Exploring conceptions of sustainability education in initial teacher education: Perspectives from Australia, Canada and Scotland

Abstract

This paper draws on interview data to explore Australian, Canadian and Scottish teacher educators' conceptions of sustainability education (SE) within initial teacher education (ITE). Findings were generated across three themes: teacher educators' (i) conceptions of SE and SE in ITE, (ii) curriculum and pedagogical practices, and (iii) barriers, challenges and opportunities to engaging with SE. Analysis revealed inconsistency amongst teacher educators' conceptualizations of SE, and significant barriers and challenges when offering SE within ITE programs. Related opportunities highlighted destabilizing established norms within ITE programs and encouraging future thinking about the wider purposes and processes of education with preservice teachers.

Keywords: teacher educators, sustainability education, initial teacher education, teacher thinking, preservice teachers, sustainability.

Introduction

Teacher thinking and its relationship to teaching and learning is an important research area in ongoing efforts to improve education. What and how teachers think influences the activities that take place in the classroom and, consequently, students' experiences (Chapman, 2017). This paper is concerned with teacher thinking in relation to conceptions of sustainability education (SE) within initial teacher education (ITE). Emphasis on the importance of including SE in ITE has been punctuated since the 1990s through a range of initiatives (e.g., York University, n.d.; United Nations Educational, Scientific & Cultural Organisation [UNESCO], 2005; 2010; 2015). However, researchers consistently report that SE is not widely taken up in ITE (Boeve-de Pauw et al., 2022; Karrow & DiGuiseppe, 2019; Ferreira et al., 2009) and, consequently, there is limited understanding of teacher educators' (academics teaching in ITE programs) thinking or conceiving of SE.

Teacher educators' conceptions of SE or how they interpret, understand or think about SE influences their teaching and learning practice when working with student teachers (Sinakou et al., 2018). Hence, we contend that deepening understanding of teacher

educators' conceptions of SE will provide more reliable evidence upon which to build student teachers' capacity to address SE once in schools. This exploratory study works towards this goal by drawing on scholarship that addresses SE, ITE and teacher thinking in combination with interviews conducted with a group of teacher educators from three international contexts: Australia, Canada and Scotland. Exploring what and how teacher educators conceive SE is important if we consider that (i) ITE plays a critical role in developing teachers who are "ready, willing and able" to adopt SE into their practice (Ferreira et al., 2007, p. 226), and (ii) how teacher educators conceive SE influences their teaching and learning approaches and practices and, in turn, student teachers' own practices into the future (Sinakou et al., 2018). The three countries were selected based on their historical association with SE, engagement in the policies and practices of SE in ITE, and their various responses to international SE initiatives (see Evans et al., 2021). Conducting a study of teacher educators' conceptions of SE from varying international contexts offers the opportunity to identify commonalities and differences that broaden understanding of possibilities, and promote critical perspectives useful for informing future efforts to build student teachers' capacity to teach SE. Better understanding SE in ITE is a central concern for the members of this research team, who are active in working to better embed SE into their personal teaching practices and institutional contexts.

We begin by outlining the conceptual foundations underpinning this research, before describing the internationally specific contexts within which the teacher educator participants in this study work. An overview of the methods and synthesis of the findings is followed by a discussion of the key themes of the study, insights and recommendations for future research in this field.

Sustainability education and initial teacher education

Sustainability education (SE), nationally nuanced as, for example, Education for Sustainability (EfS), Education for Sustainable Development (ESD), Learning for Sustainability (LfS) and Environmental and Sustainability Education (ESE), aims to build capacity for innovating towards a more sustainable environmental, social, and economic

future (United Nations Economic Commission for Europe [UNECE], 2011). Internationally, ESD has gained much significance through the United Nations Decade of Education for Sustainable Development (DESD) from 2004-2015 and the follow-up Global Action Programme on Education for Sustainable Development (United Nations Educational, Scientific and Cultural Organisation [UNESCO], 2019). The importance of the Global Action Programme (GAP) is reinforced by the United Nations 2030 agenda and sustainable development goal 4, which aspires to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (United Nations, n.d.). However, reports and scholarly work consistently finds that the extent to which teacher educators engage with SE is minimal. A UNESCO (2016) review of country progress in meeting the sustainable development goals found that only eight percent of 66 countries reported integrating sustainable development into teacher education. A further 2017 progress report found coverage of sustainable development themes in ITE is limited and ad-hoc (Bourn et al. 2017). Scholars working in the Australian context have made similar conclusions (e.g., Ferreira et al., 2009; Jenkins, 1999/2000; Steele, 2010), as have researchers in Canada (Karrow & DiGuiseppe, 2019; Karrow et al, 2016) and Scotland (Nicol et al., 2019). Considering how teacher thinking or conceptions of SE are developed in ITE is one important step forward in deepening SE in teachers' classroom practices.

