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Transformative learning, teaching and action in the most challenging times

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Transformative learning, teaching and action in the most challenging times

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Editorial: Transformative learning, teaching, and action in the most challenging times

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transformative learning, sustainability, sustainability education, higher education, sustainability challenges

Editorial on the Research Topic
Transformative learning, teaching, and action in the most challenging times

This Research Topic invited articles on sustainability-related transformative learning, transformative teaching, and transformative actions or practices in the field of higher education. The focus was based on the proposition that classic models of education have not managed to deal with the complexity of current socio-environmental world problems. Therefore, sustainability education should offer learning settings and promote learning processes that enable learners to critically reflect on their attitudes, values, paradigms, and worldviews, which may lead to conceptual change and thus transformative learning (Sterling, 2011; Balsiger et al., 2017; Rieckmann, 2020).

Transformative learning theory

With its roots in ancient philosophy, *transformative learning* has extended within twentieth-century critical enquiry to oppose hegemonic oppression. Transformative learning theory was developed by Jack Mezirow, inspired by several other scholars, among them Karl Popper, Paulo Freire, and Jürgen Habermas (see, e.g., Mezirow, 1991; Mezirow et al., 2009). As a teaching practice, transformative learning emphasizes critical thinking, reasoning, and reflection as ways through which to challenge the learners' assumptions and even transform their worldviews. In addition to higher education, the theory is applied to a range of formal and informal adult learning settings. Part of a broad

educational discourse, transformative learning has become popular in sustainability education (see Taylor, 2007; Lange, 2019; Wolff, 2022).

As editors, our intention was to bring together the most current theories and empirical studies on transformative approaches in sustainability education across higher education contexts. We particularly hoped to promote research exploring alternative, innovative, and critical ideas about how sustainability can transcend its entanglements with unreachable policy aims and make an actual difference.

The topics of the articles

The submissions engaged with a multiplicity of ideas on what transformative learning is. Four major themes are evident in the nine accepted articles with a total of 28 authors: competency discourses in relation to transformation, the role of emotions in transformative learning, the role of universities in relation to global policy, and the flexibility of transformative learning theories. The diversity within these articles reflects the significance of current uncertainty and the potential of transformation in educational practice.

Competency discourses in relation to transformation

Redman and Wiek undertook a vast systematic literature review to explore competencies for advancing transformations toward sustainability. Five established and three emerging key competencies were focused on. The authors focus on three emerging key competencies, and see these competencies as an integrated framework connecting science, education, and society in the transformations of the Sustainable Development Goals, and further. Jaakkola et al. propose a more critical view of competency thinking in sustainability education. Their article aim to develop a deep understanding of the concept of self-awareness, and on how the development of such self-awareness might be a necessary process for transformative learning.

The role of emotions in transformative learning

The importance of understanding the roles of emotions in what and how people learn about sustainability issues is central to the article by Singer-Brodowski et al. They emphasize the necessity for safe spaces within which learners navigate the uncertainty of current times. Environmental films created the emotional engagement of viewers in an online course, which was evaluated by Esmail and Matthews-Roper. In their article, the authors recommend viewer response strategies to support student engagement and learning about sustainability and climate change in higher education.

The role of universities in relation to global policy

Three of the articles in the special issue relate higher education to global policy. Wolff et al. explored transformation and transformative learning within teacher education programs. They compared policy advice on sustainability education offered by UNESCO and teacher education policy in Finland. Mpofu-Hamadziripi et al. adopted a case-study approach to compare transforming curricula from Austria and Zimbabwe. Arguing for synergies between the Global South and the Global North, they assert universities' agency in sustainability and change. Varela-Losada et al. recommend more research situated in diverse social-cultural contexts that is global, connected, and pluralistic. This is informed by a bibliometric analysis of publications on transformative learning for sustainable development.

The flexibility of transformative learning theories

Two of the articles assert that transformative learning has to be continuously developed. Rob VanWynsberghe questions the conceptualization of transformative learning in single courses or programs, and argues that becoming a practitioner in sustainability is a life-long and life-wide commitment involving both formal and informal learning. Friedman attempt a reorganization of transformative learning theory through the work of Vygotskian cultural-historical activity theory, and a newly synthesized meta-theory of learning and development. In so doing, he articulates research questions and hypotheses that may be amenable to observation and analysis.

Conclusion

At the time of writing this editorial, the validity of transformative higher education approaches *with sustainability* was again foregrounded. From June to August 2022, the weather was extremely warm in parts of North and South America, southern and eastern Asia, western and southern Pacific Ocean, Europe, and Antarctica. In some regions, it was the warmest ever recorded, with the fourth failed rainy season in the Horn of Africa. The Russian invasion of Ukraine saw much of Europe burning more coal. COVID-19 continued to frustrate the world and its universities.

It is challenging to imagine how universities that have experienced, maintained, or participated in the creation of the

unsustainable state of the world can transform to address the scale of these dilemmas. While the role of higher education is intricate, we believe sustainability education can and should continue to contribute to further development of transformative learning in higher education.

The complex challenges imply profound changes to thinking, practice, and socioeconomic models. Some of the articles in this special issue offer answers, others raise questions anew. What the special issue affirms is the need for change in many areas of education, including teaching, learning, research, actions, and policy.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Competencies for Advancing Transformations Towards Sustainability

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Advancing transformations towards sustainability calls for change agents equipped with a new set of competencies. Such sustainability competencies have been articulated with multiplicity and ambiguity, which is counterproductive to joint and accelerated progress. A unified framework of sustainability learning objectives would provide guidance to students, educators, and administrators of sustainability programs. To this end, we carried out a systematic review of the relevant literature. After scanning thousands of publications, we identified over 270 peer-reviewed articles of highest relevance, spanning two decades. Despite appearance otherwise, we found that there is a high level of agreement among scholars over the sustainability competencies that students should be trained in. Expanding on the five key competencies, namely, systems-thinking, anticipatory, normative, strategic, and interpersonal competence, that have gained widespread use, this article synthesizes the new suggestions made over the past decade into a unified framework. It centers on 8 key competencies in sustainability (the 5 established and 3 emerging—intrapersonal, implementation, and integration competence), which are complemented by separate disciplinary, general, and other professional competencies. This comprehensive framework of key competencies in sustainability is applicable across disciplines and can guide faculty, students, and practitioners in their joint efforts to advance transformations towards sustainability.

Keywords: learning objectives, sustainability education, transformations, change agents, key competencies in sustainability

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INTRODUCTION

To achieve the Sustainable Development Goals (SDGs) by addressing persistent sustainability challenges such as climate change, biodiversity loss, and socio-economic injustices requires ambitious and whole-scale transformations of societies worldwide (UNESCO, 2017; Scoones et al., 2020). Facilitating these transformations will require novel approaches (Linnér and Wibeck, 2019) that ought to be carried out by change agents who are educated in sustainability and sustainable development (Franco et al., 2019; Redman et al., 2021). In response, the number of sustainability programs at universities and colleges has substantially increased worldwide—to over 1,500 in the United States alone over the past decade (Weiss and Barth, 2019). Yet, critics have long noted that most of this education hews too close to the status quo (Orr, 2003) and graduates of these programs are equipped only to make incremental improvements, instead of being the change agents

capable of advancing transformations (Gordon et al., 2019). The characteristics of such *transformational* change agents should be reflected in the learning objectives of sustainability programs.

Yet, there still remains a lack of clarity and coordination regarding a unified framework of sustainability learning objectives (O'Byrne et al., 2015), which undermines effectiveness, innovation, and legitimacy of such programs (Vincent and Focht, 2009). Guidance is unlikely to come via high-level policy (Mochizuki, 2016), as neither the UNDESD, nor the more recent SDG 4.7, which calls for Education for Sustainable Development (ESD) globally (Giangrande et al., 2019), provide any explicit learning objectives, let alone a coherent framework for advancing transformations. In contrast, UNESCO has articulated how key competencies in sustainability can be utilized to develop educational programming around all seventeen of the SDGs (UNESCO, 2017).

Scholarly reviews of university sustainability programs (Trencher et al., 2018; Salovaara et al., 2020) and expert surveys (Rieckmann, 2012; Demssie et al., 2019; Brundiers et al., 2021) have brought those perspectives into the scholarly literature. At the same time, the growing number of scholarly works on sustainability learning objectives in diverse disciplines, from science and engineering to teacher education, has remained dispersed and thus does not offer coherent direction. Some literature reviews have been published, but these have either been large and systematic, yet, without a thorough synthesis (Hallinger and Chatpinyakoop, 2019), or synthesizing, yet, small and non-systematic (Lozano et al., 2017). In summary, there is a need for a comprehensive, systematic review which goes beyond description. This study offers such a review and synthesizes a unified framework of sustainability learning objectives to provide guidance to sustainability educators and accelerate transformations towards sustainability.

METHODS

Synthesizing a growing body of research such as that on sustainability learning objectives is best done through a systematic literature review (Snyder, 2019). We followed the procedures laid out by Fink (2014) to be systematic, explicit, comprehensive and reproducible. One of the goals of this study was to be as thorough as possible and identify almost everything that has been published on sustainability learning objectives. In order to be sure that definitional differences did not accidentally exclude relevant articles, we searched for synonyms of learning objectives. We sought to draw from as broad a pool of publications as possible; thus, we conducted our search on Web of Science, SCOPUS, ERIC, and Google Scholar. Based on other sustainability education literature reviews, we expected these databases to provide comprehensive coverage.

The exact search strings can be found in the supplementary materials, but in brief, we were looking for publications through the end of 2020, in English which described specific learning objectives (e.g., competencies, capabilities, and attributes) for sustainability education programs (degrees, courses, etc.). In line with the transformational framing of this review, education focused exclusively on incremental behavior changes (e.g., how to sort recycling material) were excluded. The identified publications went through an iterative screening process (**Figure 1**) to create a final collection of articles for review. At each stage, publications were only excluded when they clearly did not fit the above characteristics. For final inclusion, descriptions of specific sustainability learning objectives had to be identified in the text. In addition, each of the databases was screened for articles published or in press until August 2021, and the most relevant were included in the overall qualitative analysis.

For the analysis, bibliographic information as well as any information coded or extracted from the publications was imported into R (R Core Team, 2020) for analysis. A variety of analyses were performed such as text mining of the titles, keywords, and abstracts, citation analysis, and others. The learning objectives and their descriptions were extracted from each publication for both quantitative and qualitative analysis. The overall collection was also reviewed and synthesized qualitatively. Specifics and more details on the methods used for analysis can be found in the **Supplementary Materials**.

RESULTS

Study Selection

After duplicates were removed, we were left with 4,520 bibliographic entries to review. The iterative process is described in more detail in the PRISMA diagram (**Figure 1**), but essentially, we first made several passes to exclude those publications which were clearly irrelevant before reviewing the remaining ones. The collection ultimately contained 272 publications used for complete analysis plus 5 more from 2021 which were qualitatively reviewed only (see **Supplementary Materials** for a full list).

