

Transformative approaches for trans-disciplinary sustainability curriculum design

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Introduction

The paper focuses on analysing challenges and opportunities in the development of new postgraduate (PG) resources and a coherent course structure for a new course in Sustainability in University of Strathclyde in Scotland. Discusses three core aspects related with this challenge, hoping to provide relevant context and share experiences with curricula developers across the globe: (i) knowledge systems and disciplinary 'inequalities' or 'imbalances' within sustainability curricula and the strive for bringing in trans-disciplinary approaches to teaching, (ii) integrated approaches for teaching differently as opposed to new content development on sustainability and finally, (iii) an extended discussion of Education for Sustainable Development skills and competencies integration in curricula across disciplines through updated content on certain cross-cutting thematic areas. The paper then goes on to discuss all those challenges associated with the last part in greater detail and position those within a wider context of university structures and strategic decision-making processes. It touches upon accreditation, international competition of PG programmes in a new educational market and wider visions for the future of graduates, engaging relevant recent literature. Finally, it concludes with some recommendations from future pedagogies and strategies for postgraduate curriculum shaping, stemming from reviewing UK and European university approaches to sustainability PG curricula development and the own experience in the Centre for Sustainable development, University of Strathclyde in Scotland.

Background

While the scope of the paper is not to provide a definition of sustainability vs sustainable development, but the development of any new teaching resource on the topic, inadvertently deals with this conceptual challenge around the terms, related to defining content for a new curriculum.

The sustainable development goals¹ help to define a broad area of 'transformations' needed to achieve sustainable development, and are increasingly used as a way of framing contemporary societal challenges within the higher education sector. Universities are well positioned to harness those in their education as well as research and externally facing activities to contribute to the achievement of the goals². Sustainability on the other hand, has been defined as meeting our own needs without compromising the ability of future generations to meet their own needs and positions

¹ Nations, United. *The Sustainable Development Goals 2016*. eSocialSciences, 2016.

² Stiftung, Bertelsmann. "SDSN,(2017)." *Sustainable Development Goals Index: Overview* (2017).

a focus on resource efficiency and wise planning considering boundaries of planet and environmental resources. As a result of both new pedagogies have emerged based on notions of 'learning for sustainability', aiming to give students the skills and knowledge to live, work, and seek change in societies facing cross-cutting sustainability problems³ 4). Education for Sustainable Development (ESD) aims to equip people to develop the skills and competencies to play an effective part in real-world action for sustainable development, often by employing transdisciplinary processes of learning and action^(5,6).

ESD commonly focusses on approaches such as projects, problem-based learning and learning through volunteering experiences⁷, that can enable a holistic approach combining theory and practical experience. ESD also aims to trigger reflective learning on the goals of Sustainable Development⁸ and, as such, can profit from innovative approaches that enable learners to challenge their existing assumptions, values or goals⁹ while working across disciplines in response to challenging problems.

The paper builds upon the recent publication by Strachan et al¹⁰ which presents a selection of examples of how to embed a range of action-oriented, problem-based, experiential ESD offerings into Higher Education (HE) teaching practice and curricula, drawing from the University of Strathclyde (UoS) experiences and focusing on postgraduate level of studies and scoping of dedicated course on sustainability. It adds further considerations on wider development of unique sustainability focused interdisciplinary MSc degrees on the subject.

Aim of this provision would be to complement the existing classes and courses relevant to SD within certain departments only with a set of core cross-cutting modules which would complement disciplinary knowledge and experts-developing postgraduate curricula, with graduates getting broader set of ESD skills as well as real-world market skills to face sustainability challenges. The paper aims to share learning experience from this process of '*collaborative curriculum development*' across faculties in UoS, while discussing key challenges (from the perspective of academic structures and systems) and opportunities (from the perspective of student experience, learning outcomes and pedagogical innovations). The paper will discuss the following identified challenges and contrapose them to wider discourses around:

- deal with institutional challenges for changing 'disciplinary definitions' and developing new PG curricula

³ Kemp, S., Laura Bellingham, and James Longhurst. "Education for sustainable development: Guidance for UK higher education providers." (2014).