Teachers' conceptions of SE

Scholarly work on teachers' conception of SE draws on a range of contexts (e.g., primary, secondary, higher education) and concepts including beliefs, perceptions, understandings, views, and interpretations. For the purposes of this paper, we combine research on school teacher conceptions of SE with those of teacher educators more generally. This is because, although issues in schools differ from those in teacher and higher education and the difference persists across continents and countries, research finds school teachers and academics (those working in higher education broadly) share similar perspectives with regards to SE (Ballantyne, 1999; Cotton, 2015).

Teacher conceptions form the foundation of teachers' decision making (Chapman, 2017; Huang, 2015). What and how teachers think about or conceive of a particular

topic, issue or curriculum area can profoundly influence their teaching and learning decisions and students' experiences (Chapman, 2017; Ferguson et al., 2021). In general, teachers' pedagogical decisions are shaped by their personal belief systems (Aarnio-Linnanvuori, 2019; Hart, 2003; Moroye, 2009; Morrison, 2018). Various studies have investigated links between teachers' beliefs and decisions related to SE. Hart (2003) and Moroye (2009) find teachers who include SE in their practice share a common concern for the environment. Such teachers find ways to include SE regardless of whether it forms part of the formal curriculum or not. In contrast, teachers who resist SE tend to focus on barriers to its inclusion and prioritize reasons for excluding SE over considering how SE might enhance the work they already do (Cotton, 2006). These findings are reflected in the higher education sector where it seems that academics generally support SE, but their personal beliefs, conceptions, perceptions and understandings strongly influence if and how SE is included in their teaching and learning (Cotton et al., 2007; Jones et al., 2008). Some researchers argue that the majority of academics in higher education view SE as mostly about the environment and do not support embedding SE in every subject area (Cebrian et al., 2015; Dawe et al., 2005; Ryan & Cotton, 2013; Sinakou et al., 2018).

A review of work on teacher educators' conceptions of SE reflects similar findings. Studies carried out with Australian (Buchanan, 2011, 2012; Wilson, 2012) and Pakistani teacher educators (Mirza & Tajuddin, 2020) find that most teacher educators recognize the importance of SE, but believe it is a time intensive addition on the margins of practice. This is partly due to constraints such as overcrowded curricula, lack of support, and limited awareness and expertise. Hofman's (2012) study (cited in Wolff et al., 2017) with 154 Finnish teacher educators finds they hold diverse views of sustainability and SE. Most think that sustainability is important for student teachers, but do not consider that their own work is an important contributor to developing student teachers' capacity for SE. Summers' (2013) and Jetly and Singh's (2019) research demonstrates that when British and Indian teacher educators consider SE, most focus on the environment; only a small number include social and economic conceptions. In contrast, a global study of teacher educators' conceptual understanding of ESD by Sinakou et al. (2018) concludes that teacher educators tend to emphasize the social and economic

dimensions of SE, with “nutrition, eradication of poverty, well-being for all humans and social justice being emphasized more than environmental protection” (p. 328).

In summary, our review of the literature aligns with the finding from Brown et al. (2019), that historical, personal and contextual factors influence educators’ conceptions of SE. This means that belief systems, policies and work environments influence how teacher educators think about SE and, in turn, implement SE in their own practice.

Contextual background

This exploratory study conducted interviews with teacher educators from three international contexts, Australia, Canada and Scotland, to better understand their conceptions of SE in ITE.

Australia

Australian teacher educators have always been challenged to engage with SE. Most agree on the need for community and government actions for economic, political, social and environmental improvements. However, an emphasis on reading, writing and mathematics, coupled with a lack of requirement to address sustainability issues such as climate change, political turmoil and war, and growing inequality between rich and poor, results in SE being seen as optional and marginal to the main purpose of ITE (Evans, 2019; Davis & Davis, 2021). Yet what Nolet (2013) calls “pockets of innovation” (54) can be found within education programs around Australia. However, these tend to be ad-hoc and reliant on teacher educators with a personal interest in sustainability rather than coordinated and supported through policy and leadership. It is important to note that this has not always been the case. For approximately five years, coinciding with the Decade of Education for Sustainable Development from 2005 to 2014, SE in Australia was prioritized through a range of policies, curriculum frameworks and other initiatives. The election of a conservative government in 2013, however, saw SE policies and initiatives either canceled or downgraded. A small number of initiatives do still exist, such as the sustainability cross-curriculum priority (Australian Curriculum, Assessment and Reporting Authority [ACARA], n.d.), but lack of material support such as funding

and professional development affects the extent to which such initiatives can have meaningful impacts (Evans, 2019).

