Transdisciplinarity from the Grassroots: Exploring Student-led Dialogues for Sustainability

Abstract

The responses of higher education (HE) institutions towards the climate crisis and escalating social inequalities have been researched from either "top-down" (i.e., institutionally-led) or "bottom-up" (i.e., student-led) perspectives. As scholars call for enhanced insight into the space between these two poles, this paper provides an autoethnographical account of a "bottom-up" network led by doctoral students – Researchers 4 Sustainability (R4S) – initiated within a UK university to contest "top-down" structures by way of disciplinary silos. Likening disciplines to communicative subsystems, we draw on a social constructivist perspective of dialogue to demonstrate how three forms of dialogue – exploring, explaining and expanding – support not just the transcending of disciplinary boundaries, but crucially, institutional hierarchies, in the creation of sustainability knowledge. Herein, we introduce a framework against which to organise student-led dialogues relative to their inter- and/or trans- disciplinary orientations and offer recommendations for theory and practice.

Keywords: autoethnography, dialogue, doctoral students, higher education, interdisciplinarity, sustainability, transdisciplinarity

Introduction

It is increasingly recognised that making progress on "grand" sustainability challenges, including the climate crisis and escalating social inequalities, requires higher education (HE) institutions to prioritise their contributions to society (Nicotra, Del Giudice and Romano, 2021). Consequently, extant research in HE has focused on hierarchical – or "top-down" (Brinkhurst et al. 2011) – approaches to sustainability by way of programmes and curricula (Di Giulio and Defila, 2017; Sales de Aguiar and Paterson, 2018), institutional strategies and commitments (e.g., Ferrer-Balas et al. 2008) and incentive structures (Tijsma et al. 2023). Additionally, "bottom-up", student-led approaches to driving sustainability, have captured attention in HE scholarship (e.g., Butt and Avery, 2014; Pilbeam, Lloyd-Jones and Denyer, 2013). More recent work has, however, identified that "top-down" and "bottom-up" initiatives are not mutually exclusive, but may even challenge, reinforce and shape one another iteratively (e.g., Vienni Baptista and Rojas-Castro, 2020), emphasising a need for more research in the space *between* these two poles (Brinkhurst et al. 2011; Mazon et al. 2020; Tijsma et al. 2023).

It is against this backdrop that we adopt an autoethnographic methodology (e.g., Dann et al. 2019; Hibbert et al. 2014) to consider how doctoral sustainability students bridge academic disciplines through dialogue. We analyse the authors' own experiences as members of the Researchers 4 Sustainability[1] (R4S) network established by doctoral students at a UK university to contest "top-down" knowledge structures related to sustainability by way of disciplinary silos from the "bottom-up". Our focus rests on doctoral students who operate at the boundary of prescribed "top-down" or "bottom-up" institutional structures given that they have lower adherence to conventional disciplinary boundaries but are also more autonomous than taught-students given their focus on self-directed learning (Cumming, 2010; Meschitti, 2019). R4S thus

provides a unique empirical case (Yin, 2009) of a doctoral student network (Pilbeam, Lloyd-Jones, and Denyer, 2013)

We focus on the communicative practices of doctoral students in integrating insights across academic disciplines (interdisciplinarity) and transcending disciplinary boundaries (transdisciplinary) through a social constructivist perspective on dialogue (Cunliffe, 2002; Luhmann, 1986, 1995). Dialogue – the joint creation of meaning between two or more parties – provides the lens through which we explore how doctoral students communicatively link and contest various disciplines or "subsystems" (Beech, MacIntosh, and MacLean, 2010), and consider the implications for knowledge hierarchies within HE. We contribute to a communicative view of education (Wright et al. 2023) in two ways.

First, as opposed to focussing on students' learning strategies within traditional academic structures (e.g., Gorsky, Caspi and Trumper, 2006), we explore student agency in creating communicative encounters for bridging disciplines through dialogues of *exploration*, *explanation* and *expansion* (see Baudoin et al. 2022; Mazon et al. 2020). Herein, we introduce a framework against which to organise student-led dialogues relative to their inter/transdisciplinarity orientations, extending dynamic and constitutive understandings of dialogue in HE (Gorsky et al., 2006; Wright et al. 2023), particularly in the context of sustainability (Arevalo et al., 2020). Second, we demonstrate how "bottom-up" dialogues initiated through doctoral student curiosity (Hibbert, Siedlok and Beech, 2015) have a substantive impact on "top-down" institutional structures. We not only heed Cumming's call (2010) for a broader conception of doctoral education, but demonstrate the levelling effect of student-led dialogue in bridging knowledge hierarchies across and beyond HE institutions. We thus divert attention from the dominant focus on "top-down" / "bottom-up" HE sustainability strategies and instead add nuance to

"transformative" education that stems from the ground in between (Brinkhurst et al. 2011; Cotton et al. 2009; Malfroy, 2011; Sterling, 2004; Vienni Baptista and Rojas-Castro, 2020).