⁴ Wiek, Arnim, Lauren Withycombe, and Charles L. Redman. "Key competencies in sustainability: a reference framework for academic program development." *Sustainability science* 6, no. 2 (2011): 203-218.

⁵ Sterling, Stephen, and David Orr. *Sustainable education: Re-visioning learning and change*. Vol. 6. Totnes: Green Books for the Schumacher Society, 2001.

⁶ Wiek et al. 2011 (ibid)

⁷ Sterling, Stephen. "Learning for resilience, or the resilient learner? Towards a necessary reconciliation in a paradigm of sustainable education." In *Resilience in Social-Ecological Systems*, pp. 59-76. Routledge, 2013.

⁸ Vare, Paul, and William Scott. "Learning for a change: Exploring the relationship between education and sustainable development." *Journal of Education for Sustainable Development* 1, no. 2 (2007): 191-198.

⁹ Tilbury, Daniella. "Learning based change for sustainability: perspectives and pathways." *Social learning towards a sustainable world* (2007): 117-132.

¹⁰ Strachan, Scott, Louise Logan, Debra Willison, Rod Bain, Jennifer Roberts, Iain Mitchell, and Roddy Yarr. "Reflections on developing a collaborative multi-disciplinary approach to embedding education for sustainable development into higher education curricula." *Emerald Open Research* 3 (2021): 24.

-include content on 'ways of knowing' to support transdisciplinary work, disciplinary definition and basis for cross-disciplinary collaboration

-scope core new content on themes and challenges linked to sustainability or sustainable Development (opting for a definition) in tandem with existing curricula and university strengths

-visualise novelties in assessments through capturing ESD higher level competencies (like systemic, anticipatory and critical thinking) in learning objectives and activity design

Programme level integration and 'disciplinary definitions' of sustainability

On a program level, the integration of sustainability into course content can be done *vertically* (sustainability integrated via specific sustainability-related courses) or *horizontally* (sustainability integrated within different regular courses of the curriculum) (^{11 12 13}). Two core challenges for changing 'disciplinary approaches' to curriculum are identified here:

Firstly, ESD competencies position less focus on content and more on skills development, which may initially seem as applicable across disciplinary content but of course with limitations. For example, foresight and anticipatory thinking is integrated in certain disciplines like economics while science communication skills may lie stronger in humanities and educational departments. Moreover, in multiple other UK institutions, a consistent, institution-wide approach to competency definition, development and evaluation – where staff and students are clear on what competencies are to be developed (and how these are defined), or even how they may be developed and measured – has proved challenging¹⁴. The 21st century skills integration, already promoted active and Problem-based learning approach within curricula, which may generate key question on vertical vs horizontal integration of sustainability (eg. developing new curriculum to focus on that approach).

On the other hand, certain disciplines hold their diverse understandings of sustainability, with engineering specifically enacting on environmental sustainability since decades now, making evident the difference between disciplines on pillars of sustainability. Engineering for Global Development, a credit-bearing core module for undergraduate Civil and Environmental Engineering students and Vertically Integrated Projects for Sustainable Development, a programme of 21 research-based projects in Strathclyde, showcase the advances realised within the Engineering faculty¹⁵. now looking to expanding across more departments. The table below is not to be considered exhaustive but only illustrative of variant 'disciplinary perceptions' of the concept and its effects on content shaping as identified in exemplary UK MSc courses (not named here) that include sustainability elements in their core¹⁶.

¹¹ Ceulemans, Kim, Marijke De Prins, Valérie Cappuyns, and Wouter De Coninck. "Integration of sustainable development in higher education's curricula of applied economics: Large-scale assessments, integration strategies and barriers." *Journal of Management & Organization* 17, no. 5 (2011): 621-640.