Canada

The development of Environmental and Sustainability Education (ESE) in ITE in Canada has slowly progressed over the past four decades, initiated by its pledge to enact the guiding principles of the *Tbilisi Declaration* (UNESCO/UNEP 1977), and guided by the establishment in 1999 of the UNESCO *Chair on Reorienting Teacher Education for Sustainability* (York university, n.d.) (Inwood & Elliott, 2019). However, Canada's decentralized education system has hindered the pace of this work, as governance, policies and practice differ greatly across its ten provinces and three territories, making any kind of curricular or pedagogical change towards ESE across the country highly challenging (Inwood & Elliott, 2019). A report addressing ESE in Canadian Faculties of Education (Council of Ministers of Education [CMEC], 2012) found that many faculties of education across the country have been making efforts to embed ESE into ITE programs, but with varying degrees of success. For some ITE programs, this manifests as extracurricular learning or elective courses in ESE offered to student teachers on a voluntary basis. A smaller number of programs have added core courses in ESE, mandatory for program completion. Concurrently, a recent scoping study (Kennedy et al, under review) demonstrates a significant increase in research focused on ESE in teacher education, fueled in part by the founding of a national ESE in Teacher Education network in 2016 dedicated to better embedding ESE in ITE. The pace of this work will only be quickened by the recent release of the *Accord on Education for a Sustainable Future* by the Association of Canadian Deans of Education (2022); this policy statement signals a new responsibility for all faculties of education across the country to engage in ESE as part of ITE. These positive developments offer hope that ESE will soon have a greater presence in ITE programs across Canada.

Scotland

There is a comprehensive policy architecture supporting the development and integration of Learning for Sustainability (LfS) in Scotland, although this architecture is

not reflected in ITE provision, which remains patchy and inconsistent (Evans et al, 2021; McGregor & Christie, 2021; Nicol et al 2019). In 2009 the Scottish Government commissioned a review of ITE, including continuing professional development and early career and university level education (Donaldson, 2011). Amongst the various outcomes was a push for ITE to "take [student teachers] beyond any inclination, however understandable, to want to narrow training of immediate and direct relevance to life in the classroom" (Donaldson, 2011, p. 6). This challenge to broaden education and take a whole school and community approach to teaching and learning is core to LfS (the Scottish approach that encompasses Education for Sustainable Development, Outdoor Learning and Global Citizenship). It is defined as "a whole-school approach that enables the school and its wider community to build the values, attitudes, knowledge, skills and confidence needed to develop practices and take decisions which are compatible with a sustainable and equitable society" (Scottish Government, 2016, p. 7). Key drivers such as the *One Planet Schools* report (Scottish Government, 2012) and the subsequent *Vision 2030+* report (Scottish Government, 2016) secured policies which enabled LfS to become an entitlement of all Scottish pupils, a responsibility of all teachers and education leaders, and a core aspect of the General Teaching Council for Scotland's (GTCS) Professional Standards (GTCS, 2020). LfS is now part of the Scottish school inspection process, and the Scottish Qualifications Authority (SQA) has committed to incorporating LfS within all new and revised national courses, skills for work courses and learning pathways that are followed by all 5,406 Scottish schools (SQA, 2020). However, translation of this comprehensive policy architecture into ITE provision across Scotland remains inconsistent (Nicol et al, 2019).

Methods

This study employed a qualitative interpretive research approach (Cohen et al., 2011) which allowed us to work directly with research participants' understandings and experiences of SE. Adopting this position and developing a qualitative research design enabled an exploratory understanding and appreciation for teacher educators' thinking related to SE and SE in ITE. After obtaining formal ethical approval from all universities in the study, we adopted a combination of convenience (Robinson, 2014) and purposeful sampling techniques (Patton, 2015) to recruit study participants. In the first

instance, this involved the researcher at each university announcing the study to teacher educators via email and inviting them to self-select to participate in semi-structured interviews. Following, researchers drew on their own context-based knowledge to personally invite teacher educators with interest, knowledge and/or experience in SE to participate in interviews. This strategy aligns with an exploratory research approach, where individuals sought are knowledgeable about a topic or process (Stebbins, 2001).

Interviews were conducted in person and followed a flexible pre-prepared interview guide. This allowed deviation to probe participants' responses to gain further insights into individual conceptualizations and experiences of SE within ITE (Lankshear & Knobel, 2010) whilst remaining in alignment with the overall research aims. First, interviews in Australia were conducted, then interviews in Scotland and Canada followed whilst the first author was on sabbatical in those countries. In total, eleven interviews were held, comprising four teacher educators from Australia, four from Scotland, and three from Canada. Each interview took between 30 and 60 minutes, were audio recorded, transcribed verbatim and checked for accuracy by the first author. All participants were experienced teacher educators with a minimum of five years' experience teaching in ITE programs across a range of curriculum areas including English, Science, History, Geography, and Mathematics. Prior to their experience in ITE, all but one were secondary teachers and one was a primary school teacher. As an exploratory study, the small number of interviews provides a starting point for understandings that can be developed further through, for example, larger studies.

