

**Embedding Interdisciplinarity into the first year Undergraduate
Curriculum: Drivers and Barriers to a Cross-Institutional
Enhancement Project**

Rebecca Turner^{a*}, Debby Cotton^b, David Morrison^{a*} and Pauline Kneale^a

^a*Library and Educational Development, University of Plymouth, Plymouth, UK;*

^b*Deputy Vice-Chancellor's Office, Plymouth Marjon University, Plymouth, UK;*

rebecca.turner@plymouth.ac.uk corresponding author

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Embedding Interdisciplinarity into the first year Undergraduate Curriculum: Drivers and Barriers in a Cross-Institutional Enhancement Project

Engaging with interdisciplinary learning during higher education (HE) study, can provide students with skills and modes of thinking informed by multiple worldviews. Opportunities for interdisciplinary learning in the English HE system are limited; associated primarily with postgraduate study or later undergraduate stages. This paper reports on an enhancement project that sought to engage first year students with interdisciplinary learning. Drawing on data gathered from staff interviews, student focus groups and module enrolments, we examine drivers and barriers impacting on the planned curriculum transformation. Whilst drivers emerged from many directions (e.g. professional bodies, staff advocates), these were overwhelmed by the barriers – both administrative and ideological. Student responses were mixed. Some would have liked a wider choice of truly interdisciplinary modules, but it was clear many students did not understand the rationale for the modules, and felt that they needed more support to participate.

Keywords: Interdisciplinarity; curriculum change; academics; first year experience; student induction; student choice.

Introduction

Higher education (HE) is in a period of substantial flux, as worldwide challenges such as climate change, tense international relations and inequality become more urgent, and student pressure for change intensifies (Barber et al., 2013; Drayson et al., 2014). Interdisciplinarity is increasingly being seen as a key part of the required educational response to these so-called ‘wicked problems’ (Rittel and Webber, 1973) which have poorly defined boundaries and contested causes or solutions. Understanding the variation in disciplinary framings of wicked problems and learning to facilitate communication across different disciplines could prepare students to work on global challenges (McCune et al., 2021). However, there are subjective and objective constraints to interdisciplinary teaching in HE, including structural barriers inherent in the organisation of institutions into departments and faculties, and a lack of understanding of interdisciplinarity in a world where specialism is revered (Lindvig et al., 2019; Yang, 2009). The ‘siloes’ nature of academic life, and existence of ‘tribes and territories’ has been effectively discussed and analysed by Becher and Trowler (2001), though their focus was not specifically on interdisciplinary working. Notably, twenty years later, little has changed in the structure of teaching units in most institutions in the UK and internationally.

Before commencing any discussion of interdisciplinary teaching, it remains crucial to define the term itself, which remains contested and is often (incorrectly) considered to be synonymous with multi-disciplinarity. To summarise a lengthy and divisive debate, interdisciplinarity involves the merging or integration of disciplinary knowledges to offer novel perspectives, unlike multi-disciplinary approaches in which each discipline contributes from its own epistemological origin but remains fundamentally unchanged by its encounter with alternative views (Razzaq et al., 2013). Interdisciplinary teaching is considered to assist in developing 'Mode 2 knowledge' (Gibbons et al., 1994): Knowledge that is outward-looking and focused on solving real-world problems. It is evident immediately that interdisciplinarity is not an easy concept to teach or learn about, especially for academics who have spent most of their education and career immersed in a disciplinary context (Lyll et al., 2015). Interdisciplinarity represents a way of thinking and working which involves a move away from traditional domain-specific conceptions of knowledge, to individuals embracing a view of the world which encourages them to adopt multiple perspectives and synthesise knowledge from different disciplines (Lyll et al., 2015). It does not seek to undervalue the position of the discipline, rather encourages reimagining of the discipline. In doing so, it encourages students to recognise the fluidity of disciplinary boundaries and be prepared to look beyond their chosen discipline in order to solve problems, and to think critically and creatively (Brookes, 2017; Spelt et al., 2009). Interdisciplinary learning is challenging: to form connections across disciplines, students need to deploy advanced cognitive skills, thus powerful pedagogies are required (Klein, 1990). Simply put, a well-designed and learner-centred curriculum (Spelt et al., 2009) is important in promoting interdisciplinary learning.