¹² Lambrechts, Wim, Ingrid Mulà, Kim Ceulemans, Ingrid Molderez, and Veerle Gaeremynck. "The integration of competences for sustainable development in higher education: an analysis of bachelor programs in management." *Journal of Cleaner Production* 48 (2013): 65-73.

¹³ Figueiró, Paola Schmitt, and Emmanuel Raufflet. "Sustainability in higher education: a systematic review with focus on management education." *Journal of cleaner production* 106 (2015): 22-33.

¹⁴ Strachan et al. 2021 (ibid).

¹⁵ Strachan et al. 2021 (ibid)

Focus of example PG programmes	Host department & relevant disciplines	Content and skills examples
Sust development and environmental management	Geography/ Civil/environmental engineering departments	Environmental impact assessment of infrastructure solutions, waste management and disposal etc
Sustainable (urban) development	Urban planning/	Global south/ urban/international development and regeneration, slums challenges and quality of infrastructure
Sustainable or international development	Political or social science departments	International development discourses,
Business strategy and/or entrepreneurial approaches	Business schools/Business administration departments	Leadership, business models, supply chain choices
Sustainable design and manufacturing/biomaterials	Chemistry/Design and manufacturing departments	Sustainable choices in processes, lean design, material innovation (bio/eco-materials and their applications)
Sustainable and circular built environment	Architecture departments	Regeneration and reuse, material innovation energy efficiency/ occupants behaviour, circularity and reuse
Climate science and Sustainability	Ecology, Climate science departments	Climate science, planetary boundaries, socio-ecological systems, climate policy analysis

The presence of variant 'disciplinary definitions' and perceptions of components of sustainability identified here (presented in the Table above) suggest clear challenges in realistic application of the vertical integration approach, without reducing its value.

A variant set of holistic definitions of the concept, which also hold truth, have been proposed by Connelly¹⁷. Despite its contested nature, the SD concept has been largely explored by researchers in varying fields. Connelly identified four ways in which the ambiguity of "sustainable development" is addressed in literature: 1) presenting a concept unproblematic in principle and hard to achieve in practice (i.e., a value-laden concept of what is wanted without specifying what should be done¹⁸ the first-level, uncontested center of the overlapping social, environmental, and economic spheres), 2) noting the ambiguity of the term, but selecting a preferred definition (commonly the Brundtland Report's), 3) noting the ambiguity of the term and developing praxis (e.g., *strong versus weak sustainability*), 4) seeking to understand how "sustainable development" developed as a concept¹⁹. Mensah²⁰ has provided an equally critically reflection on the contested meaning of the term and its consequences for operationalisation, focusing on the pillars (socio, economic, environmental and the contested nature of the SDGs).

Existing literature on barriers and opportunities related to education for sustainability covers a wide range of similar issues, ranging from conceptual issues to support /

¹⁷ Connelly, Steve. "Mapping sustainable development as a contested concept." *Local environment* 12, no. 3 (2007): 259-278.

¹⁸ Ziemann, A. "Communication theory and sustainability discourse." In *Sustainability communication* (pp. 89-96). Springer (2011): 89-96.

¹⁹ Stough, Talia, Kim Ceulemans, Wim Lambrechts, and Valérie Cappuyns. "Assessing sustainability in higher education curricula: A critical reflection on validity issues." *Journal of Cleaner Production* 172 (2018): 4456-4466.

²⁰ Mensah, Justice. "Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review." *Cogent social sciences* 5, no. 1 (2019): 1653531.

motivation frameworks (accreditations, assessment approaches) as well as core disciplinary 'battles' around content^(21 22), including:

- **Communication / Interpretation of sustainability.** Translating the added value of sustainability to different stakeholders, with various meanings associated to the term by different groups.^(23 24 25 26).
- **Assessment framework** in place with appropriate indicators, monitoring, evaluation, and reporting procedures^(27 28 29 30). While this may refer in literature to university-wide applications of 'Sustainable campuses' the aspect of assessing learning in sustainability within class also remains challenging.
- **Disciplinary nature of universities.** Academics not seeing the relevance to their discipline, being core challenge in terms of motivating change but also promoting a less individualistic culture that inhibits collaboration and trans-disciplinary cooperation^(31 32 33 34).