Increasing Publication Efforts and the Challenge of Convergence

Publishing on sustainability learning objectives only began in earnest this millennium and has grown continuously between 1997 and 2020 (**Figure 2**). Across the most relevant publications (n = 272), many perspectives are being represented among diverse scientific journals (more than 100), with the top 3 journals accounting for about one third (32%). Over half of the sampled articles (n = 143) were written for a particular discipline including teacher education (n = 32), business/entrepreneurship (n = 29), engineering (n = 29), and many more such as design, computer science, health, tourism, facility management, agriculture/food, and construction. Geographically, the sample is far less diverse with only 9% of publications coming from outside of the OECD member countries.

This varied body of literature converges in the intention to prepare students for contributing to sustainability transformations. Publication abstracts and titles typically include phrases explicitly referring to sustainability challenges

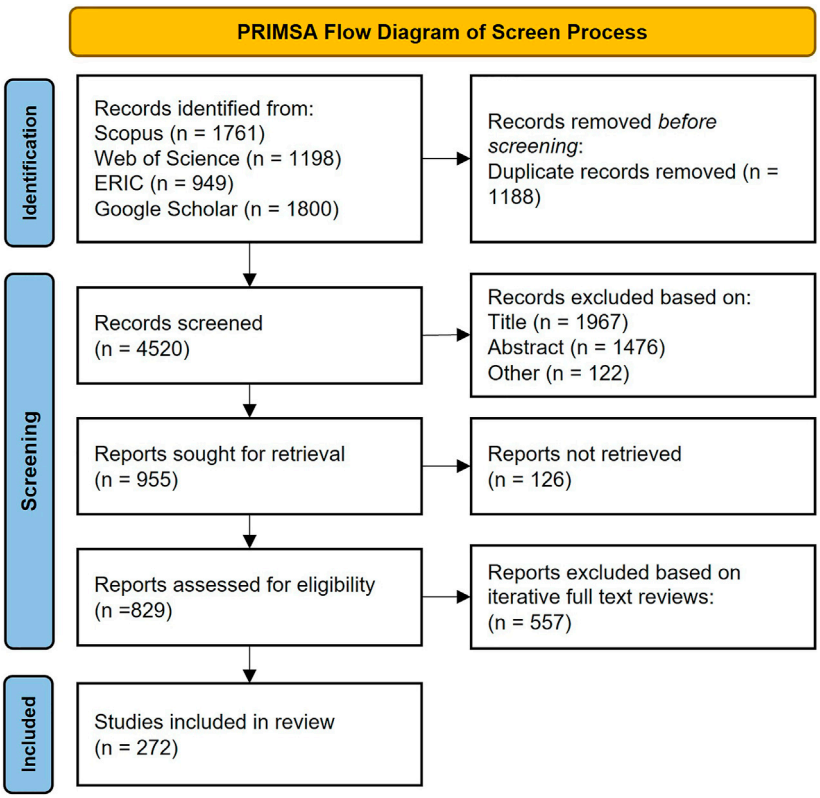

FIGURE 1 | PRISMA Flow Diagram Illustrating the Screening Process for this Study.

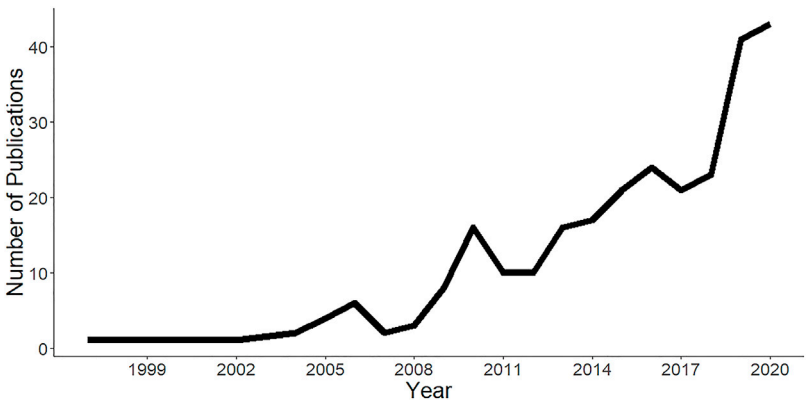

FIGURE 2 | Number of publications in collection (*n* = 272) by year (1997–2020).

(77%) and pointing to the need to address them (76%). This is grounded, to some extent, in the literature, with *Our Common Future* and the *UN Decade of Education for Sustainable Development* being the two most cited background references (by 23% of articles for each).

The conducted literature search included common synonyms for learning objectives, e.g., "literacy" (Dawe et al., 2005) and "attributes" (Barrie, 2006), with "competencies" emerging as the most widely used term (**Figure 3**). A competence is defined as "a complex combination of knowledge, skills, understanding, values, attitudes and desire which lead to effective, embodied human action in the world, in a particular domain (Crick, 2008)." Competencies are most often specified as independent of domain-specific content knowledge, which allows for articulating competencies across disciplines and professions. The competencies approach to education was broadly

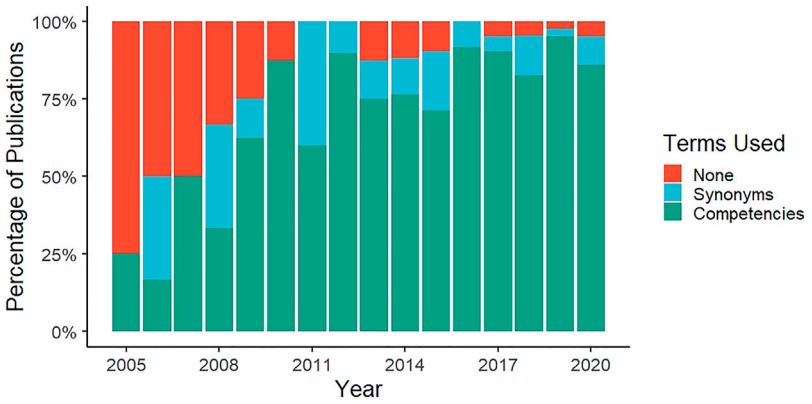

FIGURE 3 | Percentage of publications mentioning competencies versus all other synonyms ("literacy" etc.) in title, keywords, or abstract by year (2005–2020) (publications prior to 2005 (n = 10) were excluded for better presentability).

popularized beginning more than two decades ago through efforts such as the OECD-led initiative on "Definition and Selection of Competencies (DeSeCo)" (Rychen and Salganik, 2000). Yet, as late as in 2008, it was not seen as commonly used in sustainability education (Van Dam-Mieras et al., 2008), though with increased adoption since (Barth, 2015).

A common theme in the literature is that "no consensus has been reached within ESD discourses as to the process of how to identify essential abilities and as to a list of abilities seen as important" (Wolbring and Burke, 2013). Even as recently as 2021, scholars (and presumably practitioners) continue to operate as though there is "no agreement on exactly what these key competencies are" (McCarthy and Eagle, 2021). This position lends legitimacy to the current practice of continuously re-inventing sustainability competencies in the literature. At the same time, there is little explicit connectivity in the literature, with 40% of the articles (prior to 2019) not being cited by any others (in the whole sample).

Convergence on Key Competencies in Sustainability

Yet, when looking beyond terminological differences, we find convergence in the literature on what graduates and professionals need to be capable of to advance social transformations to sustainability. The 2011 review article "Key competencies in sustainability—a reference framework for academic program development" (Wiek et al., 2011) was the first articulation of this convergence. The authors synthesized from the literature a framework of sustainability-problem solving competence, integrating five key competencies, namely, systems-thinking, anticipatory, normative, strategic, and interpersonal competence. This article has been received as a unifying framework[•] and identified as "the most influential paper" in ESD (Grosseck et al., 2019, 26). Over the past decade, it has been cited by over 63% (n = 141) of the sampled articles published in 2011 or after (n = 225). The second most cited publication (Rieckmann, 2012) (by 25%) distills expert opinions into a list of competencies, without synthesizing a framework, while the third most cited publication (Barth et al., 2007) (by 21%) focuses on how competencies may be developed rather than offering a framework. Beyond citations, the 2011 key competencies framework has facilitated explicit convergence, being used as the full foundation in 32 articles (14% of the sampled articles published 2011 and after) and as a partial foundation in 78 articles (35%). Mapping this framework over the entire sample (n = 272) between 1997 and 2020 demonstrates convergence on these competencies (**Figure 4**). Interviews with sustainability professionals have found these competencies to be well recognized (Salovaara et al., 2020). In addition, this framework has been applied in many real-world contexts from university programs (Boone, 2015; Richard et al., 2017; Jarchow et al., 2018) to K-12 teacher training (Archambault et al., 2013; Kieu et al., 2016; Redman et al., 2018), K-12 education directly (Wiek et al., 2016; Rodríguez-Aboytes and Nieto-Caraveo, 2018), and training for in-service professionals (Thomas and Millar, 2016; Withycombe Keeler et al., 2017).

Updating the 2011 Key Competencies Framework

In the ten years since the publication of the 2011 key competencies framework (2011–2020), 110 articles were published that substantively engaged with the framework (beyond just citing it). Analysis of this body of literature identifies both insufficient receptions and productive suggestions relevant to an update (Wiek and Redman, 2021).

Indicative of the deficient, yet prevailing *list*-approach to competencies, scholars often acknowledge the relevance of the five competencies and then add a competence or two without offering how those might integrate into the framework and specifically contribute to sustainability problem solving (Heiskanen et al., 2016). Beyond the lack of adopting the *framework*-approach, many articles lack concise definitions and clear conceptual development of new competencies, a flaw called out by several other reviews (Sterling et al., 2017;

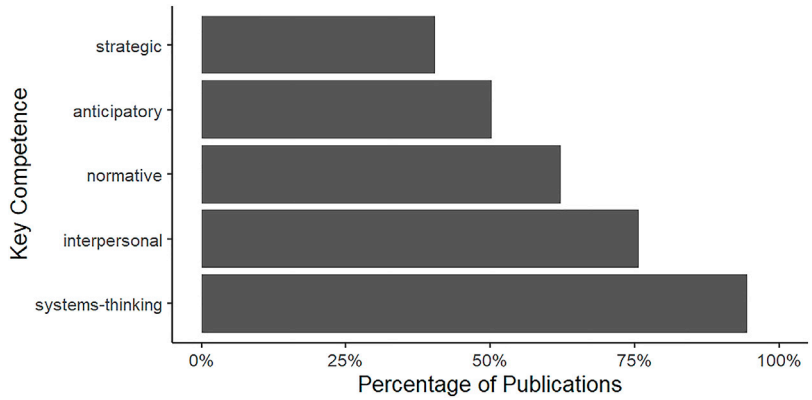

FIGURE 4 | Percentage of sampled publications (n = 272) on competencies that can be mapped onto the 2011 framework (1997–2020).