Theoretical background

Driving sustainability from the "top-down": The prevalence of disciplines

The implementation of sustainability initiatives generally occurs through "top-down", or hierarchical (i.e., management-led) approaches in HE (Brinkhurst et al. 2011; Mazon et al. 2020). The signing of commitments and 'treaties' (e.g., Ferrer-Balas et al. 2008), the creation of dedicated research centres or institutes (e.g., Slager et al. 2018), the development of programmes and curricula (e.g., Di Giulio and Defila, 2017; Sales de Aguiar and Paterson, 2018), and incentivize structures (i.e., tenure, finances) (Tijsma et al. 2023) are examples of institutionally-led mechanisms to bring sustainability further into education, as well as HE research culture (Brinkhurst et al. 2011). Benefits of such "top-down" approaches include the acceleration of institutional change, greater cross-campus commitment and increased visibility (Brinkhurst et al. 2011; Lozano et al. 2015; Mazon et al. 2020).

These activities work *within* traditional institutional structures and have received critique for an absence of buy-in from the "bottom-up" – i.e., students and academics – to truly foster new ways of thinking (Acevedo-Osorio et al. 2020). Here, students and staff are treated as receptors rather than active agents, with research identifying challenges in translating institutional commitments and policies into practice (Baudoin et al. 2022; Mazon et al. 2020; Tijsma et al. 2023). HE literature has thus emphasised the dialectical tension between "top-down" and "bottom-up" initiatives (e.g., Brinkhurst et al. 2011; Mazon et al. 2020; Tijsma et al. 2023) as prioritising voices from the "top" may preclude those from the "bottom" to emerge (Acevedo-Osorio et al. 2020).

One additional "top-down" influence comes from the organisation of HE institutions into disciplines and the sub-division of knowledge into 'silos'. Yet, as the scale of sustainability challenges faced by society gathers pace, 'mono' (i.e., *within*-discipline) approaches to generating sustainability solutions are being challenged (Bernstein, 2015; Klein, 2017) and greater emphasis is placed on multi- (i.e., within multiple), inter- (i.e., across multiple) and trans- (i.e., transcending) disciplinary thinking (see Table 1 adapted from McGregor, 2014). Despite contestation surrounding what truly constitutes inter/transdisciplinary research (Frodeman, 2017; Klein, 2017), we align with the view that interdisciplinarity and transdisciplinarity both aim to integrate multiple perspectives to advance knowledge; a key distinction being that transdisciplinarity engages non-academic actors (Arevalo et al. 2020; Vienni Baptista and Rojas-Castro, 2020). Transdisciplinarity, specifically, has been viewed as the key to unlocking complex sustainability problems (Pohl, et al. 2017, 323) and a significant way in which to challenge "top-down" knowledge silos.

Current literature overlooks the dynamic between "top-down" structures and "bottom-up" initiatives in the context of inter/transdisciplinary sustainability research in HE contexts. Recent findings from Vienni Baptista and Rojas-Castro (2020) indicate in their study of the institutionalisation of transdisciplinarity at universities that "top-down" and "bottom-up" initiatives may not always be oppositional, but instead mutually reinforcing or complementary. Yet, how do individuals operating at the boundaries of prescribed institutional structures develop transdisciplinarity from the "bottom-up" and shape "top-down" university initiatives? It is against this backdrop that we turn to the lens of constructivist dialogue (Cunliffe, 2002; Luhmann, 1986, 1995) to conceptualize the communicative interactions of those bridging disciplines.

Towards transdisciplinarity from the "bottom-up": Constructivist dialogue

Luhmann (1986, 1995) describes society as a communicative system comprising multiple sub-systems (e.g., economy, arts, academia) that are *autopoietic* (i.e., closed and self-referential). This means that wider social and academic systems are predisposed towards reproducing and maintaining the status-quo. In academic contexts, each discipline develops its own communication codes and beyond academia, social subsystems (e.g., economic, political) feature 'codes' that enable efficient information processing, while simultaneously restricting communication across and between them. Luhmann (1986, 1995) conceptualises people as part of the environment of the subsystems. As such, some people can switch between codes when engaging with different subsystems. For instance, we use different language to appreciate art than we do for evaluating the worth of a house. Those able to switch between codes and couple between codes translate insights from one subsystem to another (e.g., art brokers translate aesthetics into monetary value). However, the communicative conditions that favour transdisciplinarity and the bridging of subsystems remain largely unknown. Accordingly, we argue that a social constructivist perspective on dialogue (Cunliffe, 2002) based on Luhmann's notion of autopoietic subsystems (Luhmann, 1986, 1995) may help us understand the fostering of transdisciplinary in two ways.

First, social constructivist dialogue prioritises communication as the organising principle for meaning-making in HE (Wright et al. 2023). Knowledge is constructed through dialogue when two or more people question, explain, and evaluate issues orally and in writing (Gorsky et al. 2006). We argue that dialogue – with the self and others – bridges autopoietic systems and codes by transferring and translating knowledge from one domain to another; a process well-attuned to HE where collaboration is the goal (Hibbert et al. 2015; Montonen et al. 2020). There are differences between "spontaneous" dialogues, driven by curiosity and loose goals, and "instrumental" dialogues driven by a specific problem or opportunity (Hibbert et al. 2015;

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Montonen et al. 2020). Spontaneous dialogues can effectively explore learning processes but may disrupt learners and involve risk and uncertainty, particularly where different disciplinary subsystems intersect (Hibbert et al. 2015). However, collaborating in curiosity-driven dialogue may be the first step towards overcoming divisions across sub-systems (Hibbert et al. 2015).