Sustainability teaching and learning has been considered not adequately valued in HEIs, compared to traditional, single discipline research, which at many fields is more

²¹ Ávila, Lucas Veiga, Walter Leal Filho, Luciana Brandli, Colin J. Macgregor, Petra Molthan-Hill, Pinar Gökçin Özuyar, and Rodrigo Martins Moreira. "Barriers to innovation and sustainability at universities around the world." *Journal of cleaner production* 164 (2017): 1268-1278.

²² Higgins, B and I Thomas. "Education for sustainability in universities: challenges and opportunities for change." *Australian Journal of Environmental Education* 32 (2016): 91-108.

²³ Bilodeau, Leanne, Jackie Podger, and Alaa Abd-El-Aziz. "Advancing campus and community sustainability: strategic alliances in action." *International Journal of Sustainability in Higher Education* (2014).

²⁴ Holm, Tove, Kaisu Sammalisto, Thomas S. Grindsted, and Timo Vuorisalo. "Process framework for identifying sustainability aspects in university curricula and integrating education for sustainable development." *Journal of Cleaner Production* 106 (2015): 164-174.

²⁵ Soini, Katriina, Alexandra Jurgilevich, Janna Pietikäinen, and Kaisa Korhonen-Kurki. "Universities responding to the call for sustainability: A typology of sustainability centres." *Journal of Cleaner Production* 170 (2018): 1423-1432.

²⁶ Trencher, G, M Yarime, K B. McCormick, C N. Doll and S B. Kraines. "Beyond the third mission: Exploring the emerging university function of co-creation for sustainability." *Science and Public Policy* 41 (2014): 151-179.

²⁷ Chalker-Scott, Linda, and Rod Tinnemore. "Is community-based sustainability education sustainable? A general overview of organizational sustainability in outreach education." *Journal of Cleaner Production* 17, no. 12 (2009): 1132-1137.

²⁸ Disterheft, Antje, Sandra Caeiro, Ulisses M. Azeiteiro, and Walter Leal Filho. "Sustainable universities—a study of critical success factors for participatory approaches." *Journal of Cleaner Production* 106 (2015): 11-21.

²⁹ Hart, Angie, Simon Northmore, Chloe Gerhardt, and Polly Rodriguez. "Developing access between universities and local community groups: A university helpdesk in action." *Journal of Higher Education Outreach and Engagement* 13, no. 3 (2009): 45-60.

³⁰ Stough et al., 2018 (ibid)

³¹ Holm et al., 2015 (ibid)

³² Higgins and Thomas, 2016 (ibid).

³³ Shiel, Chris, Walter Leal Filho, Arminda do Paço, and Luciana Brandli. "Evaluating the engagement of universities in capacity building for sustainable development in local communities." *Evaluation and program planning* 54 (2016): 123-134.

³⁴ Soini, Katriina, Alexandra Jurgilevich, Janna Pietikäinen, and Kaisa Korhonen-Kurki. "Universities responding to the call for sustainability: A typology of sustainability centres." *Journal of Cleaner Production* 170 (2018): 1423-1432.

highly favoured. This is usually in stark contrast with the standards of success for research which endorse and promote collaboration and exchange between disciplines, suggesting that closest interaction between research and teaching agendas may be key for developing successful curricula on sustainability in a more natural way. This disciplinary issue, in theory, becomes less important when developing whole postgraduate course resources and models, as existing disciplinary knowledge base is necessary and recognised in prospective students to enable deeper cross-disciplinary enquiry.