Galleli et al., 2019; Shephard et al., 2019; Wilhelm et al., 2019; Brundiers et al., 2021). One example is "action competence" (Mogensen and Schnack, 2010), which is frequently added to the 2011 framework, but often confounded with strategic competence (Lans et al., 2014). Another common reception is to emphasize general and disciplinary competencies such as creativity (Steiner and Scherr, 2013; Lozano et al., 2017) or critical thinking (Rieckmann, 2012; Fukushima et al., 2017). As explained in the 2011 framework (p. 211), while these are necessary competencies for solving sustainability problems, they are not *key* competencies, as they are not distinct to *sustainability* but considered learning objectives of education *in general* (Voogt and Roblin, 2012).

Yet, there have also been a number of productive suggestions to expand the framework. Most relevant are three emerging competencies (for definitions, see **Table 1**), which have been proposed with varying frequencies (**Figure 5**). *Intra*personal competence has been called out in several conceptual (Anderson, 2013; Frank, 2021) and empirical (Giangrande et al., 2019; Brundiers et al., 2021) studies; yet, there remains some disagreement on whether this is a competence (Gómez-Olmedo et al., 2020) or an underlying disposition (Brundiers et al., 2021). *Integration* competence has already been mentioned in the original framework (p. 212) and elaborated in an early update of the framework (Wiek et al., 2016); it has been mentioned frequently thereafter (Evans, 2019). The least frequent explicit proposal is for an implementation competence (see **Figure 5**). The 2011 framework focuses on the competence to *plan* sustainability problem solving, and only touches on competence to *implement* sustainability interventions and solutions. Some authors have argued that implementation competence deserves the status of a *key* competence in sustainability (Perez Salgado et al., 2018), which is in line with other more vague descriptions of strategic action competence (Frisk and Larson, 2012). There is emerging agreement that sustainability education ought to prepare students for *taking action* (Mogensen and Schnack, 2010; Frisk and Larson, 2012); more specifically, for "collective interventions" (Clark, 2016; Perez Salgado et al., 2018) towards "transformative social change" (Glasser, 2016). As indicated in the original version of the framework (*p*. 214), this is a call for *collective* sustainability problem-solving competence that goes beyond the capacity of individuals (Barth, 2015).

Framework of Competencies for Advancing Sustainability Transformations

The unified framework of competencies for advancing sustainability transformations centers on 8 key competencies in sustainability (with 5 established and 3 emerging), and is complemented by disciplinary, general, and other professional competencies (**Figure 6**; **Table 1**). As a framework, the key competencies are *not* compiled as a *list* to select from; instead, *all* key competencies need to be integrated for advancing sustainability transformations. Systems-thinking, futures-thinking, values-thinking, and strategies-thinking enable crafting sustainability action plans that yield sustainability outcomes if successfully implemented (which requires implementation competence). Inter- and intra-personal competencies (key professional competencies) enable that planning and implementation is undertaken in collaborative and self-caring ways—key factors for success (Sipos et al., 2008; Frisk and Larson, 2012). Finally, integration competence enables a coherent combination of collaborative and self-caring planning and implementation efforts, using established procedures for sustainability problem solving (Angelstam et al., 2013; Polk, 2014; Wiek and Lang, 2016; Henry, 2018). Complementary competencies are organized on two axes: disciplinary competencies complement the (content-independent) key competencies through content-dependent expertise; general competencies such as critical thinking and creativity as well as other professional competencies such as responsive project management are generic competencies (used in many different fields) that complement the sustainability-specific key competencies in efforts to advance sustainability transformations.

Competencies that fulfill important functions complementary to the key competencies in sustainability can be differentiated into disciplinary, general, and other professional competencies.

TABLE 1 | Definition and most common descriptors from the literature for each key competence in sustainability.

Competence	Definition	Descriptors from the literature
Systems-Thinking Competence	Ability to apply modeling and complex analytical approaches: 1) to analyze complex systems and sustainability problems across different domains (environmental, social, economic) and across different scales (local to global), including cascading effects, inertia, feedback loops, and other system dynamics; 2) to analyze the impacts of sustainability action plans (strategies) and interventions (how they change systems and problems)	Understand, identify, describe, analyze sustainability challenges and problems, complex issues, effects, relationships, impacts, patterns, structures, unintended consequences, feedback loops, context, interactions, etc. across different domains (environmental, social, economic), scales (local to global), and perspectives (interdisciplinary), etc.(Connell et al., 2012; Sandri, 2013; Gray, 2018; Levy et al., 2018; Schuler et al., 2018; Mahaffy et al., 2019)
Futures-Thinking Competence	Ability to carry out or construct simulations, forecasts, scenarios, and visions: 1) to anticipate future states and dynamics of complex systems and sustainability problems; 2) to anticipate how sustainability action plans (strategies) might play out in the future (if implemented).	Anticipate, foresight, envision, craft, analyze, and evaluate long-term future consequences, scenarios (multiple futures), and visions regarding intergenerational equity, future generations, uncertainty, etc.(Withycombe, 2010; Gardiner and Rieckmann, 2015; Ojala, 2017)
Values-Thinking Competence	Ability to identify, map, specify, negotiate, and apply sustainability values, principles, and goals: 1) to assess the sustainability of current and/or future states of complex systems; and 2) to construct sustainability visions for these systems; (3) to assess the sustainability of action plans (strategies) and interventions.	Identify, assess, negotiate, reconcile, reflect on, map, apply sustainability principles, morals, norms, ethics, goals, integrity, justice, conflicts, trade-offs, etc.(Remington-Doucette et al., 2014; Verma et al., 2016; Komasinkski and Ishimura, 2017)
Strategies-Thinking Competence	Ability to construct and test viable strategies (action plans) for interventions, transitions, and transformations toward sustainability.	Design, create, develop, test transformative, innovative, viable, feasible interventions, transitions, strategies, action plans, solutions, etc. considering barriers, inertia, path dependence, carriers, assets, etc.(de Haan, 2006; Wesselink et al., 2015; Fukushima et al., 2017)
Implemen-tation Competence	Ability to put sustainability strategies (action plans) into action, including implementation, adaptation, transfer and scaling, in effective and efficient ways.	Implement, enact, adapt, manage, transfer, scale action plans, strategies, change plans, intervention plans, governance initiatives, etc.(de Haan, 2006; Perez Salgado et al., 2018; Schank and Rieckmann, 2019)
Inter-personal Competence	Ability 1) to collaborate successfully in inter-disciplinary and -professional teams; and 2) to involve diverse stakeholders, in meaningful and effective ways, in advancing sustainability transformations.	Enable, motivate, facilitate interdisciplinary, transdisciplinary, cross-cultural collaboration in teams and among stakeholders through listening, compassionate communication, negotiation, conflict resolution, empathic leadership, etc.(Ulrich, 2016; Brundiers and Wiek, 2017; Sarpin et al., 2018)
Intra-personal Competence	Ability to avoid personal health challenges and burnout in advancing sustainability transformations through resilience-oriented self-care (awareness and self-regulation)	Reflect, motivate, have respect for, be responsible, be empathetic, self-care for identity, commitment, feelings, burnout, personal boundaries, limits of capacity, etc.(Glasser, 2016; Lozano et al., 2017; Giangrande et al., 2019)
Integration Competence	Ability to apply collective problem-solving procedures to complex sustainability problems: 1) to develop viable sustainability strategies (action plans); and 2) successfully implement them, in collaborative and self-caring ways.	Develop, apply, promote, make decisions to advance sustainability by using viable, equitable, and inclusive solution processes, procedures, frameworks, schemes, etc.(Jegstad and Sinnes, 2015; Hull et al., 2016; Wiek et al., 2016)

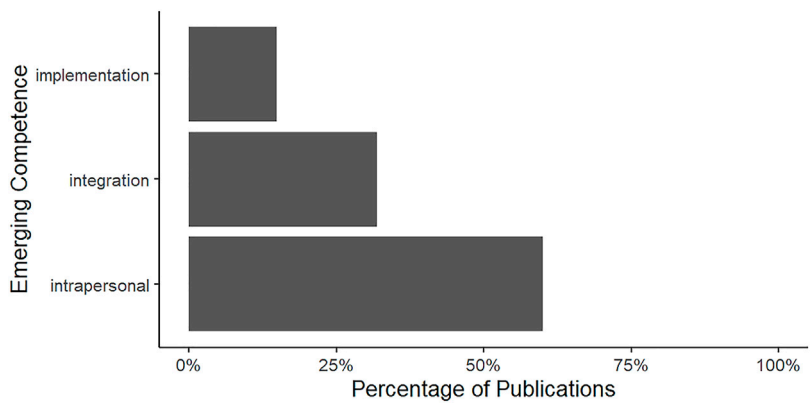

FIGURE 5 | Percentage of sampled publications (n = 272) that can be mapped onto the three emerging competencies (1997–2020).