Second, social constructivist dialogue emphasises interaction and critical self-reflexivity; learning is a reflexive process of awareness and transformation (Cunliffe, 2002; Meschitti, 2019; Mezirow, 1991). Luhmann (1986, 1995) argues that coupling between subsystems is dependent on such interaction. As Cumming (2010) highlights, academics are institutionalised into mono-disciplinary thinking from the outset of careers, with doctoral students being trained in codes *within* specific disciplines, precluding critical self-reflexivity *across* disciplines. Thus, "early" specialisation may limit an inclination towards transdisciplinarity, deterring doctoral students from communicating their expertise within and outside of HE. Yet, given their autonomy, intellectual curiosity and potentially lower adherence to conventional disciplinary boundaries (Cumming, 2010) doctoral students may be in an ideal position to "unlearn" the assumptions derived from autopoietic systems (Hibbert et al. 2015), or perhaps resist it outright. Consequently, we ask: how do doctoral sustainability students bridge academic disciplines through dialogue?

Methodology

Research context

We focus our study on a "unique" case (Yin, 2009) of 'R4S' – "an informal network of postgraduate and early career researchers working on (or with an interest in) sustainability" (R4S, 2021) – for three reasons. First, it pertains to rarity; there is a dearth of research on "bottom-up|" sustainability initiatives in HE as doctoral students have been largely overlooked in HE research as generators of transdisciplinary knowledge (Meschitti, 2019; Pilbeam et al. 2013). Second, R4S

provides a case of transdisciplinarity in action as the network expanded from roots in business/ management and geography to comprise disciplines including history, health science, engineering, chemistry and architecture. Additionally, while initiated for doctoral students, the network soon encompassed early-career (e.g., postdoctoral researchers and Lecturers) and senior scholars (e.g., professors), as well as administrative and university estates staff (in the first year), therefore bridging institutional hierarchies. At its 2017 peak, R4S had 370 members across disciplines, university functions as well as geographic locations given that the UK campus had locations in East and South Asia (PRME SIP Report, 2017). Local businesses also became key contacts and part of an extended network.

Finally, the R4S network was born out of a spontaneous dialogue (Hibbert et al. 2015) between two doctoral students in a chance encounter in 2012. In identifying areas of research overlap, the students realised that there was no provision for interdisciplinary conversations on the topic of sustainability and so they established R4S in 2013, building a team of five doctoral students. As opposed to adopting a traditional "top-down" structure controlled through the university's Student Union [SU] and prescribed institutional arrangements, the network opted for a fluid doctoral student-led committee and an open membership structure. Lacking formalised support, R4S justified its presence within the university's research culture via advisory associates (e.g., Professors in the Business School and School for Education).

The network was motivated to, "promote inter/transdisciplinary collaboration and discussion, facilitate knowledge exchange, and raise awareness of opportunities available within the University, and beyond (e.g., funding, careers, collaboration)" (R4S, 2022). Participants engaged in R4S in various ways and with varying frequency. The fundamental aim was to learn from one another through monthly/bi-monthly research-led discussions and communication

channels that included email newsletters, social media (Twitter – 326 followers and Facebook – 143 members to date) and a blog. These channels were essential to supporting the establishment but also continuation of R4S in providing virtual 'spaces' for members to engage in. ad-hoc events included visits to local businesses, external speaker sessions, annual conferences and informal networking events. R4S is still in operation and has seen five iterations of leadership, with reading groups being introduced as well as workshops on journal special issues more recently. The UK-based R4S network also expanded to the Southeast Asian campus where R4S initially attracted doctoral and postgraduate students from natural sciences, but grew to attract undergraduate, postgraduate students, as well as alumni and members of the local community, unlike R4S in the UK. After being merged with other grassroots initiatives in the locality, R4S Southeast Asia was rebranded as a "greener environment" education network with a stronger predilection for online events and communications than seen in the UK chapter, even before the pandemic.

R4S emerged in a UK "Russell Group" university; a group of "world class, research-intensive universities" (Russell Group, 2023). One of the key priorities of this group was transdisciplinarity and research impact through collaboration with partners in and outside of academia (Russell Group, 2012). Bringing together like-minded researchers to build collaborations, applications for funding, etc., was thus encouraged. R4S' home university was also subject to the Research Excellence Framework (REF), a national assessment of the quality of UK HE research, and its impact. The university had thus institutionalised mechanisms to support transdisciplinarity, such as funding support for doctoral students to travel to and visit international campuses and organise events with non-academic partners. R4S applied competitively for such funds.

Autoethnography and secondary data collection

Following a relationally reflective approach (e.g., Dann et al. 2019; Hibbert et al. 2015) we adopted an autoethnographical approach to reflect on our personal experiences and interactions with other doctoral students in R4S (Meschitti, 2019). We see ourselves as an "instrument" (McCormick and White, 2000) and elucidate the situated "life-with-others of the researcher" for co-creating novel theoretical insights (Hibbert et al. 2014). Two of the authors were involved in R4S as doctoral students between 2012 and 2015. One of the authors – a white, British female – formed the network and served on the R4S committee for two years (2012 – 2014). The second author, a Latin-American female, was involved in R4S from 2013 to 2015, involving a year on the steering committee. As per our relationally reflexive approach, we invited a third author unconnected to R4S to support and verify the data collection and analysis.