Despite increasing enthusiasm for interdisciplinary study in HE (Klein, 1990; Lyll, 2015), research on interdisciplinarity in university education remains relatively limited (Hammons et al., 2020). It has been argued that encouraging students to address cross-disciplinary, thematic challenges or societal problems is important (Brookes, 2017; Holmwood, 2010), encouraging students to look at broader issues, beyond their immediate discipline and in the process develop higher-level skills (Kezar, 2013). Many benefits have been claimed for interdisciplinary programmes (including increased tolerance of ambiguity, awareness of ethical issues, and critical thinking skills) yet evidence in support of these is mixed. Likewise, research comparing the learning outcomes of students who have been following interdisciplinary courses with those on discipline-focused programmes is conflicting. Newell (1992) found that students in the School of Interdisciplinary Studies performed better on certain assessments than did those students in disciplinary programmes. Yet Lattuca et al. (2017) identified little difference between interdisciplinary and disciplinary majors for most learning outcomes though enjoyment was higher for students on interdisciplinary programmes.

Other research has focused on effective strategies for interdisciplinary teaching. A review by Lyall et al. (2015) highlighted the lack of ‘curriculum ideologies’ to support interdisciplinary learning, which means that interdisciplinarity can be constructed in different ways. Subject-based interpretations lead to interdisciplinarity framed through a content-based lens, potentially reinforcing existing pedagogic practices and maintaining well-established disciplinary boundaries (Lyall et al., 2015). In-between these two positions ‘convergent’ approaches emerge, where thematic issues are addressed from disciplinary perspectives. Here the importance of multiple worldviews is strongly advocated (Brooks, 2017). There are arguments that effective interdisciplinary practice relies on the higher-order skills (e.g. criticality, ability to synthesise multiple perspectives) that emerge through latter stages of undergraduate study (Miller, 2016), but there have also been calls for interdisciplinary practice to be integrated earlier, when students’ conceptions of knowledge are changing and they are potentially more receptive new ideas (Lyall et al., 2015; Brookes, 2017).

Most of the research in this area has been undertaken on staff and students who work in inter-disciplinary units or are enthusiasts for this approach. The literature currently has a dearth of research exploring staff and student responses to interdisciplinarity in the curriculum as encountered by non-experts whose usual mode is discipline-focused teaching (a notable exception is Lindvig et al., 2019), and we could find none that involved a systematic cross-institutional transformation towards embedding interdisciplinarity in the undergraduate curriculum. Our study contributes to this literature by reporting on an evaluation of the introduction an inter-disciplinary module offered to first-year students at a large multi-discipline university in the UK and taught primarily by staff who are discipline experts with little experience in interdisciplinarity. The perceptions of academic staff and students about interdisciplinary learning were gathered as part of a large-scale study to evaluate the transformation project, offering novel insights to the ongoing debate about the role of interdisciplinary teaching and learning in HE.

Context and background to the curriculum innovation

The introduction of an interdisciplinary module for all first-year students was one part of a wider curriculum innovation undertaken at a publicly funded, teaching-focused university in southern England. The curriculum framework utilised a model of extended induction with the intention of enhancing student learning and reducing early withdrawals. The value of an extended first year induction has been recognised as beneficial to all students (Bovil et al. 2008; Tinto, 2008), and the success of various elements of the scheme has been reported elsewhere

(e.g. citations removed for peer review), together with the detailed pedagogic principles of the cross-institutional project. Key elements of the scheme included a revised semester structure (which is depicted in Figure 1); each semester included one immersive ('short fat') modules followed by two more typical 'long thin' modules delivered in parallel after the conclusion of the immersive module. This revised structure of the first year was applied in each semester, followed by an assessment period.

Figure 1: revised structure of the academic year

Semester	Week number	Module format	
1	1-4	Immersive module 1: Principles and practice of the Discipline (20 credits) Short and fat, intensive delivery Assessment completed and submitted at the end of module	
	5-13	Traditional module (20 credits) <div>Long and thin, parallel delivery</div>	Traditional module (20 credits)
	14-15	Assessment period for traditional format, semester 1 modules	
2	16-19	Immersive module 2: Interdisciplinary learning (20 credits) Short and fat, intensive delivery Assessment completed and submitted at the end of module	
	20-28	Traditional module (20 credits) <div>Long and thin, parallel delivery</div>	Traditional module (20 credits)
	29-30	Assessment period for traditional format, semester 2 modules	

The introduction of 'short-fat' modules built on practice from America, where immersive

scheduling (Davies, 2006; Muraskin, 1998) has been identified as increasing retention (Soldner et al., 2000), developing critical thinking skills, and improving both academic performance and student-staff relationships (Richmond et al., 2015). Each immersive module lasted four weeks, during which time students completed module assessments. Studying only one module at key time points in the first year was felt to create opportunities for fostering strong peer connections and developing relationships with key academic staff (citation removed for peer review). The modules introduced higher-level skills integral to academic success, and early assessments provided students with a sense of achievement, building their confidence in their ability to succeed at university. Immersive module 1 occurred at the start of semester 1 and focused on principles and practices of the discipline, as well as on core study skills; immersive module 2 took place at the start of semester 2 and offered all students an opportunity to experience interdisciplinary learning.

