	0	6	13	53	28	
I have had opportunities to work with other students as part of this unit	0	0	0	25	75	

At the time of writing, much of the world is under lockdown. HEIs across the globe have—in the wake of the mass disruption caused by the Covid-19 pandemic—been forced to transfer *all* teaching online. As a result, there is renewed impetus for units like the one profiled above, which illuminates the role that blended learning can play in HE, both today and in the future. The central motivation for curriculum design was that the Unit was for it not to be a mere conduit for communicating facts. Instead, it was to both encourage personal, critical reflection and facilitate collaboration and exchange between students. This was in terms of the concepts taught, which moved from empirical discussions of renewable energy transitions to reflections on the role that different research methods (and their associated epistemological and ontological standpoints) could have in such change. This rationale for accessible, holistic content-delivery is also found in the way information was delivered. The first iteration of the unit involved over 260 students. This volume creates a danger of bottlenecks of teaching, assessment and marking and the creation of a passive learning environment that restricts student engagement (Exeter et al. 2010; Cash et al. 2017). To mitigate these issues, the unit adopted a pedagogical approach informed by the concepts of "blended learning" and "flipped classroom" to provide the necessary materials to many students, drawn from diverse disciplinary backgrounds.

Students can pause, revisit and review with ease, aided by the provision of high-quality closed captions. This is useful for students with accessibility needs, non-native English-speaking students, and those who need clarity on particular words or terminology used. Such an approach of blended learning allows for the creation of a multi-modal, post-disciplinary content that captures contributions from a variety of agents and constituencies present in discussions of SD and the SDGs.

The post-disciplinary character of this unit, its content and its delivery are evident in the disciplinary make-up of the teaching team. Chemists worked with historians, engineers with human geographers: all to demonstrate to students that voices from other disciplines can contribute to shared discussions on SDGs. The goal was to illuminate how no discipline has supremacy in understanding climate change, its drivers and potential solutions. Instead, a holistic vision is necessary: a vision that transcends and subverts traditional disciplines, epistemologies and ontologies, to provide students with a comprehensive view of what SD is that maintains relevance long after the assignments are submitted, and the marks bestowed. This post-disciplinary teaching did not take the form of disciplinary blindness – instead, students were encouraged to turn to different disciplines to understand the challenges faced (Stentoft 2017). On a personal note, we were particularly struck by how such a process forced us all to reflect on our respective disciplinary backgrounds, and its strengths and blindspots in teaching topics of environmental science and policy. It showed us that, more than ever, in teaching these topics HE must embrace not only the diversity of the classroom but also the difference within its teaching staff.

In an era where more and more HEIs across the globe are embedding climate change education into their curricula, we see the SDU as an exemplar of post-disciplinary engagement, creative and critical thinking, and the use of digital materials to increase accessibility and reach. However, we also see the unit as a work in progress. We will continue to respond to the feedback of both successive cohorts and groups of staff involved in delivery to improve this unit. We will continue to seek inspiration from all disciplines, and we will strive to provide students with a holistic vision of how to address challenges in an era of climate emergency.

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