Autoethnography is well-suited to examining our research question for two reasons. First, it allowed direct access to individual experiences of R4S. The two authors involved in R4S wrote self-reflective essays of experiences both retrospectively and in real-time that served as primary data sources (see Supplementary File 1) (Meschitti, 2019). Second, the autobiographical material was complemented with documentary evidence (see Table 2). These sources amounted to 487 pages of text for cross-referencing our impressions. Data were anonymised and pseudonyms assigned to protect the identities of network members.

[Insert Table 2 about here]

Data analysis

Data analysis blended thematic analysis (Gioia, Corley and Hamilton, 2012) with abductive reasoning (Alvesson and Kärreman, 2007). We conducted three interconnected rounds of data analysis that supported our relationally reflective ethnography (e.g., Dann et al. 2019; Hibbert et

al. 2014). Figure 1 presents the data structure. In the first stage, we analysed the retrospective self-reflective essays and secondary data to identify dialogical practices used within R4S. In the second stage, we identified where disciplinary boundaries were crossed – or "transformative" moments occurred (Mezirow, 1991) –searching for the bridging of autopoietic systems (Luhmann, 1986, 1995). This provided the basis for nine first-order informant-centric codes that were not distinct, but overlapping (Van Maanen, 1979). From here we moved iteratively between theory and data to develop our second-order research-centric themes (Van Maanen, 1979) related to three forms of dialogue – "exploration," "explanation" and "expansion." We developed narrative vignettes of memorable episodes that are presented as part of our findings to encapsulate individual experiences occurring in interactions with others (see Meschitti, 2019).

In the final round of analysis, we cross-checked interpretations and introspections of the two first authors with the third author as an R4S "outsider" and discussed preliminary findings with R4S committee members. These conversations identified that our three themes coalesced around orientations towards inter/transdisciplinarity (see Table 1). We then developed aggregate dimensions of dialogue for sustainability, outlining where an interdisciplinary orientation was particularly prominent (e.g., 'high') or less visible (e.g., 'low'), as well as combinations across these two poles. Illustrative excerpts are provided in the findings section and in Supplementary File 2.

[Insert Figure 1 about here]

Findings: Exploring doctoral student-led dialogues for sustainability

This section illustrates three forms of dialogue as summarised in Table 3: "exploratory" (cross-fertilising sustainability knowledge through high interdisciplinarity / low transdisciplinarity);

"explanatory" (translation of sustainability knowledge through low interdisciplinarity / high transdisciplinarity); and "expansionary" (transforming sustainability knowledge through high interdisciplinarity / high transdisciplinarity). These dialogues are not mutually exclusive but exist in fluid interaction.

[Insert Table 3 about here]

Exploratory Dialogue

Vignette 1: Antonia

Today's "research rocket" session challenged me, for the first time, to consider how my research connects and contrasts with different academic disciplines. We heard from a doctoral speaker from the School of Geography who proposed assigning values to ecosystems. The talk focused on ecological accounting, challenging the view of nature as a commodity and a service provider, clear linkages here with my management context! We also heard from a doctoral speaker from the School of Law, who argued that natural entities may be valuable in and of themselves, without necessarily relating them to an economic or human-based rationale. Despite representing different disciplines, both speakers agreed that humans were dependent on ecosystems. This triggered a debate and provoked reflection on the notion of "value". I compared my worldview with the Law and Geography perspectives. I also had to work through some misconceptions, which came out informally over coffee at the end… the attendees assumed that, as a business student, I'd take a very economic stance and see nature as a commodity—but that is not the case at all! Positioning my research against other disciplines helped me connect with others and provided a useful opportunity to reflect on my own stance in a way I hadn't done before.

Exploratory dialogue is the most pervasive form of dialogue due to its purposeful orientation to cross-fertilise disciplinary knowledge. In this sense, it provides a "high" focus on interdisciplinarity, but given its orientation around the HE context, provides a "low" focus on transdisciplinarity. It also operates within, rather than challenges, "top-down" disciplinary structures, therefore reaffirming existing structures. Vignette 1, written from the viewpoint of Antonia is based on an R4S blog post. It shows how the students built interdisciplinary dialogue around a specific sustainability problem (i.e., the value of nature) among the multidisciplinary audience (see Table 1). These dialogues involved self-reflection and the testing of disciplinary

assumptions via presentations of a position or code through curiosity-driven dialogue. Active listening was integral to the presentation as students learned through observation. Informal dialogue, occurring after presentations, provided further opportunity for honest reflection without an audience.

Participants mentioned in the vignette offered their own disciplinary understandings by packaging their knowledge in responses to oral presentations. This allowed presenters and audience members, such as Antonia, to craft a talk (including visual aids) that differed from their usual discipline-specific discussions. The doctoral students made their arguments accessible, moving reflexively away from one specific subsystem via audience interactions; the bridging of disciplines could not be pre-empted, but occurred in 'live' interaction. This reflexivity enabled subsystems such as law, geography, and business to be identified and "bridges" to be dialogically explored (see Table 1). For instance, the geography presenter began with a slide about axiology— a term the audience wished to clarify. In response, the speaker reframed the concept, offering an alternative explanation. Other doctoral students then rephrased (or "de/recoded") (Luhmann, 1986, 1995) the information and the student further revised her position. Although no new concepts were created, participating in such dialogue involved entering unfamiliar territory and students openly discussed struggles in feeling unable to communicate with others outside of their field.