Data analysis involved several cycles, following Saldaña's (2013) approach: the first cycle entailed descriptive coding, where we read through the data individually to summarize in a word or short phrase the main themes reflective of our research aim to investigate teacher educators' thinking about SE. From this, we developed an organizing schema to apply a more focused second cycle of analysis. Member checking (Birt et al., 2016) followed, and involved each author checking a random sample of the transcripts from each section of the schema before meeting to discuss interpretations and align understandings in relation to the aim of the study.

Findings

The findings are organized around three themes that emerged from the analysis: (i) teacher educators' conceptions of SE and SE in ITE, (ii) teacher educators' practice related to curriculum and pedagogy, and (iii) barriers, challenges and opportunities teacher educators face when engaging with SE. Table 1 provides a comparative overview of the findings.

Table 1. Comparative overview of teacher educators' conceptions of themes

Themes	**Australia**	**Canada**	**Scotland**
Teacher educators' conceptions of SE	SE is broad & complex. Involves teaching & thinking about sustainability issues & praxis	SE is broad & complex. Involves teaching & thinking about sustainability issues. Should involve the epistemologies of Indigenous peoples	SE is broad & complex. Linked to justice, reciprocity, community & relationships. Involves teaching & thinking about sustainability principles, & interrogating mechanistic assumptions. Not enough SE is taught.
Teacher educators' conceptions of embedding SE in ITE	N/A	Important, but competes with other issues & agendas.	Important, but competes with other issues & agendas. Out of place in ITE.
Teacher educators' curriculum and pedagogical practices	Teaching traditional science-based content such as ozone depletion, carbon cycle, water quality, waste. Providing unbiased information. Applying traditional pedagogies. .	Practice informed by the work of the United Nations (e.g., ESD, SDGs) & concepts of interdisciplinarity, social justice, & ecojustice. Posing questions related to social justice & ecojustice issues. Team problem solving. Inclusion of Indigenous history, knowledge & pedagogical strategies.	Facilitating interdisciplinarity & connections to big ideas (e.g., land, environment, identity, health). Applying traditional pedagogies such as lectures & presentations.

		Discussions on the work on environmental scientists & activists. Applying integrated, interactive & experiential pedagogical strategies.	
Barriers to embedding SE	N/A	Prioritization of Mathematics & Science.	Siloed structure of disciplinary divisions. Lack of resources & professional development.
Challenges to embedding SE	How to integrate SE into teaching courses.	How to integrate SE into teaching methods courses. Disciplinary structures & subject divisions. Gap between theory and practice.	How to integrate SE into teaching courses. Low self-efficacy. Being too political or offensive.
Opportunities from embedding SE	N/A	Unifying concept for addressing broad & complex issues.	Foster futures thinking. Unifying concept for addressing broad & complex issues.

Theme 1: Teacher educators' conceptions of SE and SE in ITE

When teacher educators were asked to explain their understanding of SE, some focused on the practice of SE specifically, whilst others took a more general approach discussing the broad topic of sustainability beyond the specific pedagogical focus. Many teacher educators acknowledged the complexity and breadth of the field. For example, one teacher educator stated that "sustainability isn't just about science" (TE2 Australia), while another explained "there are different varieties. We can say there's EE [Environmental Education], you use EfS [Education for Sustainability]. We tend to use Environmental and Sustainability Education here – ESE" (TE2 Canada). One teacher educator captured the broad range of understandings with the statement "sustainability is whatever you want it to be" (TE3 Scotland).

Some teacher educators linked sustainability and SE to justice, equity and ethics, to cultural, social and environmental systems, to politics and power, and to long-term vision over short-term gain. One teacher educator expressed that “it’s about children and students and everybody coming to a recognition that there’s only one Earth and the Earth in lots of ways is finite … I would emphasize justice is at the heart of [SE]” (TE1 Scotland). Another teacher educator explained that SE is complex because “it’s not acquired in a packet of knowledge. It’s not teaching the curriculum, it’s not teaching to the learning outcomes, but it’s about being responsive and receptive to things …. It’s a kind of approach to learning, an approach to being with other people and an approach to [managing] uncertainty” (TE5 Scotland). Others agreed with the complexity inherent in teaching about sustainability, with one teacher educator noting that

> sustainability [is] a way of being, so this whole concept of community and relationships and being attentive to the world around you, being attentive to people around you, this sort of non-violent way of understanding how our actions may or may not be useful for others to fulfill their needs, so that kind of reciprocity (TE5 Scotland).

