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

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1 **Embedding Interdisciplinary into the first year Undergraduate**
2 **Curriculum: Drivers and Barriers to a Cross-Institutional**
3 **Enhancement Project**

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9

10 **Embedding Interdisciplinary into the first year Undergraduate Curriculum:**
11 **Drivers and Barriers in a Cross-Institutional Enhancement Project**

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

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

28 **Introduction**

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

44 Before commencing any discussion of interdisciplinary teaching, it remains crucial to
45 define the term itself, which remains contested and is often (incorrectly) considered to be
46 synonymous with multi-disciplinarity. To summarise a lengthy and divisive debate,
47 interdisciplinarity involves the merging or integration of disciplinary knowledges to offer novel
48 perspectives, unlike multi-disciplinary approaches in which each discipline contributes from its
49 own epistemological origin but remains fundamentally unchanged by its encounter with
50 alternative views (Razzaq et al., 2013). Interdisciplinary teaching is considered to assist in
51 developing ‘Mode 2 knowledge’ (Gibbons et al., 1994): Knowledge that is outward-looking and
52 focused on solving real-world problems. It is evident immediately that interdisciplinarity is not
53 an easy concept to teach or learn about, especially for academics who have spent most of their
54 education and career immersed in a disciplinary context (Lyall et al., 2015). Interdisciplinarity
55 represents a way of thinking and working which involves a move away from traditional domain-
56 specific conceptions of knowledge, to individuals embracing a view of the world which
57 encourages them to adopt multiple perspectives and synthesise knowledge from different
58 disciplines (Lyall et al., 2015). It does not seek to undervalue the position of the discipline,
59 rather encourages reimagining of the discipline. In doing so, it encourages students to recognise
60 the fluidity of disciplinary boundaries and be prepared to look beyond their chosen discipline in
61 order to solve problems, and to think critically and creatively (Brookes, 2017; Spelt et al.,
62 2009). Interdisciplinary learning is challenging: to form connections across disciplines, students
63 need to deploy advanced cognitive skills, thus powerful pedagogies are required (Klein, 1990).
64 Simply put, a well-designed and learner-centred curriculum (Spelt et al., 2009) is important in
65 promoting interdisciplinary learning.

66 Despite increasing enthusiasm for interdisciplinary study in HE (Klein, 1990; Lyall,
67 2015), research on interdisciplinarity in university education remains relatively limited
68 (Hammons et al., 2020). It has been argued that encouraging students to address cross-
69 disciplinary, thematic challenges or societal problems is important (Brookes, 2017; Holmwood,
70 2010), encouraging students to look at broader issues, beyond their immediate discipline and in
71 the process develop higher-level skills (Kezar, 2013). Many benefits have been claimed for
72 interdisciplinary programmes (including increased tolerance of ambiguity, awareness of ethical
73 issues, and critical thinking skills) yet evidence in support of these is mixed. Likewise, research
74 comparing the learning outcomes of students who have been following interdisciplinary courses
75 with those on discipline-focused programmes is conflicting. Newell (1992) found that students
76 in the School of Interdisciplinary Studies performed better on certain assessments than did those
77 students in disciplinary programmes. Yet Lattuca et al. (2017) identified little difference
78 between interdisciplinary and disciplinary majors for most learning outcomes though enjoyment
79 was higher for students on interdisciplinary programmes.

80

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

94

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

108

109 **Context and background to the curriculum innovation**

110

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

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

123 **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)	Traditional module (20 credits)
	Long and thin, parallel delivery		
	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)	Traditional module (20 credits)
	Long and thin, parallel delivery		
	29-30	Assessment period for traditional format, semester 2 modules	