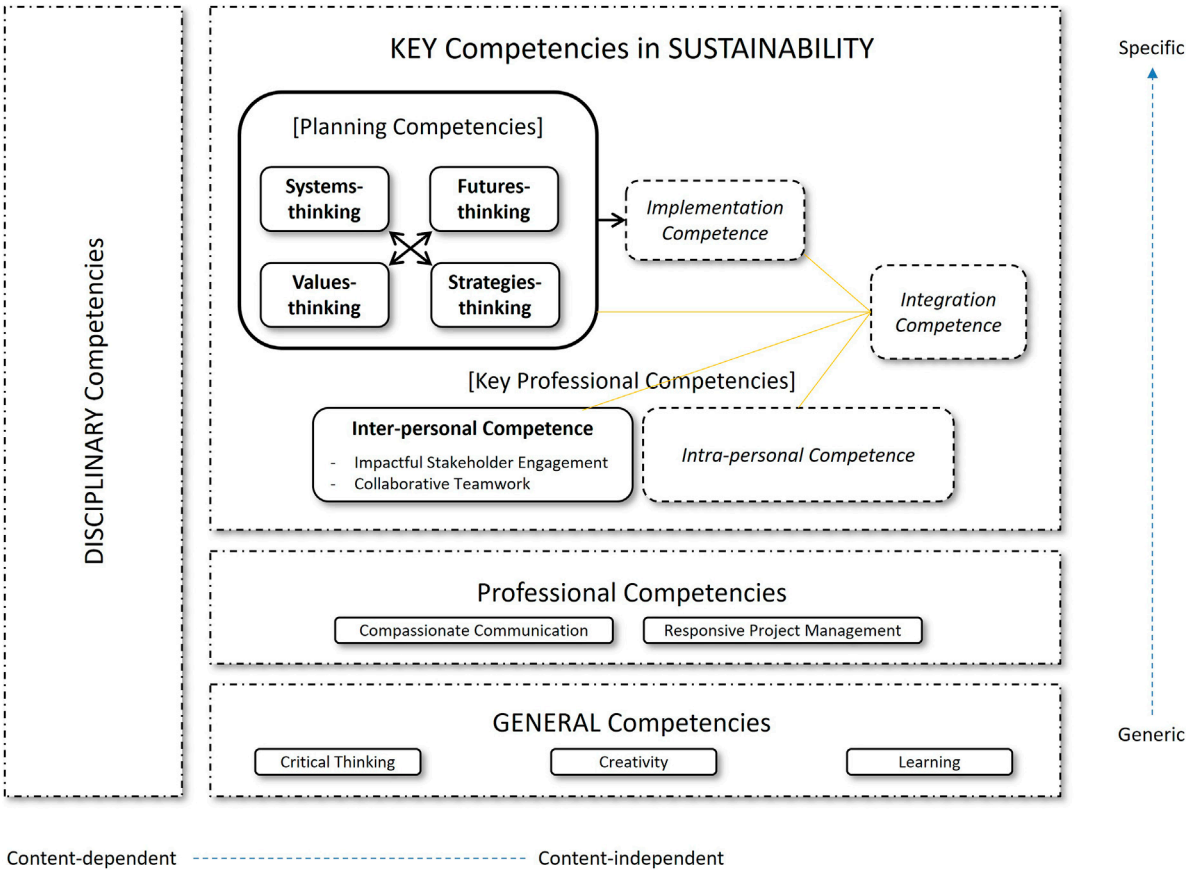

FIGURE 6 | Unified framework of competencies for advancing sustainability transformations; centered on 8 key competencies in sustainability with 5 established (bold) and 3 emerging (italic); and complemented by disciplinary, general, and other professional competencies.

Disciplinary competence: There is broad agreement that advancing sustainability transformations requires content-dependent competencies, e.g., on climate, water, energy, food, and international development (Dale and Newman, 2005; Demssie et al., 2019). Disciplinary specialties will be critical complements to the content-independent sustainability competencies, resulting in "t-", "pi" or "shield" shaped professional profiles (Uhlenbrook and de Jong, 2012; Conley et al., 2017; Pennington et al., 2020).

General: Although there are no universally agreed-upon general competencies, Binkley et al. (2012) distilled a broad sample of literature into a set of ten so-called "21st century skills". Three of these general competencies were also frequently mentioned in the literature reviewed in the present study and can therefore be considered important complementary general competencies for advancing sustainability transformations, namely, the abilities of critical thinking, creativity, and learning.

Professional Competencies: As indicated above, inter- and intra-personal competencies are considered key competencies in sustainability, shared mostly with other caring professions, e.g., medicine, nursing, social work. In addition, two other, more "regular", professional competencies, namely (advanced) compassionate communication and responsive project management, are important for advancing sustainability transformations on a more basic level (MacDonald and Shriberg, 2016; Brundiers and Wiek, 2017; Lozano et al., 2017).

DISCUSSION

This systematic review of the growing body of literature found, despite appearance to the contrary, a convergence on learning objectives in sustainability education around a discrete set of key competencies. In particular, the five key competencies described through a framework in 2011 (Wiek et al., 2011), namely, systems-thinking, anticipatory, normative, strategic, and interpersonal competence, have gained widespread use. Several productive propositions have emerged as well. Integrating the advances of the last decade, a framework of eight key competencies in sustainability is described, along with three classes of complementary competencies which form the best published scholarly knowledge of how to equip sustainability change agents to advance sustainability transformations. While this study focused on the

perspectives captured in the literature, reviews of university sustainability programs (Trencher et al., 2018; Salovaara et al., 2020) and expert surveys (Rieckmann, 2012; Demssie et al., 2019; Brundiers et al., 2021) largely align with the findings presented here.

Zooming into the review results, systems thinking is the most established of the planning competencies, followed by interpersonal competence, which is addressed in many project-based sustainability courses (Konrad et al., 2020) (**Figure 4**). However, these are the less transformative of the key competencies. Futures-, values-, and strategies-thinking competencies, so far established to a lesser extent, are critical for change that disrupts the status quo (Hsu, 2020). These competencies enable graduates and professionals to envision sustainable futures, based on the SDGs, and develop effective and efficient strategies (action plans) to achieve them.

Beyond this, the three emerging competencies are much more unconventional, if not controversial. First, the aspects included as intrapersonal competence (self-awareness and self-care) are not part of typical learning objectives (Shephard, 2008; Frank, 2021), and do not fit well with how competencies are generally defined (Shephard et al., 2019; Gómez-Olmedo et al., 2020). Yet, this points more to a broader issue in education: medical schools, for example, having long realized they need to address emotional, and not just intellectual development in students (Coombs and Virshup, 1994). Second, while addressing sustainability problems is a common theme in sustainability education at the university level (Brundiers et al., 2010), this does not usually mean fully preparing graduates for *doing* sustainability (Alvarez and Rogers, 2006). Implementation competence calls for that to change, yet, this is a largely unexplored space for university programs. Finally, this review showed that like other scientists, those in sustainability continue to dissect holistic processes (i.e., problem-solving), into constituent parts (i.e., lists of competencies, as in (Lozano et al., 2017)). Integration competence pushes against this tendency and urges an emphasis on educating for the connections between competencies.

Sustainability science has developed and adopted a variety of approaches to solving problems (Angelstam et al., 2013; Polk, 2014; Wiek and Lang, 2016; Henry, 2018), with initial attempts to explore how that can shape education (Wei et al., 2020). The unified framework centers on how professionals can best collectively engage in sustainability problem solving and advancing sustainability transformations. Through this foundation, the framework is explicitly *not* intended to serve any specific discipline but should be adoptable by *all* disciplines and fields (with some relevance to sustainability). The framework offers a base from which to build off and specify learning objectives in life science, engineering, business, or teacher's education, to name a few. To this end, the language of the unified framework has been further universalized (e.g., "normative" is often mistranslated), and discilenary competencies are now situated within this more extended framework.

The reviewed literature focused on publications in English, which underrepresents large regions of the world; a problem confirmed in other studies (Weiss and Barth, 2019). Indeed, there is, for example, a growing discourse in Latin America (in Spanish) around how to develop sustainability education (Dieleman and Juarez-Najera, 2008). We found that specifically with regards to learning objectives in sustainability little has been published (in English) by researchers from outside the OECD. After many early calls for it (Mochizuki and Fadeeva, 2010), publications from underrepresented countries have recently increased (23 of 25 identified were published in the last 5 years), but more comprehensive inclusion of these perspectives is needed.

CONCLUSIONS

The results of this study show that, despite terminological differences, there is substantive convergence in the literature on what change agents need to be capable of to advance social transformations to sustainability. On this basis, the article describes a framework of eight key competencies in sustainability, broadly applicable to sustainability education in all disciplines. The unified framework of key competencies in sustainability links science, education, and society in the joint effort of broadening and accelerating transformations towards the Sustainable Development Goals. This does not mark the endpoint of needed research, rather an opportunity to make much needed advances. Three immediate needs include: 1) research and development of the emerging competencies; 2) operationalization of the framework across disciplines, learning settings, and global contexts; and 3) testing the framework in real-world problem-solving settings. Even more fundamental though is the need for the community of scholars to come together and better coordinate their efforts. Complementary and comparative studies would overcome the current fractured structure of the field and allow for more robust and accelerated advances.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

AR and AW designed the research project together and structured the article and wrote the article together. AW secured the funding, and AR did the data collection and full literature review. Both authors approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2021.785163/full#supplementary-material

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Transforming Curricula in Higher Education: Description of Two Perspectives From the Global South and the Global North

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The paper is part of the broader narrative of transforming curricula in universities in Zimbabwe and Austria. The landscape in higher education globally is inexorably shifting as a result of major global forces of change. For that reason, higher education cannot remain immune to these global challenges and changes. Rather, universities should be the agents of change. Higher education in Austria and Zimbabwe, in response to these global challenges and imperatives, has begun the process of transforming curricula to educate graduates for the future. The paper explores the strategies that universities in Zimbabwe and Austria have initiated to be able to support students to make meaningful contributions to the global learning and sustainability narrative. The two central questions that this paper seeks to answer are: Which additional innovations in curricula and new epistemologies should universities in Zimbabwe and Austria implement in order to educate graduates for a sustainable future? What can universities in the South and in the North learn from each other? In attempting to reflect on these questions, pertinent lessons will be drawn from initiatives in Austria and Zimbabwe to build capacity to achieve the Education for Sustainable Development (ESD) agenda through various strategies.

Keywords: global learning for sustainable development (GLSD), sustainable development goals, North-South-perspective, transformational imperatives, higher education

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INTRODUCTION

This study reflects developments at universities in Austria and Zimbabwe. The North-South perspectives will be paramount for drawing lessons from the initiatives of the universities in the North and South with the goal of mutual learning. Sustainable Development Goal 4, aspiration 4.7 stipulates that by 2030 all learners acquire the knowledge and skills needed to promote sustainable development (UNESCO, 2017). A major role of the university in society is to generate and transmit knowledge which should ultimately lead to the transformation of society (Moscardini et al., 2020; Pee and Vululleh, 2020). This means that the design of curricula has to address the current dichotomy between knowledge and skills by embedding essential competencies which will impart "A complex of knowledge, skills, and attitudes that enable successful task performance and problem solving on real-world sustainability challenges and opportunities" (Wiek et al., 2011). For that

reason, it is imperative that higher education institutions in the twenty-first century question their role in society in order to be relevant to the global agenda of sustainable education (Steele and Rickards, 2021). The global landscape in higher education is inexorably shifting as a result of major global forces of change in the interwoven domains of economy and politics as well as in social, demographic, geospatial, and environmental developments. Higher education cannot, therefore, remain immune to these global problems and changes. Rather, universities should proactively be the agents of change if the goal of higher education is to transition society to one of education for the sustenance of livelihoods and the environment (Stephens et al., 2008). It is against this backdrop that higher education urgently needs to respond to the global changes by re-orienting curricula, teaching, and learning to educate graduates for the future. Two studies will endeavor to answer two key questions: Which additional innovations in curricula and new epistemologies should universities in Zimbabwe and Austria implement in order to educate graduates for a sustainable future? What can universities in the South and in the North learn from each other?

Frisk and Larson (2011) highlight that UNESCO provided the impetus for Education for Sustainable Development as early as the late 1990s when they declared that education is the most effective means that society possesses for confronting the challenges of the future. Indeed, education will shape the world of tomorrow. In a more recent UNESCO (2003), the United Nations Plenary Assembly proclaimed 2005–2014 the Decade of ESD. Current international United Nations programmes such as the Sustainable Development Goals—especially goal 4 "Quality Education" (UNESCO, 2017), the 2015 UNESCO Global Action Programme on Education for Sustainable Development (UNESCO, 2014), and the currently launched Programme ESD for 2030 (UNESCO, 2020)—show the significance of the issue.