The introduction of interdisciplinarity sought to create opportunities for students from different programmes to come together to work collaboratively in a way that would broaden their focus and allow them to develop new social relationships. Schools were invited to develop interdisciplinary modules that aligned with this vision. To support this, a set of guidelines were introduced to support the development of interdisciplinary modules. These guidelines directed staff to collaborate in new ways, bringing together at least two disciplines or subject areas, focusing on big picture issues that cut across disciplines or were of relevance to wider society, and employing pedagogies such as students-as-researchers that could foster interdisciplinary learning. The module teams were also directed to develop a maximum of four learning outcomes (two knowledge-based and two skills-based outcomes). The guidelines were intentionally broad to allow local innovation to promote ownership of the curriculum innovation, an approach which echoes advice in the literature (e.g. Blackmore & Kandiko, 2012). Staff development workshops were delivered to support the planning of the modules, though these primarily focused on inclusive assessment, active learning, and module design in general, rather than interdisciplinarity specifically. Faculty advocates supported interdisciplinarity, facilitating local interpretation of the guidelines, and discussions of interdisciplinarity to consider how this may manifest within each Faculty. The rationale for the faculty advocate role was that support for implementation from someone with local ‘field’ knowledge and experience would help promote uptake of the pedagogic innovation (Hasanetendir et al., 2017). A portfolio of 52 interdisciplinary immersive modules was developed, with three of the four University faculties presenting an ‘interdisciplinary offer’ to incoming students. The Health Faculty was not included in this curriculum innovation as

interdisciplinarity was identified as a theme already integrated within degree programmes, and also restrictions of professional accreditation. During the first few weeks of the academic year students selected their interdisciplinary elective.

Research Aims

As part of the project evaluation, staff and student experiences of the varied interdisciplinary modules were captured, with the aim of assessing the drivers and barriers to interdisciplinary teaching and learning. This study represented a departure from extant research which has focused primarily on capturing staff experiences of the process of developing and delivering interdisciplinary modules (e.g. Kezar, 2013; Mansilla & Dursaising, 2007; Spelt et al., 2009) by simultaneously capturing the student experience which, as Lyall et al. (2015) observed, has been overlooked in much existing research. The evaluation was designed to address the following questions:

- How did academic staff interpret the agenda for interdisciplinarity?
- What drivers and barriers were there to the development of inter-disciplinary modules?
- What were student responses to the interdisciplinary modules?

The evaluation was informed by the work of Bamber (2013) who identified the need to ‘evidence value’ from curriculum innovation activities. Bamber (2013) advocates drawing on measures of hard and soft outcomes (e.g. qualitative and quantitative measures of impact) to ensure insights are gained which are cognisant of context. Given this, the evaluation was multifaceted: in-depth empirical studies were designed to be undertaken during the first implementation of each immersive module. We have already reported on the evaluation on the initial immersive module which sought to introduce new students to the practices and principles of their discipline (citation removed for peer review). In this paper we report the evaluation undertaken to capture student and staff perspectives of the immersive interdisciplinary module.

Methodology

Using a mixed-methods approach, the study captured qualitative data through staff interviews, student focus groups and quantitative data on module enrolments. As noted above, a portfolio of 52 immersive interdisciplinary modules was developed; from this a purposive sample of 15 interdisciplinary modules across three faculties were selected for study. A member of the evaluation team, external to the curriculum innovation, made initial contact with the leaders of selected modules, to introduce the study and request their participation. All agreed to be involved and, in total, 17 staff from the 15 chosen modules participated in semi-structured interviews (Table 1).

Table 1: Overview of interview participants

Faculty	Number of Participants	Number of Modules represented by participants
Arts & Humanities	5	5
Business	5	5
Science	7	5

The choice of an interview method enabled the opening up of what Cousin (2009: 73) refers to as a ‘third space,’ where the lecturer and researcher worked together to develop an understanding of participants’ conceptualisation of interdisciplinarity, and its role in the first-year curriculum. Interviews were conducted at the end of the interdisciplinary module, to ensure participants were able to draw on their experiences of designing and delivering teaching, marking assessments and reviewing student feedback. Interviews explored the different elements of preparing and teaching the module along with participants’ perceptions and interpretations of interdisciplinarity and the opportunities and challenges the module presented for them. The study deliberately did not impose a definition of interdisciplinarity so that we were able to explore the different understandings of participants with expertise in diverse disciplines.