Exploratory dialogue did not aim to locate an "absolute" truth, but to identify and understand points of agreement and contestation across disciplines. Exploratory dialogue could also occur when individuals were alone, stimulating self-reflexivity after the R4S interaction. In Vignette 1, Antonia reflected on her research stance and others' interpretations of her work in composing her blog post. Further, many doctoral students described R4S as a "safe and friendly space" for the free expression of thoughts and opinions, facilitating community-building. While some

opportunities for informal engagement were available within the university's provision for doctoral students, they failed to focus on sustainability, let alone explore interdisciplinarity. Most research-led talks available to doctoral students focused on pre-selected topics at the faculty and departmental level where they had little power to influence. These largely "top-down" university initiatives thus struggled to create a community feel.

Explanatory Dialogue

Vignette 2: Ben

The first R4S event I joined involved travelling to a power plant to engage with "real world" sustainability practitioners, an experience that had never been offered in my doctoral program. At this point, I was only starting the 2nd year of my PhD in Geography and still figuring out the puzzle I'd be addressing and where I would publish my work. I felt a little nervous about joining, but as I was trying to identify industry contacts to interview, this was a valuable networking opportunity. I wasn't disappointed: the presentations were full of technicalities and contrasting views, but the discussions challenged me to consider the practical impact of my work. I gave an "elevator pitch" of my research to the Corporate Social Responsibility (CSR) Manager, which forced me to condense my ideas into simple, accessible statements. We had a good conversation on the back of this, so I'd obviously conveyed my ideas well. I left with more confidence in speaking to those outside academia and I made a new contact that would be useful for considering the potential benefit of my work to broader audiences.

Explanatory dialogue focuses on translating codes from academic to non-academic contexts. In this sense, they provided a "high" focus on transdisciplinarity, embracing the integration of academic and non-academic perspectives (see Table 1). As collaboration between disciplines is somewhat more implicit, this form of dialogue embodies a "low" interdisciplinary orientation. As Ben's vignette illustrates, dialogue is less about testing the boundaries/assumptions of sustainability knowledge and much more about goal-directed, instrumental "decoding" of language (see Table 1). For instance, the CSR manager's expertise informed Ben's doctoral project, while he in turn gained new intellectual insight, exemplifying how "one person's knowledge [is used] to help with another person's problem" (Hibbert et al. 2015, 32). The dialogue with the CSR manager also enabled Ben to translate arguments and bridge practical and academic

codes. Here the notion of sustainability itself is uncontested; more dialogue enabled students to embrace commonalities between subsystems and bridge differences, operating outside of HE knowledge silos and established structures. In this sense, this form of dialogue offered some contestation to "top-down" structures and the situation of knowledge as Ben was facilitated to consider the "practical impact" of his work, as opposed to "where he would publish it".

As Ben highlighted, practitioner presentations introduced him to a new technical vocabulary that illuminated the limitations of his own discipline-specific knowledge. The visit also contextualised the nature of the problem i.e., the impact of (un)sustainable management. The unfamiliar technical talk pushed Ben to distil practitioner codes vis-à-vis his own disciplinary codes, bridging the divide between academia and practice. The on-site visits provoked explanatory dialogue; an innovative learning experience that many faculties had found difficult to incorporate in programs and curricula offered to doctoral students.

Explanatory dialogue also emerged within the academic setting. At one R4S event, an MBA student in Entrepreneurship and a Professor from Engineering discovered a common interest in renewable energy. Following a chance encounter, two MBA students and three doctoral Engineering students entered a business competition to create a solar-powered oven, winning the "Social Value" prize of £6,000 to commercialize their idea. This transdisciplinary project illustrated the value of bridging subsystem codes (e.g., the commercial rationale with Engineering expertise) in the context of sustainability.

Expansionary Dialogue

Vignette 3: Juliet

I attended R4S events to seek solace in the welcoming community, negotiating the sometimes-lonely experience of being a doctoral student. I was halfway through my PhD when I joined the R4S core organising team. I quickly became involved in a range of activities that I could never have imagined! For instance, R4S was approached to develop and communicate the University's sustainability strategy. This also led to the Business School's report on progress for the UN's Principles for Responsible Management Education (PRME). Additionally, an attendee at one of our events— a Professor from the School of Education— invited R4S to develop and implement the University's first "MOOC" (massive open online course) on sustainability. She said, "What would I have done without R4S? How else could I have identified my transdisciplinary research team?" We seemed to fill a core gap in the university's provision. These activities raised the visibility of R4S and established links with doctoral students at the University's campuses in East and South Asia, too. I'd never anticipated that I'd be launching R4S activities around the globe!

Compared to the previous dialogues, expansionary dialogues were neither curiosity-driven nor instrumental, but occurred serendipitously among academic and non-academic participants, offering both a "high" focus on transdisciplinarity and interdisciplinarity (see Table 1). These dialogues transformed sustainability knowledge by actively facilitating knowledge across the "top" and the "bottom" of HE structures. This led to unexpected outcomes and opportunities for innovation in "top-down" structures (i.e., university strategy and curricula development). Thus, pre-established codes were not explored or translated (as in "exploratory" or "explanatory" dialogue), but new codes were reconstructed to create new axioms. This transformative process demonstrates that "top-down" and "bottom-up" approaches to sustainability were not mutually exclusive but interconnected in various ways, blurring HE knowledge hierarchies.