- **Overcrowded curriculum is an issue discussed a lot in literature: this may be in relation to sustainability** being an add-on to existing content, due to resistance to change (Disterheft et al., 2015; Hart et al. 2009; Higgins and Thomas, 2016; Holm et al., 2015;³⁵ Shiel et al., 2016; Trencher et al., 2014). Focus of sustainability can be considered too broad or vague leading to issues of overcrowding in new programmes as well (eg. aiming to cover from environmental sciences /climate change topics to wider socio-economic aspects and political science approaches to sustainable development). Therefore, such a curriculum design requires clearer steering and alignment with content of relevance to the specific institutional vision, specialisms and professional roles of targeted student cohort.
- Wider academic quality and procedural structures: timelines to processes for approval and support of PG programmes that are interdisciplinary may pose challenges to existing systems developed for disciplinary learning and teaching. Enhancing collaborative curriculum design is also a core aspect needing support to enable success.

Discussion

Despite the challenges and barriers discussed in previous section there are obvious innovation and wider benefits from engaging in change or even in disruption for integrating sustainability in postgraduate curricula. The type of challenges described suggests that an internal systemic change is necessary to support collaborative action towards new course generation, including cultural and identity aspects in HEIs. Academic literature has focused a lot on exemplifying external collaboration with communities, and real-world based learning on the expense of sharing cultural aspects of attaining true cross-disciplinary collaboration or thematic clusters of knowledge sharing within universities in support of teaching sustainability. Wider factors to enable change in universities across Central European countries (not only internal) are described by Dlouha et al.³⁶ and some of the ones reflecting our own experience are included in the following section.

Secondly, aspects of strategic direction towards sustainability and types of learning play an important role in shaping each University's approach. For example, in University of Strathclyde, a focus on developing the context for *useful learning, including shaping skills for employability is core for the wider educational content development. Furthermore, innovative aspects like reflection-oriented classes are included in multiple postgraduate courses, providing opportunity for reflections on skills development but also a pathway to shape responsible citizens.* The wider focus on entrepreneurship (university wide commitment as well), with examples discussed in

³⁵ Northmore, Simon, and Angie Hart. "Sustaining community-university partnerships." *Gateways: International Journal of Community Research and Engagement* 4 (2011): 1-11.

³⁶ Dlouhá, Jana, Peter Glavič, and Andrew Barton. "Higher education in Central European countries—Critical factors for sustainability transition." *Journal of Cleaner Production* 151 (2017): 670-684.

Strachan et al. (ibid), also supports models of real-world practical learning through working with 'clients' and communities to achieve social impact.

External influences and drivers

Additional to those challenges, external and contextual factors may affect the focus and targeting of aspects of the concept in developing new taught content on SD:

- **Techno-centric approaches influenced by governmental priorities and corporate interests** may favour certain disciplinary perspectives. Partnerships tend to focus on the built environment over human and social systems. (Holm et al., 2015; Higgins and Thomas, 2016; Trencher et al., 2014) Those can be considered as focusing on 'one aspect of the concept' with focus of curricula that originate in social policy department which may be structured around international development or cover aspects of sustainable development challenges (but may not market or name themselves as sustainability courses).
- **National and international law, as well as the rising of Climate science as an urgency** of our days also position a focus on the 'ecological' components of the concept which may come in contrast with the broadness of the SDGs. The United Kingdom's (UK) Climate Change Act 2008¹ was instrumental to the adoption of mandatory carbon reporting for all UK companies in 2013 and was the first dedicated piece of carbon-related legislation in the world. Especially in Scotland and Glasgow in specific the experience of hosting COP26 has left a strong legacy and impact on both participants students, academic and wider community also seeking more empowerment of the youth through curricula. Environmental education (EE)-Climate education and literacy trends are requiring universities to respond to the challenge.
- **Accreditation:** ironically enough, while sustainability reporting and monitoring of objectives has been rapidly evolving in certain business and industry areas (EIA frameworks, BREEM and relevant standards in built sector, ESG and corporate responsibility approaches in business context) accreditation of relevant taught programs that may cultivate such skills, as part of wider knowledge, have been much slower.