During the delivery of the module, two focus groups were organised with groups of course representatives (students who have volunteered to represent their cohort in giving feedback on teaching to university staff) in a single faculty, to offer an opportunity to hear the student voice more directly and capture students’ experiences of interdisciplinary learning. Focus groups are recognised as creating opportunities for the ‘sharing and comparing’ experiences (Morgan, 1997: 21), and they are a common approach to capture student perspectives (Cousin, 2009). Course representatives in the chosen faculty were regularly brought together to provide feedback on the experiences of their peers, so they were familiar and confident with doing so. The two focus groups explored student experiences of academic and social integration over their first year, teaching, learning and assessment, and specifically interdisciplinarity. In total, 14 students participated.

Both focus groups and interviews were audio recorded and transcribed verbatim. An iterative process of analysis was employed (Silverman, 2005); the initial round of coding was

informed by common themes in the literature but was expanded as new themes emerged from the data (Silverman, 2005). We also examined module enrolment data, to gain insights into the extent to which students engaged with the elective component of this curriculum innovation and whether they opted to embrace the choice afforded to them. Whilst the results of this single institution research are not open to statistical generalisation, it is possible to use the data collected to theorise about the possible wider applicability of the findings to interdisciplinary teaching and learning in other contexts using ‘theoretical inference’ (Hammersley, 2014). The paucity of literature on this topic, and the importance of interdisciplinary learning in HE, enhances the value of this research.

Findings and Discussion

Across these data there were very diverse responses and respondents, with some staff and students embracing the curriculum innovation and interdisciplinary working, and others preferring to retreat to more safe and familiar educational territory. Three themes emerged across the staff and student data sets, as follows:

1. Conceptions of interdisciplinarity (staff)
2. Champions and mutineers (staff)
3. Module choice and interdisciplinarity (staff and students)

These themes are discussed in turn below.

1. Conceptions of interdisciplinarity

Unsurprisingly, staff interpretation of interdisciplinarity affected the framing and development of modules. A content-focused or disciplinary interpretation prevailed, with 33 of the 52 modules dominated by disciplinary discourse (as reflected by module titles such as ‘principles of business for the 21st century’; ‘foundations in philosophy’), justified through practical or functional reasons. Though the guiding principles directed staff to design modules that could be taken by students from across schools and faculties, lecturers often focused on what they perceived *their* students needed:

“What could we do that would be useful to [names discipline] students that was outside of their discipline, and might also be relevant to people in other disciplines? That was our thinking at the time.” (Business ML4)

So the pedagogic thinking in this example was from a specific disciplinary perspective, with other disciplines very much secondary, aligning more closely with a multi-disciplinary approach whereby disciplines combine rather than converge and intertwine, as associated with

interdisciplinarity (Brooks, 2017). An alternative approach, which would have moved towards interdisciplinarity, could have considered how a topic or theme might be viewed by different disciplines. This could enable interdisciplinary considerations to emerge – but would unquestionably be more complex to deliver.

In a similar vein some of our respondents seemed unclear about what made the module interdisciplinary, with some assuming that it was about the staff involved or the students registered on it, rather than the content or pedagogic approach:

“I understood that the goal for a successful [interdisciplinary] module was to develop a module that included at least one other programme of study...maybe I misinterpreted it from the beginning” (Arts ML3)

“I think what makes it interdisciplinary is the subject matter, it's not who teaches it, or who it's taught to. It's the fact that it is a subject which is interdisciplinary” (Business ML4)

This lack of clarity around interdisciplinarity resulted in narrow interpretation of the guiding principles, meaning that in many cases a multi-disciplinary rather than interdisciplinary approach was adopted. This was further reinforced through actions such as targeted recruitment of specific groups of students, the presentation of module aims / assessments through a disciplinary lens or through the introduction of pre-requisites which excluded students from other faculties. Across the portfolio, 29 modules targeted specific students, with eight applying pre-requisites:

“The module has been set up with the expectation that all [x programme] students will enrol. It links with their tutorials and is assessed by their tutors.” (Science ML2)