In considering teacher educators’ conceptions of SE in ITE, responses reflected a general orientation towards teaching student teachers about sustainability issues and engaging them in thinking about the issues. For example, one teacher educator stated “[SE] is about learning about our environment, our local environment, our natural environment, the global environment, thinking about sustainability, social-environmental justice issues, about equity for all, thinking about power” (TE2 Scotland). Another teacher educator focused more broadly by asking student teachers to explore “the key principles around sustainability… reciprocity, interconnectedness, relationships - to interrogate the linear day mechanistic assumptions that are embedded in the subjects that we teach in the curriculum policy” (TE5 Scotland). One asked for their students to connect theory to practice by “thinking about those [sustainability] issues” and extended this line of thinking to consider how student teachers may take up SE within their own teaching: “then think about how they could address those things with their students” (TE1 Australia).

When asked for their views on the embedding of SE in ITE, teacher educators' responses reflected a combination of support and tension. As expressed by one teacher educator: "as important as I think [SE] is, there are more fundamental issues that need to be addressed" (TE1 Scotland). A plausible reason for this thinking is that "[SE] finds itself competing with multiple interests and multiple agendas … it largely remains on the edge of one of a list of things that people feel we need to attend to – mental health, literacy, numeracy, etc." (TE1 Canada). This is supported by another teacher educator who asserted the need to frame SE more urgently and lamented her department's exaggerated focus on mathematics: "there isn't a meeting that we go to where there isn't a major math discussion. We have a climate crisis, why isn't that the major thing that we talk about at the meeting?" (TE3 Canada).

However, there was only one strong opposing voice among the group of teacher educators who believed that ITE is the wrong place for SE:

> I really think that teacher education is the wrong place …. go and look at it elsewhere rather than teacher education. The qualifications authority are the places to tackle it. How much of a higher physics exam is driven by a requirement to be aware of sustainability issues? None of it. That's the place to start. Until it's there, nobody in schools will take an interest (TE3 Scotland).

Such a perspective may be due to an underdeveloped understanding of the scholarly field pertaining to SE in ITE. There was recognition from one teacher educator that SE is not supported by professional development in ITE. In their words: "I'm conscious that we don't do this as well as we might … I don't think that we necessarily do enough in our subject pedagogy seminars to explore what those subjects might offer in relation to LfS" (TE1 Scotland).

Theme 2: Teacher educators' practice related to curriculum and pedagogy

While a few of the teacher educators had to think carefully about their conceptions of SE theoretically, it became evident from their interview responses that for many, their curricula and pedagogy have been influenced by the work of the United Nations. Some referenced UNESCO's conceptions of ESD (2005, 2019) as well as the SDGs (United

Nations, n.d.) as influential in determining the content of their courses, while others situated their course content in relation to the 21st century competencies (UNECE, 2011). For one teacher educator, the work of the UN has informed the founding of “a cohort that has a focus on global citizenship education [that incorporates] sustainability education as well as a whole number of other sorts of SDG kinds of aims” (TE1 Canada). Many teacher educators were clear that they were introducing student teachers to curricular content related to traditional conceptions of environmental education; this could include explorations of environmental issues (e.g. ozone depletion, water quality, waste), or broader foundational topics such as the carbon cycle or systems theory. A few described the importance of introducing environmental scientists or youth activists such as Greta Thunberg. For one teacher educator, there was a concern that these curricular inclusions would be understood as biased in their approach: they asked their student teachers to consider this content “not with a view to activism, but rather a view to information and letting people decide for themselves how they might address that in the curriculum or with their classes or what is happening at their school” (TE1 Australia).

For some of the teacher educators, their conceptions of SE were evident in their expanding notions of what should be part of the curriculum of their courses. A few noted shifting towards interdisciplinarity in their discipline-based courses, looking for ways to connect to the SDGs or to ‘big ideas’ such as environment, land, identity or health. One remarked:

> It’s good in helping the students to think – think disciplinarily and then interdisciplinarily, so they are asking the question: what is it that history can contribute to understanding this? What can biology contribute to understanding this? But it also encourages them to think about softening those and they naturally come to this hybrid discipline because they realize that the topics they investigate don’t neatly lend themselves to those silos (TE1 Scotland).

For others, this line of thinking led to integrating social justice and ecojustice issues into their curriculum in innovative ways. One of the teacher educators asked an intriguing

line of questioning to initiate this: “How would our lives be different if we didn't have garbage pickup? Going to the grocery store, what would it look like? Going shopping in stores, what would it look like? How would our lives change?” (TE3 Canada).