124

125

126

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

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

140

141 The introduction of interdisciplinarity sought to create opportunities for students from
142 different programmes to come together to work collaboratively in a way that would broaden
143 their focus and allow them to develop new social relationships. Schools were invited to develop
144 interdisciplinary modules that aligned with this vision. To support this, a set of guidelines were
145 introduced to support the development of interdisciplinary modules. These guidelines directed
146 staff to collaborate in new ways, bringing together at least two disciplines or subject areas,
147 focusing on big picture issues that cut across disciplines or were of relevance to wider society,
148 and employing pedagogies such as students-as-researchers that could foster interdisciplinary
149 learning. The module teams were also directed to develop a maximum of four learning
150 outcomes (two knowledge-based and two skills-based outcomes). The guidelines were
151 intentionally broad to allow local innovation to promote ownership of the curriculum
152 innovation, an approach which echoes advice in the literature (e.g. Blackmore & Kandiko,
153 2012). Staff development workshops were delivered to support the planning of the modules,
154 though these primarily focused on inclusive assessment, active learning, and module design in
155 general, rather than interdisciplinarity specifically. Faculty advocates supported
156 interdisciplinarity, facilitating local interpretation of the guidelines, and discussions of
157 interdisciplinarity to consider how this may manifest within each Faculty. The rationale for the
158 faculty advocate role was that support for implementation from someone with local ‘field’
159 knowledge and experience would help promote uptake of the pedagogic innovation
160 (Hasanetendir et al., 2017). A portfolio of 52 interdisciplinary immersive modules was
161 developed, with three of the four University faculties presenting an ‘interdisciplinary offer’ to
162 incoming students. The Health Faculty was not included in this curriculum innovation as

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

166 **Research Aims**

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

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

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

187 **Methodology**

188 Using a mixed-methods approach, the study captured qualitative data through staff interviews,
189 student focus groups and quantitative data on module enrolments. As noted above, a portfolio of
190 52 immersive interdisciplinary modules was developed; from this a purposive sample of 15
191 interdisciplinary modules across three faculties were selected for study. A member of the
192 evaluation team, external to the curriculum innovation, made initial contact with the leaders of
193 selected modules, to introduce the study and request their participation. All agreed to be
194 involved and, in total, 17 staff from the 15 chosen modules participated in semi-structured
195 interviews (Table 1).

196 **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

197

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

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

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

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

231 **Findings and Discussion**

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

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

239 These themes are discussed in turn below.

240 *1. Conceptions of interdisciplinarity*

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

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

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

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

258

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

324

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

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

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

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

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

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

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

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

358 2. *Champions and mutineers*

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

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

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

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

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

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

378 Resistance from staff was an issue throughout the curriculum innovation – with some
379 actively working to undermine the aims of the project, and others following the guidelines but
380 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).

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

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

417 This may simply reflect the more general tendency for some academic staff to try to
418 maintain the status quo and reject change (Hacker & Drifus, 2010) or the increasing complexity
419 and high-stress nature of academic roles; however, there is always a difficult balance to be
420 struck between top-down regulations and bottom-up initiatives. A devolved system of
421 implementation should, in principle, favour innovation and empowerment (Klein and Newell,
422 1996; Blackmore & Kandiko, 2012), but this was by no means always realised in practice. In
423 fact, the flexibility of the guidelines was seen as a disadvantage by some who wanted more
424 clarity, and failing to set strong enough boundaries allowed others to actively undermine the
425 principles. The role of the faculty advocates as mentors and local leaders was also problematic,
426 with administration, timetabling and resourcing issues consuming their time and energy and
427 undermining their ability to foster innovation and 'convert' the mutineers. There is perhaps a
428 challenge inherent to the complexity of interdisciplinary curriculum innovation work, where
429 multiple interpretations and standpoints need careful framing and exploration to build staff
430 confidence to allow grass-roots innovation to emerge.

431 *3. Module choice and interdisciplinarity*

432 One of the reasons it has been argued that interdisciplinary teaching is not more widespread at
433 the undergraduate level relates to the strong 'framing' (Bernstein, 2000) or constraints on the
434 curriculum at this level (Lindvig et al., 2019). Lindvig et al. argue that the strong external
435 framing of undergraduate degrees in many European universities limits the extent of curricular
436 innovation towards interdisciplinarity. In our study, arguably, the external framing itself had
437 been challenged by the cross-institutional innovation – this should have made it easier for staff
438 to colonise the liminal spaces between disciplines (the 'interstices' as Lindvig et al. (2019)
439 described them). Nonetheless, certain elements of the undergraduate education structure proved
440 remarkably resistant to change – and it became evident that both students and staff could act as
441 brakes on innovation by defaulting to their habitual modes of working. So for example, module
442 choices (in theory a key part of the curriculum innovation) were in practice highly variable. For
443 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

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

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

522 **Conclusions and Recommendations**

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

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

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

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

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

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

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

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

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

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