These actions mediated the extent to which the initial vision for interdisciplinarity was realised. There was a sense from staff, as in other studies (Barnett et al., 2001; Woods, 2007), of the discipline being of primary importance. However, Mackinnon et al. (2013) call for greater integration of interdisciplinarity into the first-year curriculum and argue that early exposure may frame a more open and receptive disciplinary identity. While a strong discipline focus should not necessarily be seen as being in conflict with interdisciplinarity, there is a necessity for staff to understand the value of an interdisciplinary approach (and to value alternative disciplinary perspectives). Conversations needed to take place, involving students and staff, to explore

differing positions on a topic, and how these add value to teaching and learning. Such conversations should focus on the gains of this way of working, embracing the opportunities as well as the challenges this can pose. Indeed, this was a position adopted by one respondent who developed a module that sought to embrace interdisciplinarity. They highlighted the value of interdisciplinarity for future workplace environments:

the subject which I know the most about, which is [names subject], relies on collaboration out in the industry between any number of different people that might make up teams or that might be involved in the commissioning process. So [names profession] work with [names five other disciplines]. So a key skill, I think, for [names discipline] students, might be to understand that depending on the brief or the activity or the commission, you may find yourself needing to work beyond a prescribed discipline and embrace interdisciplinarity. To do this you need an understanding of how other people's practice may influence your own, there interdisciplinarity becomes potentially very important.

By embracing interdisciplinarity, they created conditions where they brought together students from different programmes and all experienced benefits from this approach:

"[...] students demonstrated an awareness of other practitioners operating with similar context and work collaboratively with them." (Arts ML2)

"Not only do they have to reflect about what it meant to work with people outside their programme or outside their discipline, but also to reflect on what they learnt about working with others" (Arts ML3)

These modules encouraged students to look at 'the bigger picture', embedded groupwork into diverse teams, and as this respondent highlighted, their focus in designing these modules was on:

'trying to construct modules so that illustrators might learn as much from designers as designers might learn from illustrators'.

Students were reported to engage with interest to these approaches and ways of thinking in other disciplines and learnt from this. These were modules that aligned with thematic or convergent interpretations of interdisciplinary, which tend to have a wider appeal. A recognised strength of interdisciplinary group work, which was sometimes delivered through these modules, is that it can allow 'third-spaces' for learning to open up, through which the meeting of different perspectives, co-learning and critical thinking can occur (Akkerman & Bakker, 2011). However, this was not always easy for students to understand, and highlights a potential challenge of introducing interdisciplinarity into the first year, particularly when centred on the use of group-based pedagogies. Group work is a notoriously challenging endeavour (Bourner et al., 2001) particularly as higher-level skills such as critical thinking and co-creation are still

forming (Plastow et al., 2010; Wingate, 2007). The emergent nature of these skills, and student lack of familiarity or confidence in their use, may be exacerbated if the rationale for working with students from other disciplines is not explicitly communicated or justified.

Even those who embraced the opportunities of interdisciplinary practice reported challenges in changing entrenched attitudes, which may have further reinforced multi rather than interdisciplinary practice across the module portfolio:

‘There are people who stay very firmly within their disciplines or, if you like, their taught discipline, but there are other people who desperately want to break out of those disciplines. I’ve grown to hate silos [...] I don’t understand that thing of protecting one’s own practice [...] it can sometimes stifle an individual’s creativity. For me, I think interdisciplinarity is very important, and probably doesn’t happen enough. And students actually say that too. One of the ideas was I think initially to try and move away from the very strong siloing of the English system which is not necessarily in step with a lot of the other...much of the rest of the world where there’s a lot more flexibility.’

Entrenched attitudes towards interdisciplinary practice, whether expressed explicitly or not, manifested in a number of ways. For example, concerns about parity and poor student feedback encouraged staff to try and ‘nudge’ their students onto specific modules – with the National Student Survey a constant background worry for many staff:

“if they’re talking to their friends, and their friends have done something which is totally different from what they’ve done, they’ll be thinking, well was that more burdensome? Did they get higher marks? Did they learn more? Was it more enjoyable? You want to have some commonality of student experience, or at least be able to tell the students, if you do this, then this is what you’ll get out of it.” (Business ML3)

Resourcing i.e. staff time, finances, which connected to institutional structures, also emerged as barriers to the emergence of interdisciplinary practice:

“I am completely interdisciplinary [but] I really found it very, very hard to get any cooperation from colleagues. And I didn’t get the impression that any resource is associated with this at all!” (Arts ML4)

The practical issue here in terms of resource was that the principle of money following students was never fully resolved, thus acting as a disincentive to recruit students from outside the faculty onto interdisciplinary modules.

Overall, conceptions of interdisciplinarity were complex, and shaped by a range of factors, that extended beyond understandings of interdisciplinary practice, to more practical or local concerns, that collectively determined the extent to which the vision of these modules was realised.