Another teacher educator noted the close connections between their curricular content and the pedagogy they use to teach it:

> I try to use the global solutions framework for handling wicked problems, really complex issues, and get them working in teams to do problem solving…here’s something you can share with your students in terms of inquiry, working towards 21st century competencies around critical thinking, problem solving, communication and citizenship – global citizenship so having a sense of moral responsibility (TE2 Canada).

While some described using traditional pedagogies (e.g., lectures, readings, debates, archival & historical research), there was more evidence of teacher educators utilizing integrated, interactive and experiential pedagogical strategies, including field work, problem-solving, community-based learning, and visual learning strategies. Only a few discussed their use of transformative approaches to teaching SE in ITE which focused on artmaking, affective learning and place-based learning, suggesting that teacher educators’ conceptions of what counts as innovative pedagogy has yet to be modeled consistently in ITE.

One distinct difference distinguished the Canadian teacher educators from the Scottish and Australian educators. All three Canadian educators noted the inclusion of Indigenous history, knowledge and pedagogical strategies as integral to their teaching of SE. One described telling their students “if you want to solve climate change, you want to solve problems, [you] need to be bold…we talk about the seven generations and Indigenous Anishinaabe people…that you have the seven generations behind you…you are here because of decisions they made” (TE3 Canada). Another discussed “getting into this concept of decolonizing education, looking at different ways of knowing and different ontologies, epistemologies, as difficult as that is” (TE2 Canada). They

recognized the challenge of introducing this content, and its central role in advancing teaching and learning about climate change in Canada.

Theme 3: Barriers, Challenges and Opportunities

Teacher educators were quick to identify both barriers and challenges to embedding SE in ITE. For the purpose of this study, we define barriers as practices and/or processes that stop progress on embedding SE altogether; for example, a more senior colleague blocking inclusion of SE within courses as they believe it is irrelevant to ITE. Challenges, on the other hand, include practices and/or processes that slow progress, but do not stop teacher educators from engaging with, or embedding, SE within their work. This may include an acknowledgment of the lack of understanding about SE and how it relates to ITE and an intention to address that through professional development, for example. Given these definitions, most teacher educators reported challenges over barriers.

The main challenge identified across the interviews related to general difficulty with embedding SE into teaching courses. In some cases, this was due to a lack of knowledge and understanding about what SE is and its role within ITE. This inevitably led to low self-confidence and, therefore, low self-efficacy in embedding SE in ITE. As one teacher educator explained:

> I'm so interested in the environment and outdoors, I knew there was a real issue with me and confidence when I was asked to do a session [on SE within a course] ... I felt just the opposite of an expert. I just felt so ignorant, I suppose…I did engage with policy and having the learning for sustainability people here is really good, but I still had this real gap in my own confidence" (TE2 Scotland).

In other cases, challenges were related to disciplinary structures and subject divisions. Learning in schools, universities and ITE is mostly siloed into disciplines and subjects. Some teacher educators perceived this monocultural structure as problematic as it conflicts with the underpinning philosophy of SE as a cross-curricular concept: "if we teach these things as isolated it doesn't work… because it's not deeply connected to everything the students are doing or at least the majority of things the students are

doing” (TE3 Canada). Another teacher educator similarly identified a gap between the theory and praxis of SE because SE “sits as this kind of concept above the school and… the school is still divided into subjects that reflect parent disciplines” (TE1 Scotland). Lastly, one teacher educator (TE1 Canada) was concerned about being too political or offensive. They were apprehensive about SE catalyzing provocative and challenging discussions which may become “too political” and potentially cause unintended offense or harm to colleagues, students and their families. This challenge was summarized by the same teacher educator as a form of “discomfort when you talk about other kinds of issues that involve power and oppression around class, race, gender, sexual orientation… people are committed, they’re on side, they want to learn but they’re so cautious because they are fearful of offending” (TE1 Canada).

Barriers identified were related to issues over which teacher educators have limited or no control, including the prioritization of mathematics and science over other learning areas in Canada. As mentioned in Theme 1 (by TE3 Canada), the extensive focus on mathematics has led to a de-prioritization of sustainability:

> With the current government everybody’s so focused on math and science and the [standardized tests] that they have to complete … Basically there's practically no other discussion taking place. The Premier is making all new teachers in the province pass a math test. What if they all had to pass a sustainability test? How wonderful and so central to what's happening (TE3 Canada).

In Scotland, the issue of prioritization was raised in relation to the senior years of schooling. One teacher educator explained that the predominant direction of resources to the last two years of schooling results in the under-resourcing of the junior years. As a result, Scottish teachers have limited capacity to access professional development to support the robust implementation of SE:

> When you go into schools in Scotland the only thing that matters is the upper years of secondary …. and so what is happening in the junior phases, where the Scottish curriculum really offers teachers an enormous amount of autonomy [to implement

SE], is a massive wasted opportunity …. all that matters is the senior years (TE 1 Scotland).