Initiatives as opposed to programmes and vertical vs horizontal integration dilemmas

While not discussed in detail in the section above, a key barrier to the development of structure postgraduate programmes is the conceptualisation of ESD as set of transformative initiatives across a campus that expands the limits of a 'traditional' structured learning programme (or a standard approach to teaching and learning) alone. Shawe et al.³⁷ provide a comparison of Irish Higher Education Institutes with international examples of sprawling 'sustainability initiatives' including some taught programmes or modules, based on sixteen case studies (seven from Ireland and nine international, four of the latter being in the UK).

Irish HEIs focus on student and staff engagement through modules, online tutorials, courses and volunteer programmes or 'outreach and sustainable campus approaches'. Shawe et al.(ibid) interestingly note that Ireland has been more successful in its 'bolt-on' approach by adding new Sustainable Development (SD) programmes than a 'built-in' approach which involves integrating sustainability across existing programmes³⁸, which is admittedly more challenging. International literature identifies as best practice

³⁷ Shawe, Rachel, William Horan, Richard Moles, and Bernadette O'Regan. "Mapping of sustainability policies and initiatives in higher education institutes." *Environmental Science & Policy* 99 (2019): 80-88.

³⁸ Department of Education and Skills. "Providers of Higher Education". 2019, <https://www.education.ie/en/Learners/Information/Providers-of-Higher-Education/List.html>

approaches those that foster integration: in reference to taught programme changes in specific, cases where deans or their appointees in all faculties acted to ensure that *modules on sustainability are included in all taught programmes* (Bilodeau et al., 2014; Trencher et al., 2014. See also vertical and horizontal integration discussed earlier). In literature, the distinction between *insertion* (a superficial or tacked-on approach), versus *integration* (full adaptation of sustainability into curricula, implemented in a holistic way) aimed mainly at praising the values of the latter³⁹. Integrative approach done right, would, theoretically, culminate in achieving trans-disciplinarity⁴⁰.

Stough et al. (ibid) provide a relevant analysis of role of assessment frameworks for promoting integrating of SD in curricula, focusing on the STARS framework which may operate as reward for both horizontal and vertical integration (⁴¹). Content distinctions are made here between “sustainability courses” (courses for which the primary focus is on sustainability and/or understanding or solving one or more major sustainability challenge), and “courses that include sustainability” as an element, specifically integrating for example “a sustainability challenge” (ibid).

ESD competencies and opportunities for transformative new content

Within the context of higher education, general competencies for SD have been defined, in order to ensure HEIs are preparing students for the complex and uncertain context of sustainability issues (e.g. ^{42 43 44 45}). Rieckmann (ibid) defined a list of key competencies for SD, validated by international academic stakeholders. Some of the 21st century skills are mirrored in those ESD competencies). The value of SD competencies lies in the fact that they clarify the broad and blurry concept of ESD and enable educators to integrate ESD in their study program, providing a clear aim for shaping learning objectives in taught programmes.

SD competencies however require new approaches in teaching and learning⁴⁶, and a reorientation of education is needed towards more multi-, inter-, and transdisciplinarity, self-regulated learning, and project- and problem-based learning (Lambrechts et al., 2013, ibid). These require transformative pedagogical approaches to be developed to respond to these needs, but admittedly also require collaborative approaches in teaching in order to harness and share inter and transdisciplinary experiences with the students. Especially the component of group working, collaborative skills and critical

³⁹ Figueiró and Raufflet, 2015 (ibid) pp. 23

⁴⁰ Palma, Lisiane Celia, and Eugênio Ávila Pedrozo. "Complex matrix for the analysis of sustainable transformative learning: an assessment methodology of sustainability integration in universities." *Assessment & Evaluation in Higher Education* 40, no. 6 (2015): 817-832.

⁴¹ AASHE (2016). Sustainability Tracking, Assessment & Rating System (STARS) Technical Manual Version 2.1. Association for the Advancement of Sustainability in Higher Education (AASHE) p.36-37.