From the UNESCO standpoint, education for sustainable development entails integrating key sustainable development issues into teaching and learning. This may include, for example, instruction about climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption. It also requires participatory teaching and learning methods that motivate and empower learners to change their behaviors and take action for sustainable development. ESD consequently promotes competencies like critical thinking, systems thinking, futures thinking, values thinking, strategic thinking, and collaborative problem-solving (UNESCO, 2003).

The concept of global learning has been encapsulated in ESD into a paradigm referred to as Global Learning for Sustainable Development (GLSD) which "includes the objective of resolving global problems, involving critical thinking, skills, and values, as well as socio-cultural awareness" (Anderberg et al., 2009; Nordèn and Anderberg, 2010). The global learning perspective means that students are exposed to problems in a global context to broaden their approach to issues and entrenches critical thinking and innovative skills (Senge et al., 2006; Sterling, 2011; Wals and Corcoran, 2012). For this to be achieved, Anderberg et al. (2009) and Nordèn and Anderberg (2010) call for cooperation and collaboration between the North and South on GLSD with the aim of bringing diversity, multilingual aspects as well as various local experiences into the global arena. Two interrelated issues can be distinguished: (a) The general issue that GLSD includes bringing indigenous knowledge systems and local knowledge into the global arena, for instance being able to benefit from both one's own local knowledge and other local knowledge from various parts of the globe, (b) the question of how to do so in African as well as in European contexts.

The paper consists of the following sections: the context which provides the background to the two cases under study; the next section presents an insight into the reforms undertaken in the North and South to transform the curricula in these contexts; this is followed by a discussion and finally a conclusion to the paper.

CONTEXT

The paper compares two cases of approaches used for ESD/GLSD in higher education. It is acknowledged that the cases to be compared are different in many respects, but as pointed out by Goggin (1986), the logic for the authors' case selection is to maximize the differences of the phenomena to be examined in order that the universities in the North discover new insights from the case in the South and vice versa. In a networked world, forging collaborations and partnerships with other higher education institutions becomes paramount with the goal being mutual learning.

Zimbabwe has 18 universities (state-funded and private), 8 polytechnics, and 14 teacher training colleges. Efforts are being made to "remodel university curricula to improve the competitiveness of local tertiary qualifications" (Tirivangana, 2019). The initiatives by the Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development (MHTEISTD) are a response to the African Union's Agenda 2063 (The Africa We Want) which has 7 aspirations and 20 goals, the 17 Sustainable Development Goals (SDG) espoused by the United Nations. Agenda 2030 and the SDGs have similar goals in their broad plan of the socioeconomic transformation of societies. In that regard, higher and tertiary education in Zimbabwe is being aligned to these dictates and has thus espoused the transformation of curricula so that it is able to foster key competencies and skills in graduates which will enable them to respond to the needs of their local societies and the country in general.

This transformation agenda has been done through two initiatives, namely, the Education 5.0 thrust that includes innovation and industrialization to the university mandate in line with the Sustainable Development Goals and the harmonization of the minimum bodies of knowledge in the course content in universities with the aim of ensuring that all higher education institutions infuse sustainable development.

Austria has 22 public universities and 14 university colleges of teacher education. The discussion of sustainability in teaching has a long tradition in Austria in the tertiary sector. The UN Decade

for ESD was the initiator for sustainability lecture series and both interdisciplinary and inter-university courses at all universities in Austria. With the launch of the Sustainable Development Goals, Austria made a clear commitment for their implementation. The main tool for this is the Overall Austrian University Development Plan. This plan is a technical and strategic planning instrument of the Federal Ministry of Education, Science and Research, which serves to shape the overall Austrian university landscape. It serves as the basis for the development plans and for the performance agreements of the public universities. Sustainable Development is a central topic in the performance agreements between the Federal Ministry of Education, Science and Research and the universities. Furthermore, the Austrian universities are members of the Austrian University Conference (uniko) and signed the uniko-manifest for sustainability that highlights the responsibility and role of Austrian universities to make a significant contribution to sustainable development.

Another initiative shaping the development of Austrian universities with regard to ESD is the Alliance of Sustainable Universities in Austria and its Universities and Sustainable Development Goals project (UniNEtZ), which will be described in further detail in the next section.

INSIGHTS INTO THE REFORMS IN HIGHER EDUCATION IN ZIMBABWE AND AUSTRIA

Insights From Zimbabwe

This section will present insights into the recent and ongoing reforms that have taken place in higher education in Zimbabwe. The underlying thread of these reforms is the infusion of the Sustainable Development Goals, in particular, Goals 4 and 9, into curricula. The reforms which will be highlighted here have taken place within the past 3 years with the intent of the university becoming responsive to the global changes by starting dialogue on transforming curricula to educate graduates for the future.

Example 1: Infusing the Heritage-Based Philosophy in Curricula for Sustainable Development

One transformation that has occurred in curricula in Zimbabwe is the Education 5.0 thrust in higher education. Previously, higher education in Zimbabwe focussed on three missions, namely, teaching, research, and community service. With the changing dynamics in the global arena and with the fourth Industrial Revolution which requires a different set of skills, the form of education that was currently prevailing in the higher education sector in Zimbabwe was proven to be inadequate particularly in light of the global problems that graduates will be expected to deal with at a personal and collective level. In an attempt to foster attributes that promote sustainability and alignment to global learning, the thrust of Education 5.0 includes five missions that focus on teaching, research, community service, innovation, and industrialization with the goal of educating graduates who will be well equipped to contribute to the economic and social development of the country. The overall aim of Education 5.0 is to industrialize the economy through research and innovation which will ultimately promote sustainable economic development. Education 5.0 is couched on the heritage-based philosophy in that science and technology development will exploit the natural resources and environment, local knowledge, and culture. This resonates with Agenda 2030 whose plan of action is for people, planet, and prosperity, thereby this reform will ultimately drive social change and motivate sustainable development.

Lessons Learned

The reforms in higher education in Zimbabwe as outlined herein are attempts to educate graduates for the future; graduates who possess creativity and innovative skills to produce goods and services and who will ultimately become key players in sustainable development. Further, the heritage-based philosophy is based on a people's resources, history, monuments, tradition, religion, language, philosophy, physical and metaphysical environment. This means that in teaching and learning, locally available natural resources and solutions will be made reference to in addressing local problems. Education will therefore cease to be divorced from the local context, but is being re-imagined so that it is able to improve livelihoods and promote sustainability. This approach will ensure that quality teaching is achieved and that the knowledge that students are exposed to as well as the knowledge that they access are in sync with transformative teaching and learning (Förster et al., 2019).

Example 2: Harmonizing University Curricula

The other reform in higher education in Zimbabwe is the harmonization of core modules of similar degrees through the Minimum Bodies of Knowledge and Skills (MBKS) program. This reform requires 80% commonality in the core modules offered by universities while still leaving room for the introduction of some minimal (20%) unique aspects at the institutional level. What can perhaps be commented on at this juncture is the room for creativity that has been given to individual institutions. This is where these institutions can take a leaf from initiatives from other countries and cultures in their quest to offer ESD-informed programs.

The MBKS program was formulated and agreed upon by program experts in the different universities. Several meetings involving key stakeholders were held over a period of 1½ years. At these meetings, similar programs offered by different universities had their minimum bodies of knowledge agreed upon so that what is taught in university A is similar to university B. These meetings were attended by faculty/institute heads, selected senior scholars, professional bodies and associations, relevant ministries, and student representatives. Programs and courses/modules were discussed according to disciplines. It was at these meetings that program experts and representatives of the respective disciplines deliberated on and consolidated their academic programs. This approach will facilitate the hassle-free transfer of students between institutions without compromising the quality of their program of study and also without prejudicing their credit scores.

Lessons Learned

This exercise has played a role in the benchmarking of programs locally. The experience from faculties at different universities who have been undertaking course review attests to the fact that the process has now been made manageable because the reference point has already been established through the agreed course synopses. It is only the 20% that represents the additional content that a lecturer has to develop. The operationalization of this reform is still ongoing, hence lessons that can be derived relate to the process of formulating the MBKS. Vital lessons will undoubtedly be learned in a couple of years once the programs have gone through their cycle.

Insights From Initiatives in Austria

The Austrian examples were chosen because they are innovative and not isolated initiatives but connected to the University as an organization (Example 1) and are part of an Austrian-wide network (Example 2). Additionally, these examples are selected because the authors were involved in both of the initiatives. Evaluations and reports from both initiatives form the data basis for the selection and the presentation (Hübner et al., 2014; Weberhofer et al., 2020).

Example 1: A University on the Way to Implement Sustainable Development

The first Austrian case at the University of Klagenfurt focused on an interdisciplinary elective "Sustainable Development," which is intended as an instrument for the implementation of sustainability at the University of Klagenfurt. The development plans of the University of Klagenfurt since 2006 have included sustainability as highly relevant from a social and cultural science perspective (Hübner et al., 2014).

In light of some current empirical literature (Bray, 2008; Ellis and Weekes, 2008), the team of course lecturers decided that the teaching and learning methods to be chosen within the elective Sustainable Development have to be based on the following principles: inquiry-based learning, problem- and research-based learning and building of learning communities. Additionally, Sustainable Development has to be viewed from different disciplines. Hence, the course contributes to fulfilling the requirements of Education for Sustainable Development in higher education, while helping students to gain important theories, competencies, and methods to meet the demands of the present time and to ensure a future that is worth living.

The dimension of traditional, regional knowledge comes into play when focusing on local regions in the province of Carinthia where the University of Klagenfurt is located. One of these regions is the biosphere Carinthian Nockberge. In 1980, the Carinthian public made a forward-looking decision: the Nockalm was not to become a ski circus, but was to serve as an exemplary alpine region and as a habitat and recreational space for future generations. Protecting the diverse flora and fauna is just as important as preserving the countrified scenery and local knowledge in agriculture, health, and nutrition. UNESCO recognized these efforts in 2012, awarding the natural protection site the designation Biosphere Reserve. The focus is on the combination of natural biodiversity, cultural characteristics, sustainable farming, and international research. The biosphere reserve Carinthian Nockberge has a partnership with the University of Klagenfurt, called science_link Nockberge, with the goal to support collaborative learning and research, for example, in the context of master's and doctoral theses (Falkner and Rauch, 2020). Furthermore, the University of Klagenfurt accompanied several projects that investigated unique Austrian traditions, knowledge, and intangible cultural heritage in remote regions, like the cultivation and processing of flax in the Lesach Valley (Strohmeier et al., 2015) or the traditional baking of bread. The center of the research focus was the dynamic process of transfer and application of local knowledge and practice, as well as the meaning of living traditions for the local community. The reflection of intergenerational encounters with local cultural heritage required a manifold process of communication and interaction.