The flipside of the many challenges identified were the opportunities that teacher educators felt SE afforded. There was a sense that SE offered opportunities to foster futures thinking through deep reflection and ideological analysis, both individually and collectively, within, for example, class discussions about the wider purposes and processes of education. Many saw SE as a unifying concept for grappling with broad and complex political, economic, environmental and social issues because "[SE] is philosophical and it's pedagogical, it's also [related] with agency and activism and dealing with the political aspects and self-ruination" (TE3 Canada). One teacher educator identified that SE provides a strategy for engaging student teachers with the concept of uncertainty because SE destabilizes established norms. In the teacher educator's words: "[SE] goes against established expectations and perceptions" (TE5 Scotland).

Discussion

The discussion is presented under two themes: connections and disconnections between teacher educators' conceptions of SE and scholarly literature, and contradictions between teacher educators' conceptions and practices. These themes were derived from the findings and will be discussed in relation to contemporary literature and policy.

Connections and disconnections between teacher educators' conceptions of SE and scholarly literature

The group of teacher educators in this study were engaged in SE and its implementation in ITE and were happy to talk about their perspectives on these matters. Teacher educators' explanations and nomenclature reflected the complexity and breadth that is suggested in scholarly work (e.g., see Jickling & Sterling, 2017; Nolet, 2009; Boeve-de Pauw, 2022; Wade, 2008). However, there was a general lack of consensus in how they named and conceived of SE, reflecting the diverse nature of teacher conceptions related to SE (Benavides-Lahnstein & Ryder, 2020). Most framed

their conception within their country, state and organizational context; for example, the Australian teacher educators spoke about EfS, whereas LfS was referenced in Scotland, and in Canada ESE was the common conceptual frame. These nuances confirm our understanding of SE as being context dependent. If we consider that, in general, teachers' conceptions shape teaching and learning decisions and practices, we wonder whether and how teacher educators' nuanced conceptions specifically influence their teaching and learning of SE. An implication arising from this point for the embedding of SE in ITE is the necessity of adopting and working with context-based understandings, rather than imposing ready-made conceptions and/or definitions. This argument aligns with Stevenson et al's (2014) research on embedding the learning and teaching of sustainability in ITE, who found that the meaning of SE "can only be constructed in particular contexts through engagement in debates about how the concept may be understood and operationalized in specific, different and changeable settings" (p. 50). A related question arising from the varied nomenclature (and three geographic contexts) is "what do teacher educators understand and mean with the particular terminology they use?" Environmental and sustainability scholars are aware of debates around terminology and associated meanings (e.g., Jickling & Sterling, 2017), and we have argued elsewhere (Evans et al, 2021) that whilst adopted terminology may vary, the traditions associated with SE share a common aim to equip future citizens with the necessary competencies to respond to complex 21st century challenges. However, to our knowledge, teacher educators' understanding of the disciplinary nomenclature has not been addressed in the literature, identifying a gap in the understanding of their conceptions of SE. So, whilst we know that there are important philosophical differences that influence choices of terminology (Sterling & Thomas, 2006), we do not know to what extent or how these are taken up by these specific teacher educators, or by teacher educators in general. Given how fundamental this is to how SE is taught in ITE, this deserves a deeper investigation.

Contradiction in teacher educators' conceptions and practices

The findings from this research point to an interesting contradiction between how teacher educators conceive of SE, SE in ITE and some of the pedagogical practices

they apply. Within the field of SE there is an emphasis on active, experimental and participatory pedagogical teaching and learning approaches. It is believed that such approaches, labeled sustainability pedagogies (Cotton & Winter, 2010; Sterling, 2012; Burns, 2015) and ESD pedagogies (McKeown, 2012), provide the most effective strategies for developing learners' capacity to act for sustainability (Sterling, 2012). Certainly, teacher educators in this study report using integrated, interactive and experiential pedagogical strategies (evidenced in Theme 2) that align with the scholarship of sustainability and ESD pedagogies. However, when asked to explain their conceptions of SE and application in ITE, teacher educators' explanations aligned with the literature in recognizing that SE invites "a kind of [different] approach to learning" (TE5 Scotland). Most stressed the need to engage student teachers in hands-on, critical reflection and inquiry into real-world experiences that focuses on exploring local issues, such as found in place-based learning. For example, debates about sustainability issues such as climate change, taking student teachers on walking tours around the campus to "learn to observe", "read the landscape" or "look for lost rivers" (TE1 Canada). However, the contradiction arises when teacher educators were prodded to expand on their conceptions of SE and SE in ITE and gave explanations that aligned with a cognitive teaching and learning approach (evidenced in Theme 1), which centres around metacognition and understanding information and concepts (Fetherston, 2006). For example, this was evident in teacher educators' response that SE concerns "issues and how to address the issues" (TE1 Australia), and "getting students to think disciplinarily and then interdisciplinarily" and to "explore questions of justice and power" (TE1 Scotland). In the words of one teacher educator:

> SE concerns learning about our environment, our natural environment, the global environment. Thinking about sustainability, social environmental justice issues, about equity for all, thinking about power, who's got the power and who doesn't …. It's about sharing. And I share with [students] a little bit about some research that I would love to do but haven't started yet about climate activism, learning for sustainability, critical literacy in the early years (TE2 Scotland).