Expansionary dialogue involved the broadening and recontextualising of focal topics beyond a "top-down" focus. The doctoral students found themselves bridging subsystems that they had initially been unaware of; subsystems codes were first deconstructed, then reconstructed to meet new ends. Indeed, one unintended outcome of R4S was the network's reach. While established to bridge disciplines via "exploratory" dialogue and some tangible outcomes occurred via "explanatory" dialogue, the network also engaged non-academic groups (e.g., professional service staff and senior institutional management) through "chance" encounters. R4S' transdisciplinary

dialogues thus shaped the University's sustainability strategy and other initiatives, with R4S members becoming known as the University's sustainability "experts". Here, knowledge was leveraged from the "bottom-up" to tackle a variety of "top-down" sustainability issues.

R4S's sustainability dialogues also expanded beyond the geographical boundaries of the UK, leading to cross-cultural knowledge sharing. The network's UK activities sparked the development of R4S in the University's South Asian campus largely replicating R4S' operations structures following a visit from an R4S committee member. Here, knowledge sharing occurred through dialogically exploring differences and similarities across cultures. For example, sharing insights was challenging due to terminology preferences (e.g., predilection of "green" versus "sustainable" in the South Asian campus). In the East Asian campus, doctoral students were keen for R4S UK to provide full direction for the network, something R4S UK resisted since it wanted to inspire and empower the campus to establish its own identity. R4S East Asia also struggled to gain buy-in from students who were less familiar with the discourse around inter/ transdisciplinarity. Expansionary dialogues, in this context, involved not just the re-evaluation of assumptions on sustainability, but the co-creation of a new set of axioms across disciplines and geographies.

Discussion

This paper has explored how doctoral students communicatively bridge academic disciplines in the context of sustainability through inter/transdisciplinary dialogue. HE institutions are facing calls for more "transformative" approaches to sustainability education that foster transdisciplinarity (Klein, 2017). Yet this agenda is hard to realise as institutions continue to privilege interdisciplinary thinking mainly through the implementation of "top-down" methods. These approaches overlook the potential for synergies with "bottom-up" initiatives that foster

transdisciplinarity (Brinkhurst et al. 2011; Mazon et al. 2020; Tijsma et al. 2023), and struggle to identify the potential of what we contextualise as the space in-between the "bottom" and "top" (Vienni Baptista and Rojas-Castro, 2020). Our paper demonstrates the centrality of dialogue among doctoral student cohorts in this middle ground – a university population previously neglected in the literature (Meschitti, 2019) – in developing transdisciplinary in HE in two ways.

First, we show how dialogue facilitates the exploration, translation and transformation of sustainability 'codes' and the bridging of autopoietic systems (Luhmann, 1986, 1995). This occurred via *exploratory*, *explanatory,* and *expansionary* dialogues. Exploratory dialogue *explores* the assumptions ("codes") of sustainability knowledge across various disciplines (high interdisciplinarity / low transdisciplinarity). Explanatory dialogue *translates* codes to non-academic contexts (low interdisciplinarity / high transdisciplinarity). Finally, expansionary dialogue *transforms* sustainability knowledge (high interdisciplinarity / high transdisciplinarity). We use these insights to create an illustrative analytical framework that maps out these dialogues across inter/transdisciplinarity building on McGregor (2014) (see Figure 2).

[Insert Figure 2 about here]

We propose that *exploratory* dialogues cross-fertilize disciplinary knowledge and are more interdisciplinary in their orientation as they involve students testing knowledge boundaries. *Explanatory* dialogues occur at the nexus of academic and professional practice and are thus more transdisciplinary and goal-directed. Finally, we propose *expansionary* dialogues as those that foster transdisciplinarity. In our matrix, "dialogue" (the bottom-left square in Figure 2) denotes any initial ways that doctoral students communicate as they are institutionalised into disciplinary codes; what McGregor (2014) refers to as "multidisciplinarity". Clearly, this foundational form of dialogue lies beyond the scope of the current paper.

In Figure 2 we use dashed rather than solid lines to distinguish fluid distinctions that may overlap as the scope of dialogue transforms. For instance, in Vignette 3, Juliet's exploratory dialogues become more expansionary with her deepening involvement in R4S, in line with earlier theorisations of the communicative constitution of sustainability within HE (e.g., Wright et al. 2023). We found that sustainability knowledge garnered from individuals working in different disciplines provoked new, unforeseen and "never-ending" forms of dialogue (Glozer, Caruana, and Hibbert, 2019) with great potential for transformative peer learning (Meschitti, 2019). This is because dialogue has performative "power" in bringing new ideas to life (Hibbert et al., 2014).