Lessons Learned

After the course was held for the first time, an external professional was commissioned to evaluate interviews with the core teaching team. The interview guide covered the process of the development of the course as well as the experiences of the interviewees during the first implementation phase. The six interviews were transcribed and categorized using the method of qualitative content analysis (Mayring, 2014). The findings were reported back to the development team. Based on these data and ongoing reflections of the teaching team, the following lessons learned could be extracted:

- Pedagogical innovations are always unique, depending on the institutions involved, the region, historical paths, the educational culture in which it is embedded, and last but not least, the acting personalities.
- The process of implementing Sustainable Development (SD) at the University of Klagenfurt started in 2005 when it was mentioned in the development plan; thus, it has been running now for more than 16 years. However, the question still remains: How can SD be brought into existence at the university as a place of organized rationality? Closely related to this question is the one of how the collective process of decision-making takes place within the university.
- The internal evaluation of the pilot course by a colleague interviewing most of the participating students and the teaching staff helped tremendously in going beyond a superficial understanding of the course's successes and weaknesses. It became a useful basis for revising the course.

Example 2: Project UniNEtZ—Options Paper for the Achievement of the Sustainable Development Goals in Austria

UniNEtZ brings together academics and artists from 16 Austrian universities as well as external partners. The overall aim of the project is to develop strategies to realize the UN Sustainable Development Goals (SDGs) in Austria. From 2019 to 2021, an option report will be developed, intended to help the Austrian government to implement the SDGs. As the SDGs are mutually shaping each other and can only be realized through inter- and transdisciplinary thinking, UniNEtZ represents a broad spectrum

of expertise from subject areas such as social sciences, science, technology, engineering, and mathematics (STEM), and the arts. A number of synergy effects are likely to emerge as a result of the project, including the implementation of sustainability in research and teaching as well as a stronger collaboration between universities and society.

Member universities have taken on the role of coordination and participation of individual SDGs. While coordinating universities manage and gather activities and knowledge, participating universities engage in terms of content. All member contributions are equally valued and much appreciated. Through this intensive cooperation and professional discussion of SDGs, contributions are collected, critically examined, and modified in order to develop different options. The networking between universities and the implementation of the SDGs in research, teaching, and society is at the heart of UniNEtZ.

The University of Klagenfurt and the University of Innsbruck have taken on the coordination role of SDG 4 "Quality Education" in Austrian higher education Participating members of SDG4 are 14 universities and stakeholders. The SDG 4 group currently has around 80 members. Regarding SDG 4, the latest reports show the positive developments in quality education in Austria in recent years. In the Subgroup SDG 4, the appreciation and reflection of local knowledge is part of the central concepts of ESD. A position paper was developed which resulted out of the expertise of SDG 4 participants as well as existing studies and literature. The SDG groups are currently working on specific options to implement the goals of SDG 4.[1] These options are summarized in two levels: Level one focuses on the fundamentals which relate to the whole education system, such as observing the principles of education for sustainable development, global citizenship, and digitalization. On a second level, the options are categorized in the following areas: Early childhood education (kindergarten, preschool), School-age education (primary, secondary, extracurricular education), Tertiary Education (universities, technical colleges, university for teacher education), Adult education (formal and non-formal).

Lessons Learned

The development of (self) critical reflection and process competency is essential not just for individuals but also for groups, organizations, or social subsystems. Such a common (social) learning process requires the development of additional skills, such as the ability to make collective decisions and act on the basis of deliberations. The ability to empathize is also essential. Thinking about others, experiencing and enduring value contradictions, also emotionally, makes it possible to deal with moral claims that result from the normativity of the sustainability concept (Rauschmayer and Omann, 2012).

For the purposes of drawing inferences, it can be summarized that the participating universities have taken a move to participate actively through the systemic coordination of the SDGs with the aims of addressing the Sustainable Development Goals across faculty and across the university and identifying possible areas of research. The other aim and perceived benefit of this initiative is capacity building in research in Sustainable Development in lecturers and students. UniNEtZ is a trial that the universities in Austria try to put initiatives in place which drive the Agenda 2030 and create new frontiers of learning and research.

[1]https://www.uninetz.at/nachhaltigkeitsziele/sdg-4-hochwertige-bildung

DISCUSSION

The World Data on Higher Education (UNESCO, 2010) states that education is expected to contribute to national and economic development. The transformation of higher education in Zimbabwe through the MBK/S and the two examples from Austria show that the global agenda that higher education should espouse ought to resonate with the Sustainable Development Goals and Agenda 2030 (UNESCO, 2017).

The introduction of the course on Sustainable Development in universities in Austria and the benefits derived therefrom, serve as an impetus for higher education in Zimbabwe to continue with the transformation trajectory. The initiatives from the global North have borne fruits and have imparted key skills and competencies that have transformed the higher education system from being merely examination-driven. This means that if the efforts to transform higher education are supported and implemented, the learning achievement for higher education in Zimbabwe will eventually transform from being "academically and examination-driven" (UNESCO, 2010), to an education that drives social change, realizes returns on investments and also one that achieves SDG4.7. The dominant narrative in contemporary times should thus be about the relevance and impact of higher education on socio-economic development. Going forward, the accreditation of modules/courses and not just degree programs could be a way of improving quality as well as ensuring that curricula continue to respond to the global challenges.

Also, the local experiences advocated for ought to be considered within the broader narrative of the pivotal role of indigenous knowledge in education for sustainable development. Local indigenous knowledge should be accorded enough space in the Sustainable Development Goals because in local knowledge ways to mitigate some of the local and global problems are enshrined (Santos, 2014). The proposition by Anderberg et al. (2009) of collaborations between universities from the North and South is befitting of the global learning paradigm as it would expose students and staff to the problems besetting societies in other parts of the world and how those problems are being resolved at the local level. The lessons to learn from this inter- and transdisciplinary approach are that students, lecturers, and researchers work out relations and options for joint actions and reflect on these actions (Hübner et al., 2014) which is crucial for the success of Education for Sustainable Development.

CONCLUSION

A question was posed at the onset of this paper: What can universities in the North and in the South learn from each

other? The simple answer is that cooperation and synergies in various areas need to be encouraged between universities in the North and South for the benefit of both staff and students. These synergies will include pedagogical innovations such as the implementation of active learning strategies, the use of local knowledge, as well as the introduction of guidance for teaching. Staff and student exchange programs can also be pivotal in bolstering the exchange of knowledge and expertise. The synergies will be beneficial to both North and South contexts. The insights presented from the initiatives to transform curricula in universities in the North and in the South are valuable milestones that can be drawn upon to inform the cooperation and also inform future curriculum planning and design. The innovative teaching approaches could incorporate practical problems that call for action research (Gibbs et al., 2017), as a way of promoting the participatory approach in teaching and learning.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

NM-H and FR: conception of the manuscript, contribution of cases, and writing. MD: co-writing. All authors contributed to the article and approved the submitted version.

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Facing Crises of Unsustainability: Creating and Holding Safe Enough Spaces for Transformative Learning in Higher Education for Sustainable Development

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The multiple crises of unsustainability are provoking increasing stress and unpleasant emotions among students. If higher education is to fulfill its mission to support transformation processes toward sustainable development, it must adapt its pedagogical approaches to help students deepen their critical thinking and empower them to engage in these transformation processes. For this reason, emotions – which can also prevent critical thinking – should be carefully addressed within transformative learning journeys. However, these journeys are themselves challenging for learners and educators. They push them to abandon stable meaning perspectives, causing feelings of incoherence and tension. Learners need safe enough spaces to navigate these situations of uncertainty. The central questions of this manuscript are: What is meant by safe enough spaces? How can learners, educators, and higher education institutions create and hold such spaces? These questions are explored on three different levels: (1) the intrapersonal level, (2) the interpersonal level, and (3) the organizational and systemic level of discourses in higher education. For the intrapersonal level, perspectives inspired by neurobiology are used to discuss reaction patterns of our autonomous nervous system and present insights into stress development. Learners should feel bodily safe when engaging in transformative learning processes. This is supported by balancing the challenges learners face with the resources they have. For the interpersonal level, the manuscript argues that focusing solely on rational discourse is insufficient to support safe enough spaces for transformative learning. We call for a culture of edifying conversations supported by respectful relationships among learners, as they are more adequate for regaining self-direction. For the organizational and intertwined systemic level, the ambition is followed to make higher education institutions offer learning environments that feel safe enough for all involved. However, as these institutions are strongly influenced by dynamics of economization and competition, they do not necessarily empower learners to challenge and disrupt unsustainable and neoliberal

discourses. The manuscript explores how learners and educators can cultivate engaged critique by acknowledging their own embeddedness in neoliberal dynamics and opening up so-called transformative spaces for institutional change. Finally, recommendations for educational practices in higher education for sustainable development are offered.

Keywords: transformative learning, safe space, emotions, higher education, sustainable development, critical thinking, climate crisis, stress

INTRODUCTION: FACING CRISES OF UNSUSTAINABILITY

Unsustainability crises are increasingly serious. Critical tipping points in global ecosystems have already or nearly been reached (Lenton et al., 2019), causing unpredictable dynamics. Against this alarming background, education for sustainable development (ESD) is facing enormous challenges, particularly in education systems in the Global North, which are hardly capable of taking into account the emotional condition of learners. Individuals are increasingly affected by the consequences of unsustainability crises, leading to emotional reactions that are difficult to deal with. Some authors argue that there is a need for education that prepares people of all ages for the potential of an interconnected planetary and social systems' collapse (Andreotti, 2021) and education for the end of the world as we know it (Stein et al., 2020). This form of education must account for learners' stress and emotional challenges.

There is a growing research strand about learners' emotions in the context of the climate crisis: anxiety (Ojala, 2016), worry (Ojala et al., 2021), guilt about being "implicated subjects" in high-emission societies where individuals cannot easily follow a more sustainable lifestyle (Bryan, 2020, based on Rothberg, 2019), grief about the loss of species (Verlie, 2019), powerlessness and helplessness. Climate knowledge is seen as "difficult knowledge" (Bryan, 2020, p.15, based on Britzman, 1998) that can increasingly be compared to knowledge about war or genocide. Its content is "traumatic or hard to bear" and leads to "learning encounters that are cognitively, psychologically and emotionally destabilizing for the learner" (Bryan, 2020, p.15).

In a way these unpleasant emotions are a healthy response to the global crisis of unsustainability: they show that individuals increasingly acknowledge and feel the dangers that are lying ahead of us (Cunsolo et al., 2020; Ojala et al., 2021). But at the same time the dynamics of unsustainable development and related emotions are causing many symptoms of stress and people are starting to think and feel about the global crisis of unsustainability in a way that prevents them from taking action. Emotions can be viewed as necessary for profound learning; but they can also cause learning blockages. Additionally, they have the potential of causing resistance to or even denial of the existence of problems.