Going beyond cognitive approaches to learning is important if SE is to empower "citizens to take informed decisions and responsible actions for environmental integrity, economic viability and a just society" (UNESCO, 2014, p. 20). If we consider that cognition refers to mental activity such as thinking and remembering (Kendall & Marzano, 2006), the application of a cognitive learning approach to teaching and learning SE leans towards understanding sustainability information and concepts over adopting active, experimental approaches to overcome sustainability problems, as promoted by SE scholars. As one teacher educator noted:

> If it's purely a cognitive engagement, we're not unsettling or resettling or really shaping. Your educational experience is significant, so really important. Part of that is establishing as best as one can, a strong community connection, so do that through multiple kinds of intentional ways to bridge and build relationships amongst our learners in our classrooms (TE1 Canada).

While teacher educators reported using a range of sustainability and ESD pedagogies for teaching SE, such as highlighting the importance of relationality, it is not possible for us to comment on the extent of the balance between cognitive learning and SE approaches as findings in this study are based on self-reported practice. If we further consider that teachers' pedagogical decisions are shaped by their conceptions (Aarnio-Linnanvuori, 2019; Hart, 2003; Moroye, 2009; Morrison, 2018), then further investigations into teachers' conceptions and the teaching and learning of SE is merited.

Insights and recommendations for further research

This research study took an exploratory approach to investigate teacher educators' conceptions of SE across three countries to answer the call for further research into this field about which little is known (Evans et al, 2017; Goller & Rieckmann, 2022). The study is underpinned by the theoretical premise that the way teacher educators conceive SE and SE in ITE influences their thinking, and their teaching and learning. Analysis of interview data supports this link, in alignment with earlier findings by Hart (2003) that teacher thinking shapes the way they view, design, and implement SE in practice. Interviews demonstrated that there is a lack of consensus in how teacher

educators from three countries conceive of SE, as well as differing rationales for integrating SE into their ITE courses. Many drew inspiration from the work of the UN (2005, 2019) and the SDGs in their framing of SE, utilizing both traditional and more progressive pedagogical strategies. Despite the rapidly growing recognition of the climate crisis in the 21st century, teacher educators continue to experience significant barriers and challenges in offering SE in their ITE programs, including a need for increased professional development to mature specific SE teaching practice, and the need for greater institutional and political support for SE. However, they were also quick to see the opportunities in conjunction with these challenges, including destabilizing established norms in their ITE program, and encouraging future thinking about the wider purposes and processes of education with their student teachers.

As an exploratory study, the purpose of this research was to build on the limited insights in the current literature into teacher educators' conceptions of SE and SE in ITE to purposefully generate areas for future research. However, the limitations of this study are clear: a small sample of teacher educators, restricted interview time, and lack of access to observe how these teacher educators' conceptions of SE manifest in their teaching practice. There is scope to further expand this work by exploring assessment in SE. Assessment is a broad and complex component of teaching and learning which to date has received limited attention in SE (UNESCO, 2017; Redman et al., 2021; Scherak & Rieckmann, 2022). However, due to the limited nature of this study, the authors did not include assessment as part of the research design and discussion topic with research participants. Moving forward we recommend more time and resources be given to researching how teacher educators' conceptions of SE manifest in their teaching, curriculum, and assessment practices. In particular, we identify three key areas for future research.

First, we suggest focusing on how teacher educators' nuanced conceptions of SE influences what and how they teach about SE, as well as what student teachers learn about SE from their approaches. Second, we recommend further investigation into the tentative contradictions this study has found between teacher educators' conceptions of SE and their SE teaching practice. Given we are in an era when clear, purposeful and

consistent teaching of SE is urgently needed to deepen education's role in addressing the climate crisis, then research that reduces contradictions and confusion within SE in ITE is vital. Third, and final, expanding on the point of assessment. We encourage researchers to investigate teacher educators' perceptions of and practices in assessment in ESE. For example, what type of assessment is appropriate and how can we use assessment to make a positive difference to students' learning for sustainability? These points of investigation will help to deepen understanding of teacher educators' conceptions of SE and offer the potential to improve the teaching of SE in ITE programs moving forward.

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