⁴² Barth, Matthias, Jasmin Godemann, Marco Rieckmann, and Ute Stoltenberg. "Developing key competencies for sustainable development in higher education." *International Journal of sustainability in higher education* (2007).

⁴³ De Haan, Gerhard. "The BLK '21' programme in Germany: a 'Gestaltungskompetenz'-based model for Education for Sustainable Development." *Environmental Education Research* 12, no. 1 (2006): 19-32.

⁴⁴ Rieckmann, Marco. "Future-oriented higher education: Which key competencies should be fostered through university teaching and learning?." *Futures* 44, no. 2 (2012): 127-135.

⁴⁵ Wiek et al. 2011 (ibid)

⁴⁶ Mulà, Ingrid, Daniella Tilbury, and United Nations Educational, Scientific and Cultural Organization (UNESCO); United Nations Decade of Education for Sustainable Development 2005-2014. "National journeys towards education for sustainable development, 2011: reviewing national experiences from Chile, Indonesia, Kenya, the Netherlands, Oman." (2011).

thinking require wider exposure to those 'modes of working', but also pre-requisites for success, which may tackle behaviours and pre-conceptions of students coming in such non-disciplinary context. Putting value in such formative activities shifts the focus from pure 'disciplinary' hard knowledge, usually acquired through individual studying to soft skills and awareness development activities that enables a more successful participant-environment (pro-social) interaction. Aspects like critical and systemic thinking skills balance the approach, with such skills typically developed through complex system analysis, individual critical enquiry of evidence and solutions through comparative analysis for example. These take traditional problem-based learning approaches to a different level, while defying typical one-sided hypothesis testing to look at multiple causes and simultaneous effects, adding layers of complexity in analytical tasks for example. These are some examples of the opportunities provided by the competency framework itself, for revolutionising and transforming curriculum content, especially in the context of curating it for interdisciplinary cohorts.

Conclusion

Despite the essential role of higher education in contributing to a sustainable society, the conceptualization of "sustainability" and, what exactly universities should do to contribute to a sustainable society, differs greatly among stakeholders (⁴⁷, ⁴⁸, ⁴⁹). Despite this and co-existent disciplinary definitions of the concept, a collaborative as opposed to competing framework at institutional level can support vertical integration approaches with wider chances for achieving transdisciplinary experiences for student cohorts. The experience on scoping the development of new MSc courses in Sustainability has identified similar challenges with the ones described within the Irish context (as discussed in Shawe et al. (ibid) with internal perceptions and disciplinary divides elaborated in the context of this paper, but also around the concept of sustainability itself. Despite those challenges, evolving application of ESD competencies frameworks next to accreditation and assessment approaches, can support novel and transformative content development for taught courses as well as programmes, building on core inter-and trans-disciplinary learning and deep learning pedagogical approaches. The paper also identified that more robust inter and transdisciplinary teaching approaches are lying in the heart of attempts to enact the integration of ESD competences but also including new SD related content in curricula. Unique elements that the University of Strathclyde provides were briefly presented here, including structures and opportunities for social impact and external partnerships supporting learning, next to 'reflective practice' elements, that together shape an even more holistic view of 'sustainable practitioners'. We aspire this paper to serve as a useful reflection piece and reference for academic colleagues and pedagogy-experts facing similar challenges and embracing the opportunities for 'a paradigm' shift that ESD framework brings to higher education.

⁴⁷ Wright, T. "University presidents' conceptualizations of sustainability in higher education." *International Journal of Sustainability in higher education* 11 (2010): 45-60.

⁴⁸ Sylvestre, P, T Wright and K Sherren. "Exploring faculty conceptualizations of sustainability in higher education: Cultural barriers to organizational change and potential resolutions." *Journal of Education for Sustainable Development* 7 (2013): 223-244.

⁴⁹ Urbanski, M. "Measuring sustainability at universities by means of the Sustainability Tracking, Assessment and Rating System (STARS): early findings from STARS data." *Environment* (2015): 209-220.