Transformative learning is a theory that allows for looking at the conditions that learners need in order not to disconnect from unpleasant, even stressful emotions or remain in automated stress reactions (Mälkki, 2019). Instead, learners can use these emotions to deepen critical thinking and develop the competencies that will enable them to deal with the multifaceted dilemmas and tensions within sustainability. Generally, "[e]motion readies us for action, for evoking motion (e-motion) of the internal or external sort" (Siegel, 2020, p. 148). Kaisu Mälkki has coined the term "edge-emotions" for "those unpleasant emotions that arise when our assumptions are being challenged" (Mälkki, 2019, p. 60) and "prime us for action to restore our sense of comfort and security" (ibid.).

Embedding (edge-) emotions in the learning process is important: neurobiology and psychology have shown that individuals usually want to maintain their frames of reference in order to stabilize the level of arousal they experience (ibid.). This prevents critical thinking and transformative learning, because individuals avoid entering processes of critical reflection triggered by edge-emotions. This manuscript argues that ESD should enable learners to embrace difficult emotions that come along with the knowledge and experience of unsustainability crises, and with the way educational organizations tackle them. It is necessary for learners to deal constructively with their inner tensions, with tensions within their relationships, as well as with tensions within their learning environments arising from the multifaceted crisis. This can empower them to be part of deep organizational and societal transformation processes. The manuscript argues that learners need *safe enough spaces* to articulate their emotions and deal with stressful experiences.

The following sections explore what safe enough spaces can look like and how learners and educators in higher education can create and hold them, ending with recommendations based on these insights at three different levels: the intrapersonal, interpersonal, and organizational and systemic levels. Section "Creating Safe Enough Spaces for Transformative Learning" presents how transformative learning is discussed and why it includes navigating a liminal space of not-knowing. Section "Balancing Challenges and Resources – the Intrapersonal Level of Safe Enough Spaces" elaborates on why transformative learning can be deeply linked to stress and coping with stressors. This section focuses on the regulation of emotions on an intrapersonal level and on how educators can support learners dealing with this process by making them feel bodily safe enough. Section "From Rational Discourse to Transformative Conversations – the Interpersonal Level of Safe Enough Spaces" discusses how safe enough spaces can be developed on the interpersonal level of human communication. It broadens the perspective of Habermas' "ideal speech situation" (1984/1987) within transformative learning and pleads for more "edifying conversations" (Arcilla, 1995;

Eschenbacher, 2020)[1]. Section "Challenging and Transforming the Embedded Dysfunctional Tendencies in Higher Education From Within – the Systemic Level of Safe Enough Spaces" explores how the learning environments of higher education institutions (at the organizational and systemic level) are influenced by the dynamics of economization strategies that privilege market and competition principles and therefore do not offer students safe enough spaces for transformative learning. It suggests how to critically reflect on these tendencies from the perspective of an engaged critique and thus offer the potential to change these learning environments. Section "Recommendations for Creating and Maintaining Safe Enough Spaces" wraps up the argumentation of what a safe enough space can look like on the three different levels in the form of recommendations for practice that can be used both by learners and by educators. These recommendations include the recognition of ambiguity and ambivalence in educational settings, encouraging learners as well as educators to face the situation in the liminal spaces; the manuscript also makes a plea for educators to seek strategies that make them feel safe enough as well. Section "Conclusion" summarizes these recommendations and discusses what this approach means for higher education institutions on the intrapersonal, interpersonal, and organizational and systemic levels.

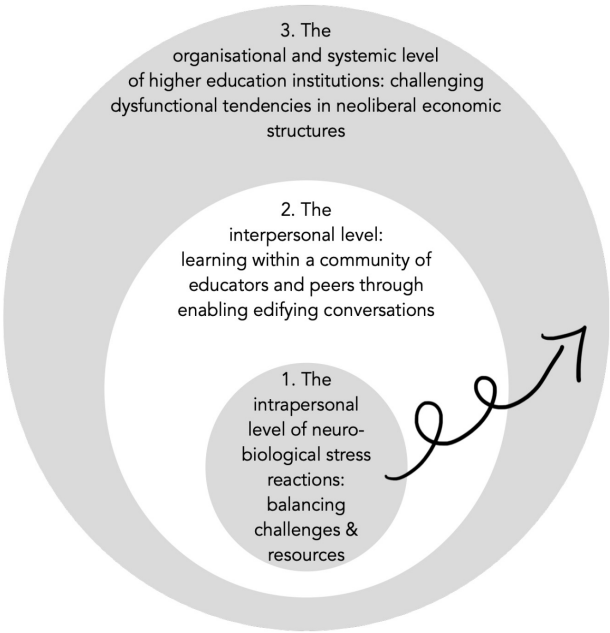

FIGURE 1 | Three levels of safe enough spaces for navigating the transformative learning journey.

CREATING SAFE ENOUGH SPACES FOR TRANSFORMATIVE LEARNING

Transformative learning is "an approach to teaching based on promoting change, where educators challenge learners to critically question and assess the integrity of their deeply held assumptions about how they relate to the world around them" (Mezirow and Taylor, 2009, p. xi). This notion of change and liberation is key to transformative learning. The transformative dimension of adult learning becomes a necessity when "the coherence-producing mechanism of our minds is interrupted" (Mälkki, 2019, p. 64). This experience of interruption, incoherence, or disorientation paves the way for reflecting on and transforming one's most guarded beliefs and guiding assumptions. For this reason, transformative learning is mostly initiated through and accompanied by diverse experiences of tension, ambivalence, ambiguity, and friction, such as facing crises of unsustainability with feelings of deep uncertainty and insecurity. These tensions and frictions do not only have intra- and interpersonal causes: they can also have organizational and systemic causes. All three levels influence the way learners experience a safe enough space for transformative learning and require specific strategies for providing safe enough spaces, as shown in **Figure 1**.

All individuals are vulnerable in one way or another; thus, no situation or space can be considered completely safe. Since no "absolutely" safe spaces exist, we suggest speaking of "safe *enough* spaces." These support learners and educators by making them "feel safe enough" to enter liminal spaces of uncertainty and to navigate through them, as this is crucial for transformative learning. In these liminal spaces old ways of being, feeling, thinking, and acting as well as underlying meaning perspectives are invalidated or stop being functional and new ones are not yet established (e.g., Land et al., 2014; Förster et al., 2019). Orientation is destabilized in "that 'in-between' zone where *all that was once stable [.] become[s] fluid*" (Mälkki and Green, 2014, p. 8). This uncertainty is challenging and stressful in itself. Learners also enter this liminal zone already destabilized by experiencing a crisis or disorientation. All these conditions cause unpleasant (edge)-emotions and stress reactions (Förster et al., 2019).

The following paragraphs elaborate on what navigating through liminality within safe enough spaces can look like on all three levels, arguing that navigating through the liminal space is necessary for empowering people to contribute to societal change processes.

Balancing Challenges and Resources – The Intrapersonal Level of Safe Enough Spaces

Transformative learning is triggered by interruption, incoherence, or disorientation, leading to liminal experiences. To get out of these unpleasant situations on the intrapersonal level, automated defense patterns may be triggered and these may inhibit critical thinking and social behavior. Therefore, understanding the role of unpleasant emotions, stress development, and coping is key to providing safe enough spaces

[1]Edifying conversations support learners in their quest for self-understanding (see section "From Rational Discourse to Transformative Conversations – the Interpersonal Level of Safe Enough Spaces").

for transformative learning. Based on the neurobiologically rooted polyvagal theory (Porges, 2017, 2021), a safe enough space on an intrapersonal level can be argued to be the space where both learners and educators feel bodily safe and are not in defense mode. An individual's overall resources have to be in a balance with the challenges to be met; this helps avoid defense reactions from emerging and supports the regulation of emotions and stress. Section "Theoretical Perspectives on Stress and Emotions in Transformative Learning" introduces the theoretical foundations of stress development and section "Practical Implications of the Stress-Development Perspective" derives recommendations for enabling feeling safe enough while facing unpleasant emotions.

Theoretical Perspectives on Stress and Emotions in Transformative Learning

Polyvagal theory describes how physiological states of the autonomic nervous system (ANS) and human behavior interface in situations of safety, threat, and life-threat, i.e., under stress (Porges, 2021). It emphasizes that the ANS has three distinct subsystems, two in the parasympathetic nervous system (PNS)[2] – the dorsal and ventral vagal circuits – and the sympathetic nervous system (SNS) (ibid., p. 258ff.). The ANS regulates three main states and corresponding responses to stimuli: (1) feeling bodily safe: allowing social engagement, (2) feeling threatened: mobilizing for fight-or-flight, and (3) feeling life-threatened: immobilizing for freeze, in the sense of a shutdown (see **Figure 2**).

From a neurobiological perspective our body is constantly evaluating inner and outer sensory inputs (stimuli) to keep us in homeostasis and support our growth and survival. Emotions reflect these complex appraisal processes and prepare us for action (Siegel, 2020, p. 148). According to polyvagal theory, appraisal *via* unconscious, rapid "neuroception" is dominant and enables the ANS's immediate adaptation of the physiological state to cope with a situation. The ANS-triggered responses to stimuli can stay within or exceed our so-called "windows of tolerance," in which humans operate in homeostasis (**Figure 2**).

When do we feel bodily safe and when not? We feel safe when our ANS is controlled by its ventral vagus circuit, the associated "social engagement system" is activated, and we are not in defense mode (Porges, 2017, p. 23ff.). This supports our primary human need to feel connected with other humans and our ability for social behavior, including regulation of emotions. A situation, in particular human interaction, is assessed as safe by neuroception *via* "cues of safety": facial expression, prosody, gestures, or contextual stimuli that we receive *via* our sensory channels (visual and auditory). Moreover, we convey our states through these cues, e.g., joy or anger *via* facial expression and corresponding intonation.

In this safe mode, the sympathetic subsystem (SNS) and parasympathetic subsystem (PNS) work in a homeostatic range, and humans operate within their "window of tolerance" (Ogden et al., 2006; Porges, 2021, p. 263). This is the optimal zone for (transformative) learning: it is still possible to experience unpleasant emotions and connected arousals of the SNS but these emotions can be regulated, leading to recovery. Within the window of tolerance, the arousal of the SNS does not lead to automated defense but supports individuals in coping with the situation. They learn something new and can be creative while staying connected with others. If they are successful in coping, they can then experience pleasant emotions, like reaching their goals or fulfilling their needs. They are rewarded (e.g., Hanson, 2013). Furthermore, if they are aroused by pleasant emotions like curiosity while facing a challenge, this will support them in approaching and exploring an unknown situation, instead of avoiding it. From this perspective "[s]afe states are a prerequisite not only for social behavior but also for accessing the higher brain structures that enable humans to be creative and generative" (Porges, 2017, p. 47). Learners can access their resources, they can engage socially, and enter and navigate through transformative learning processes.