2. Champions and mutineers

The positive contributions interdisciplinarity can make to address global issues and enhancing graduate employability represent powerful drivers that can challenge traditional disciplinary practices (Borrego & Newswander, 2010; Lattacua et al., 2004; Spelt et al., 2009). However, there are hints in the literature that the position of champion of interdisciplinary teaching and learning is not always an easy one:

“Individuals who develop interdisciplinary teaching provision were seen as pioneering champions often working against the status quo” (Lindvig et al., 2019: 355)

In a similar way, our results indicate that responses from staff ‘on the ground’ were mixed. Some participants were positive about interdisciplinary working, particularly in terms of the opportunities it provided for students:

“I really like the concept; I think it's a good idea. [...] I like the idea of trying to do something slightly different, interdisciplinary, get the students involved as researchers.” (Business ML1)

However, others felt that the lack of detailed central guidance led to inconsistency and varied interpretation of the guiding principles. A minority of participants were openly mutinous and reported circumventing the intent of the model by repackaging existing modules:

“I think if you throw it open, like with anything in a large organisation, then it's hard to just see what will actually happen [...] a lot of people [were] just saying, we're just going to stick to our subject-specific stuff.” (Science ML1)

Resistance from staff was an issue throughout the curriculum innovation – with some actively working to undermine the aims of the project, and others following the guidelines but without enthusiasm for, or understanding of, the underlying principles. Inevitably, some

381 participants embraced the idea from first inception and recognised the potential benefits to
382 students, whereas others had to wait until success was realised to see the value:

383 *“I was sceptical to start off with, because I felt that it had been introduced with perhaps*
384 *insufficient institutional knowledge. But having had to implement it, I have really come*
385 *round to it, and I really enjoy it, and I think it’s quite an interesting experience for the*
386 *students.” (Business ML2)*

387 Where there was resistance, some participants attributed this to lack of clarity in the parameters
388 of the guiding principles:

389 *“I like having flexibility, but I like to know what the framework, within which I can*
390 *exercise the flexibility, is supposed to be [...] I like to know what the objectives are,*
391 *what are we trying to achieve [...] what I don't like is not being clear about what the*
392 *limits of our flexibility are”.* (Business ML3)

393 Others saw a disconnect between the goals of their long-standing, discipline-based
394 programmes and the new expectations for interdisciplinarity and collaborative working. There
395 was a fear that students might miss valuable learning opportunities that would leave them
396 under-prepared for future modules or threaten the extent to which they could meet the
397 requirements of a professional body validating a degree programme:

398 *“Some academics have concerns that we’re losing these 20 credits from the curriculum*
399 *and they’re necessary for students in this programme ... so actually it does need to be*
400 *more discipline focused than we originally wanted ...and perhaps limited the*
401 *interdisciplinarity of the module.”* (Business ML5)

402 These staff focused on the primacy of disciplinary knowledge over other forms of knowledge
403 and skills that students can gain through interdisciplinary learning (Lyall et al., 2015; Millar,
404 2016; Woods, 2007). Interestingly, though often cited as a barrier to change, interdisciplinary
405 learning is increasingly recognised by professional bodies who acknowledge the value of a
406 ‘rounded education’ (IchemE, 2008: 13). These responses to interdisciplinarity echo reactions to
407 modularisation in UK universities in the 1990s. At this time, increased module choice raised
408 concerns around the intellectual fragmentation of degree programmes (Jenkins & Walker, 1994)
409 and potential impacts on student performance when students come together from multiple
410 degree programmes (Billing, 1996; Trowler, 1997).

For some staff, organisational complexity became a focal point of their frustrations, as they viewed the interdisciplinary module as difficult to deliver and irrelevant to students' core subject:

"[...] if you're just doing a little pocket four-week module in the middle of your [subject] degree which is also about [subject] but not related to anything. I mean, why not just study [subject] and be done with it." (Arts ML1)

This may simply reflect the more general tendency for some academic staff to try to maintain the status quo and reject change (Hacker & Drifus, 2010) or the increasing complexity and high-stress nature of academic roles; however, there is always a difficult balance to be struck between top-down regulations and bottom-up initiatives. A devolved system of implementation should, in principle, favour innovation and empowerment (Klein and Newell, 1996; Blackmore & Kandiko, 2012), but this was by no means always realised in practice. In fact, the flexibility of the guidelines was seen as a disadvantage by some who wanted more clarity, and failing to set strong enough boundaries allowed others to actively undermine the principles. The role of the faculty advocates as mentors and local leaders was also problematic, with administration, timetabling and resourcing issues consuming their time and energy and undermining their ability to foster innovation and 'convert' the mutineers. There is perhaps a challenge inherent to the complexity of interdisciplinary curriculum innovation work, where multiple interpretations and standpoints need careful framing and exploration to build staff confidence to allow grass-roots innovation to emerge.