Our second contribution extends constitutive understandings of dialogue by refocusing attention away from traditional "top-down" institutional structures in HE onto the self-driven trajectories of sustainability dialogue amongst doctoral students (Gorsky et al. 2006; Wright et al. 2023). Contrasting with recent work on instrumental modes of dialogue (Hibbert et al. 2015), our findings exemplify "transformative" approaches to sustainability in HE (Cotton, et al, 2009; Malfroy, 2011; Sterling, 2004) in that doctoral student-led dialogue enacted through R4S rendered institutional hierarchies obsolete on the one hand (i.e., through expansionary dialogue), while affirming them on another (i.e., via disciplinary silos and exploratory dialogue). While our case offers insight into doctoral students – a largely overlooked community in the research to date (Cumming, 2010) – we find that "bottom-up" approaches initiated by doctoral students influence "top-down" strategies and structures. For instance, as vignette 3 identifies, R4S activities were included in the Business School's report on progress for the UN's Principles for Responsible Management Education (PRME), shaping sustainability strategy. This highlights that "top-down" and "bottom-up" approaches to sustainability are not mutually exclusive but interconnected and

shaped in various ways (see Vienni Baptista and Rojas-Castro, 2020; Brinkhurst et al. 2011; Mazon et al. 2020; Tijsma et al. 2023).

We find that doctoral students are not only informed through networks such as R4S but also empowered to participate in transdisciplinarity from the "bottom-up". This occurred through socialisation and peer-to-peer learning which enlightened doctoral students about the possibilities of what could be achieved when transdisciplinary skills were put into use (Malfroy, 2011; Meschitti, 2019). The network served as a community in which experiences and successes could be shared, actively promoting transdisciplinarity (Cumming, 2010; Pilbeam et al. 2013). In addition, R4S provided psychological safety (Edmonson, 1999) and interpersonal trust (Pilbeam et al., 2013) which built student confidence in feeling out of their disciplinary "comfort zones". R4S was seen as a space in which students could freely express opinions and experiment with dialogue without judgement. The network thus served as a platform for professional development, overcoming the "risk" associated with moving outside of disciplines, albeit communicatively (Pilbeam et al. 2013).

While appreciating the dialectical relationship between "bottom-up" and "top-down" approaches to sustainability (Brinkhurst et al. 2011; Mazon et al. 2020; Tijsma et al. 2023), our study shifts attention from dominant "top-down" or "bottom-up" methods and more towards the space in between grassroots efforts and institutional strategy. Beyond its role in enabling transdisciplinary dialogues around sustainability, R4S also catered for the educational needs of specific groups that had not initially been targeted (i.e., MBAs, professional service staff). This underscores the educational spillover effect of such networks.

R4S did not emerge in a vacuum and the cultural settings, as well as contextual nuances, may have contributed to the success of R4S. We also acknowledge that privilege and access to

resources played a large role in the establishment of R4S; the institution in question was well-resourced financially given its research priorities (e.g., REF). While our analysis did not focus on this aspect, we conjecture that the struggles of the East Asian network and the respective success of the South Asian network might be explained by cultural and contextual differences. The UK's HE practices, and culture are known for promoting independent learning and encouraging interactions devoid of hierarchies (Yoshimoto, Inenaga and Yamada, 2007). Moreover, R4S benefited from the reputation of being 'doctoral students at the University of X', which gave a powerful footing to approach external stakeholders. Although, R4S encountered some bureaucratic challenges (e.g., room bookings could not be undertaken by R4S committee members) these never became a hurdle as they did in the East Asian campus. This underscores, again, the interconnectedness between "top-down" and "bottom-up" mechanisms for transdisciplinary to thrive in HE settings.

Conclusion

Practical implications

Doctoral students can spearhead transdisciplinarity via explanatory and expansionary dialogues and challenge "top-down" knowledge structures in HE (Pohl et al. 2017). We recommend that HE leadership teams create environments that support "bottom-up" doctoral student-led sustainability alongside "top-down" policies. Interacting with stakeholders from within and beyond the university in unconventional settings further fosters transdisciplinarity, innovation and employability (Boulos, 2016; Malfroy, 2011). Our work thus extends earlier findings that doctoral education is limited by curricula (Sales de Aguiar and Paterson, 2018) and supervisory arrangements (Cumming, 2010). Facilitating explanatory and expansionary dialogues within HE settings may support greater collaboration across academia and practice (Malfroy, 2011), a

worthwhile endeavour given the increased focus on "research impact" in HE settings, particularly in the context of sustainability (UKRI, 2022). This study focuses on an idiosyncratic, single case (Yin, 2009). While R4S may not be precisely replicable, dialogue can still be encouraged among doctoral students via similar networks that expose students to new ideas outside of their disciplines and the HE context entirely through dedicated funding calls, for instance.

Avenues for future research

Dialogue is powerful in realising, but also bridging, differences. Further empirical investigation at the level of discourse (e.g., Glozer et al., 2019) or interactionally via conversational analysis may further elucidate processes of dialogue in HE and the transformation of knowledge beyond our sustainability context. Further, forging dialogues across geographical and cultural boundaries were more difficult to establish than anticipated for R4S. R4S South Asia was successful partly because the doctoral community had already laid the groundwork for transdisciplinarity a strong cohort of members was quickly established. In contrast, the East Asian campus network was never fully established. The influence of cultural factors on sustainability dialogues is worthy of future investigation, particularly in relation to the transfer and translation of knowledge across cultural and geographic boundaries (Wright et al. 2023). We also advocate going beyond the largely privileged UK HE context to explore transdisciplinarity in the Global South. Further, we acknowledge that R4S members were intrinsically motivated to work towards transdisciplinarity, but their enthusiasm may not be shared by all doctoral students (Butt, Moore, and Avery, 2014), or indeed all HE contexts. Future research could explore the influence of personal motivations / contextual climates in encouraging or discouraging dialogues for sustainability, and explore how motivations for engaging in networks such as R4S evolve over time. We appreciate that some doctoral students might be motivated to join but face barriers due to their life circumstances (e.g.,