3. Module choice and interdisciplinarity

One of the reasons it has been argued that interdisciplinary teaching is not more widespread at the undergraduate level relates to the strong 'framing' (Bernstein, 2000) or constraints on the curriculum at this level (Lindvig et al., 2019). Lindvig et al. argue that the strong external framing of undergraduate degrees in many European universities limits the extent of curricular innovation towards interdisciplinarity. In our study, arguably, the external framing itself had been challenged by the cross-institutional innovation – this should have made it easier for staff to colonise the liminal spaces between disciplines (the 'interstices' as Lindvig et al. (2019) described them). Nonetheless, certain elements of the undergraduate education structure proved remarkably resistant to change – and it became evident that both students and staff could act as brakes on innovation by defaulting to their habitual modes of working. So for example, module choices (in theory a key part of the curriculum innovation) were in practice highly variable. For some programmes, student choice was seemingly inconceivable:

444 *"We had all of our cohort doing the one module. So they didn't get the choice to go*
445 *and do elective modules elsewhere"* (Science ML3)

446 Even where choice was allowed, some students felt that their expectation (of an open
447 choice of inter-disciplinary modules) was not matched by reality (where they often had a choice
448 of only 1 or 2 modules, often quite closely aligned with their original discipline. Providing
449 students with choice is identified as motivational, enhancing engagement, and promoting skills
450 such as self-regulation (Lattuca et al., 2004). Some staff clearly valued this element of choice
451 too:

452 *"I like the idea of flexibility of it. That students can choose what they want to do*
453 *rather than have a module imposed upon them."* (Arts&Hum ML2)

454 But some felt that choices were not necessarily clear to students, and nor were the benefits of
455 choosing a more interdisciplinary option:

456 *"It needs to be signposted much more for students... it needs to be signposted much*
457 *more for the university generally to say we are moving in an interdisciplinary*
458 *direction and we expect you as students to contextualise your knowledge within*
459 *different disciplines and get exposure to them"* (Business ML2)

460 Student focus groups echoed this view, indicating that students had received very varied
461 levels of information regarding the interdisciplinary offer. This ranged from being provided
462 solely with a module title; a module title with a short paragraph summarising content; to
463 presentations from lecturers 'pitching' alternative modules:

464 *"There probably was some sort of document online about it but no, I didn't*
465 *see it, unfortunately."* Student FG1

466 *"Yes, so we got like a set of ten things, you got an email with like some*
467 *slides on it and they had like ten different topics and it told you a little bit*
468 *about what each one was and then you just had to pick one."* Student FG1

469 Information availability impacted strongly on student's engagement with the 'choice'
470 associated with the interdisciplinary offer. Students whose lecturers took an active role in
471 promoting the elective choices talked about being encouraged to explore something new and
472 take risks. Each of these strategies had varying levels of impact, though it was clear that
473 students had to be proactive to make an informed decision regarding their elective option:

474 *"I like went out of my own way, just looked at some books, and that, and*
475 *that's how I made my decision."* Student FG1

476 Several students said that they would have liked more information on the module content its
477 relevance to their degree. The extent to which connections could be made between the
478 interdisciplinary module, their degree programme and future employability emerged as an
479 important part of the decision process for students, but was rarely considered by the teaching
480 teams.

481 Another impact on student choice was the extent to which they were concerned by having to
482 form new social groupings with staff and students who were unfamiliar to them:

483 *"I had to go socialise with other people [...] the friend making thing [...]*
484 *becomes more difficult as the stage goes on."* Student FG1

485 *"I didn't recognise any of the lecturers [...] I was just there like, I can't take*
486 *any of this in, sort of thing. So it was so different to what I was used to."*
487 Student FG2

488 This was an interesting outcome as one of the original drivers beyond the second immersive
489 module was to extend first year students' peer networks. This module took place mid-way
490 through the year (at the start of the second semester) when students had started to settle into
491 programme cohorts that they were sometimes unwilling to disrupt. This was a problem which
492 had not been anticipated and is not generally addressed in the literature on interdisciplinarity but
493 does require careful consideration if such modules are to be used more widely. The challenge of
494 working with unknown peers was a significant frustration and a particularly acute issue for the
495 minority crossing school boundaries. However, one student reflected on how this situation
496 could be mediated, and indeed may reflect the positive experience in their first immersive
497 module where the need for peer networking and social integration was highlighted in module
498 design:

499 *"[...] because we didn't have any like ice breakers, everyone just like shows*
500 *up, goes to a lecture goes home. Unless you're in the seminar and you kind*
501 *of become friends like that way. I know we did a field trip but that was in*
502 *the middle of the year when everyone's already made their friends. So my*
503 *course, I don't know if it's just my year, but no one's really friends on it. I*
504 *see them but they just don't talk because there's no like opportunity to."*
505 Student FG2

This student demonstrates the on-going need for the use of ‘integration activities throughout the first year, especially in situations where new groups of students are brought together. This was a missed opportunity, which could potentially undermine the impact of the learning opportunities presented in these modules.