needing to work part-time to fund the PhD), structural limitations (e.g., needing to prioritise research publication rather than exploring inter/transdisciplinarity) or cultural nuances (e.g., attending events outside of supervisory relationships was much more normalised in the UK-setting as opposed to the East-Asian). Investigating such points of conflicts (or consensus) longitudinally may also be fruitful to better elucidate how barriers to inter/transdisciplinarity shift over time and better elucidate the role of culture. Finally, our case involved doctoral students who were either supported, or at least not hindered, by their supervisors. Thus, future work also needs to identify how universities can ensure an open mindset in their doctoral supervisors to enable participation in such activities.

Endnotes

[1]R4S is a pseudonym to ensure anonymity in peer review.

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Table 1: Comparison of Multi/Inter/Trans-disciplinarity (adapted from McGregor, 2014)

	Multidisciplinarity	Interdisciplinarity	Transdisciplinarity
Nature of the problem	Addressing issues *within* the domain of multiple disciplines.	Addressing issues at the *intersection* of disciplines.	Addressing issues *beyond* disciplinary boundaries.
Disciplinary orientation	Disciplines *remain distinct* while people engage in dialogue.	Dialogue creates disciplinary *renewal* and *evolution*.	Dialogue *establishes new axioms* through integrating many perspectives.
State of boundaries	Disciplinary boundaries are *maintained* as actors explain and defend their positions.	Disciplinary boundaries are *temporarily bridged* to enable collaborative work.	Disciplinary boundaries are *blurred, dismantled* and *transcended.*
Concepts	Concepts are *confined* within disciplines and not integrated.	Concepts are *exchanged, transferred* and *integrated.*	New transdisciplinary concepts are *co-created*.

Table 2: Data Sources

Type of data	Description of data	Quantity in pages
Agendas/meeting minutes	25 documents in note form	25
Blogposts	34 posts written by R4S members	58
Event feedback forms	Sheets distributed at the end of events to capture contact details / feedback	40
Event toolkits	4 templates for organising events and 5 checklist documents	25
Funding applications	10 documents detailing funding requirements	46
Member newsletters	64 e-mails providing R4S updates	80
Mission statements	5 formal summaries of R4S aims and goals	12
Photos	Images taken during events	40
Powerpoint presentations	Visual aids providing overview of R4S	10
PRME progress report	3 reports (2014, 2016, 2019)	67
R4S website	Online information about R4S	20
Responses to policy consultation	5 documents outlining R4S recommendations vis-à-vis university proposals	15
Self-reflective essays	7 personal accounts written by authors	25
Statements of support	8 letters written by university stakeholders (e.g., for funding applications)	24
Total		487

Table 3: Forms of Dialogue

Form of Dialogue	Inter/Transdisciplinarity	Implications for "Bottom-up" in HE	Implications for "Top-down" in HE
Exploring: *Cross-fertilising* sustainability knowledge	High interdisciplinarity / low transdisciplinarity	Supporting "bottom-up" curiosity-driven dialogues *across* disciplines (e.g., business, health science, engineering) (Hibbert et al., 2015)	Reaffirming "top-down": operating within established HE structures
Explaining: *Translating* sustainability knowledge	Low interdisciplinarity / high transdisciplinarity	Generating "bottom-up" instrumental dialogue *beyond* disciplines (e.g., between academia and practice) (Hibbert et al., 2015)	Contesting "top-down": operating outside of established HE structures
Expanding: *Transforming* sustainability knowledge	High interdisciplinarity / high transdisciplinarity	Encouraging dialogue *between* the "bottom" and "top" in HE to establish new axioms across disciplines, functions, hierarchies and geographies	

Figure 1 Data structure

1st Order Constructs	2nd Order Themes	Aggregate Dimensions
• *Presenting:* Exploring own positionality by speaking out-loud with others; • *Collectivising:* Testing knowledge boundaries through group discussions; • *Reflecting:* Exploring individual knowledge boundaries through self-dialogue.	Dialogue *cross-fertilises* sustainability knowledge across academic disciplines	**Exploratory dialogue** (High interdisciplinarity / Low transdisciplinarity)
• *Decoding:* Exploring differences in language between academia and practice; • *Bridging:* Connecting practical challenges to academic research using examples; • *Problem-solving:* Aiming for completion of dialogue through "solving" problems.	Dialogue *translates* sustainability knowledge across practical / academic contexts	**Explanatory dialogue** (High transdisciplinarity / Low interdisciplinarity)
• *Bridging (broader):* Exploring cultural/ contextual differences and sharing knowledge; • *Reconstructing:* Developing and codifying communication norms to sustain dialogue; • *Chancing:* Encouraging serendipitous encounters and unforeseen dialogue.	Dialogue *extends* sustainability knowledge across contextual / cultural boundaries	**Expansionary dialogue** (High interdisciplinarity / High transdisciplinarity)

Figure 2 Dialogue for sustainability framework