A final issue with choice was that many students left it until the last minute and, to our surprise, more than 10% of students did not engage with the module selection process at all, so were allocated to a module centrally. The relatively limited engagement with interdisciplinarity was also evident through module enrolment data with only 2.07% of students who could select an elective choosing one outside their own faculty. The majority selected modules directly related to their chosen area of study; for example, students on environmentally-focused programmes selected electives that addressed themes such as geohazards, sustainability or climate change. Students opted for the familiar; they chose course titles that resonated or options that minimised disruption of established peer networks. Therefore, the way in which student choice is framed is crucial. Arguably, rather than creating an additional administrative burden in terms of shifting resources, the focus should be on within-faculty choice, and interdisciplinarity positioned within rather than outside of this institutional structure.

Conclusions and Recommendations

This research captured the responses of academic staff to the introduction of interdisciplinary learning into the first-year curriculum and the experiences of students studying these modules. Integrating interdisciplinary learning into the first-year curriculum was a significant departure from previous practice in this institution (as in many UK universities). Our findings indicate that, with a few exceptions, staff conceptions of interdisciplinarity were often limited, aligning more with multi-disciplinarity perspectives rather than interdisciplinarity. This in itself is an important outcome, a step in the right direction, but it also highlights the support that needs to be put in place, in terms of staff and module development, and structural change that may be required, to allow staff to engage with interdisciplinary. The discipline and programme focus represented the priority for many academics, and this became a barrier to developing interdisciplinary modules. Staff who recognised the opportunities presented by the early integration of interdisciplinarity, focused on skills such as collaboration, problem solving and communication, associated with interdisciplinary working to introduce and engage students with this agenda. Whilst drivers emerged from many directions (including some professional bodies, staff enthusiasts and student interest), these were generally overwhelmed by the barriers – both administrative and ideological - to delivering a truly interdisciplinary experience. Staff resistance was a key barrier: sometimes with good reason, staff were very protective about their

own discipline and students. However, administrative barriers (both financial and practical) were also very much in evidence despite the top-down nature of the curriculum innovation.

Student responses were mixed: It is clear that some would have liked a wider choice of truly interdisciplinary modules, but it is equally evident that many students did not understand the rationale for the modules, and felt that they needed more information and support to participate in them enthusiastically. Student disengagement with opportunities for interdisciplinarity emerged as a significant, but unanticipated, finding of this study.

In considering future research, it is useful to revisit the scope of this work. We did not set out to critically examine interdisciplinarity and the role it can play in the first-year curriculum, rather we sought to explore how staff, many of whom had limited prior experience of interdisciplinarity, responded to and engaged with an agenda to integrate into the first year curriculum. In doing this work we have highlighted the parameters on which future curriculum innovation work in this area can build. Following on from this, future research might focus specifically on pedagogic practices that promote interdisciplinary working with first year students, as positive reactions were documented by lecturers and students in response to the use of group work and collaboration around thematic issues. Examining how to introduce and frame interdisciplinarity when disciplinary identities are still emerging would support on-going pedagogic innovation in this area for the lower levels of undergraduate study. Focusing further research on students' experiences of interdisciplinarity would also be beneficial as this remains a gap in the extant literature. As the research presented here indicates, despite the multitude of advantages of interdisciplinary learning laid out in the literature, realising these in practice is rather more problematic.

Key recommendations for institutions planning to embed interdisciplinary modules into the curriculum (especially in the first year) are as follows:

1. Engage academics through targeted staff development to get a shared understanding of interdisciplinarity – and how it diverges from multi-disciplinary approaches - paying attention to current debates and practices in interdisciplinary learning and allow time for reflection and discussion. This could potentially mitigate staff resistance to interdisciplinarity, or a belief that it was a threat to their discipline.

2. Ensure resource follows students to encourage staff to offer modules which cut across traditional disciplinary boundaries, and minimise the burden of administration that comes with such modules.

3. Set up a clear process for student information and choice that includes recognition of the need to consider the link between an interdisciplinary module and their programme of study and future career.

In conclusion, this research reinforces the fact that both teaching and learning in interdisciplinary ways are complex skills that make significant demands on both parties. Despite the strong institutional support for this innovation, the barriers of administrative framing and staff and student habits proved challenging to overcome. As the value of interdisciplinary boundary-crossing is evidenced yet more strongly through the COVID-19 pandemic, the need to challenge the status quo in higher education grows ever more urgent.

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