By contrast, when a given situation is appraised as threatening or even life-threatening, it is not safe, corresponding unpleasant emotions are generated, such as fear or even anxiety, and our avoiding system is aroused (e.g., Hanson, 2013). Automated and therefore rapid defense patterns are activated by the ANS, hard-wired in the human brain to adapt to the situation fast and to survive (Porges, 2017). In defense mode, the ventral vagus circuit is first overruled by the SNS mobilizing for fight-or-flight, e.g., through increased heartbeat, while impeding the social engagement system. When this is insufficient the dorsal vagus circuit of the PNS takes over, bringing individuals into a freeze state, involving lowered heartbeat and breathing, e.g., feigning death or responding with panic, dissociation with numbness, or collapse. In defense mode, human beings can neither reflect cognitively and critically, nor be open for creative experimenting and engaging in positive social contact in order to change their way of being, thinking, feeling, and acting, as demanded in transformative learning. These processes are impeded because they would be too time- and energy-consuming in an emergency. Defense reactions endanger the ability to return into a safe mode – within the window of tolerance – when they are very intense (short period, high impact) or become chronic (last long) and individuals have no chance of regenerating themselves (Semmer and Zapf, 2018).

Complementing the polyvagal theory with other conceptualizations of stress development and coping (Semmer and Zapf, 2018) brings further insights into how safe enough spaces can be created and maintained. When individuals appraise their resources subjectively as insufficient to cope with a challenge, this causes stress (e.g., ibid., p. 24ff.). Inner or outer stimuli, events, challenges, or circumstances that have the potential to cause stress in the majority of humans are called "stressors" (ibid.). In this sense, someone "feels safe" when his/her resources are in balance with the challenges or stressors. From the perspective of polyvagal theory, staying in a safe mode

[2](1) The dorsal vagal circuit is responsible for calming down and regenerating. Its state under life-threat is immobilization. (2) The ventral vagal circuit and its associated social engagement system are activated when we feel safe. They support social behavior by conveying and assessing physiological (emotional) states mainly *via* facial expression, prosody (voice intonation) and optimized listening capabilities to human communication. They inhibit defense reactions and promote health, growth, and restoration.

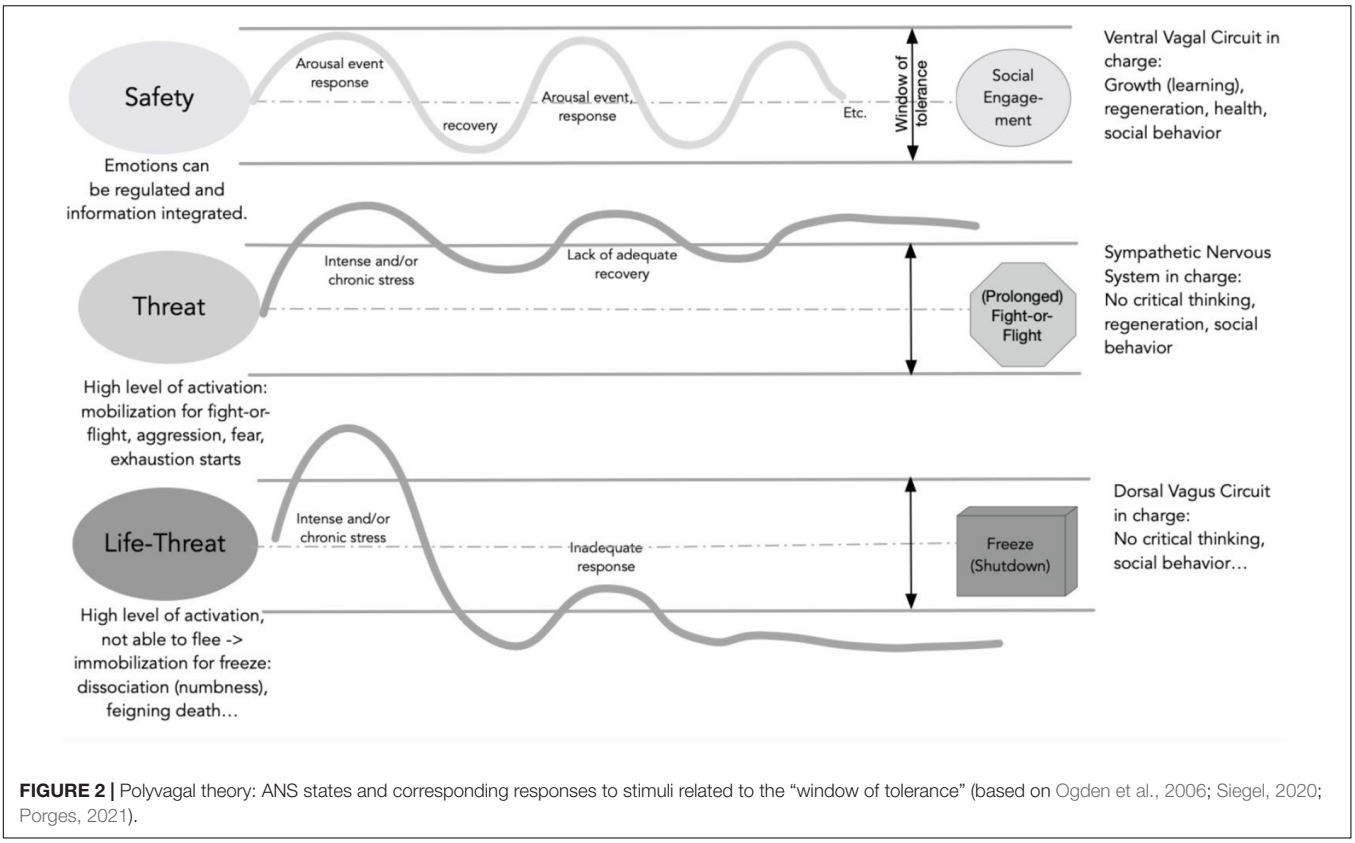

FIGURE 2 | Polyvagal theory: ANS states and corresponding responses to stimuli related to the "window of tolerance" (based on Ogden et al., 2006; Siegel, 2020; Porges, 2021).

with an activated social engagement system is therefore the most crucial resource for regulating emotions. At the same time feeling bodily safe is supported by balancing challenges with resources.

What a person experiences as stressful and particularly as (life-) threatening also depends on the intensity and/or the duration of stressors, on personal predisposition, and on the accessibility of resources. This also means that the width of the "window of tolerance" differs individually and can change depending on the context (e.g., Siegel, 2020, p. 345ff.). The more spacious it is the less reactive humans are to stressors and the less likely they are to respond with defense-activation. Nevertheless, situations like wars, car accidents, deep injustices, or environmental hazards such as flooding and wild-fire are (life-) threatening for all humans. People may have severe acute defense reactions, lose the status of feeling safe, and leave their window of tolerance. Furthermore the window of tolerance narrows, meaning the defense-reactivity to potential stressors increases after an overwhelming, traumatizing experience. This requires therapeutic intervention that will help the individual come back to a state of feeling safe and experiencing regeneration.

But humans can also cope with extreme situations through less severe stress reactions – still staying in or returning to their window of tolerance – and education can support them here. Stress is experienced when enduring the loss of orientation related to questioning our deepest sustainability values and understanding of the world as a "safe operating space for humanity" (Rockström et al., 2009), or when facing great uncertainty and not-knowing related to the accelerating climate crisis. These are experiences of disorientation, interruption, or incoherence that can become an entry point for transformative learning journeys.

Examining the initial starting point of transformative learning processes more closely helps understand why safe enough spaces are crucial. When formerly unproblematic notions of social or environmental normality are called into question and force learners into a new learning experience, they enter this process by "realiz[ing] that they have, to some extent, lost their way in the world" (Arcilla, 1995, p. 7). In that sense, unpleasant edge-emotions are experienced (Mälkki, 2019). One way forward would be to embrace these emotions and understand them as indicators of learning potential and an invitation to question guiding assumptions in light of the current crisis. Obviously, this process is "not a continuously joyful exercise in creative self-actualization. It is psychologically and politically dangerous, involving risks to one's livelihood, social networks, and psychological stability" (Brookfield, 1990, p. 179). Furthermore, edge-emotions can reveal what situations may cause automated defense reactions. Recognizing these edge-emotions and being able to live with them is an important resource when navigating the liminal space (Mälkki, 2019).

Practical Implications of the Stress-Development Perspective

Using the stress-developmental perspective for creating safe enough spaces helps learners to embrace these edge-emotions as well as other unpleasant emotions in a constructive way.

It supports them in feeling safe enough by assisting them in balancing their own resources with the challenges met. For facilitators and educators, this means helping learners to stay within, or return to, their window of tolerance, or enlarging this window. For transformative learning, it may also mean enabling learners to explore the edge of this window of tolerance, i.e., just at the edge of their own comfort zone (e.g., ibid., p. 62).

This section presents some recommendations regarding how to create safe enough spaces for learners as well as for educators that take these neurobiological insights into account.

Considering the need to balance resources with challenges, we – as learners and educators – can either change or reduce the challenges/stressors, or support regeneration. Stress development and feeling safe are complex mind–body processes, therefore it is generally important to involve the whole body in transformative learning. The crises of unsustainability – i.e., the main stressors – cannot be eliminated, but it is possible to minimize the stress they cause by:

- Providing zones for a temporary time-out, helping to distance oneself from a stressor triggering defense reactions.
- Building in periods where regeneration can take place, e.g., supporting relaxation.
- Facilitating an optimal point of learning where resources and challenges are balanced and e.g., goals are clear and can be met; thus feedback can be received and encouragement be given (Csikszentmihalyi, 2014).

Apart from buffering the challenges, it is necessary to support and activate learners' personal and external resources, by:

- Activating the social engagement system passively using neuroception (Porges, 2021, p. 83ff., 267 ff.) by giving cues of safety and mitigating defense reactions and thus supporting the human need for connecting and engaging socially. Indeed:
    - Experiencing trustful, supportive relationships conveyed through positive interaction, and specifically *via* facial expression, gestures, prosodic vocalization (e.g., melodic intonation), and keeping eye contact. These cues are transmitted *via* audio or visual input channels and used to assess whether the situation is safe enough.
    - Removing auditive (and visual) distractions. Disturbing background noises are additional stressors and can be eliminated or minimized. Furthermore, providing a quiet environment (ibid., p. 267) or calming music (e.g., with melodic intonation) helps calm down (ibid.).
- Activating the social engagement system actively, i.e., voluntarily including training on how to regulate emotions; broadening the window of tolerance, which is only possible when there are enough cues of safety. Learners can be supported by:
    - Specifically strengthening self-awareness and staying present as a key to emotional self-regulation and therewith coregulation: recognizing edge-emotions, or recognizing based on previous experiences that they are about to have a stress reaction that may not be adequate in the given situation. This can be supported by being able to read sensory-motoric signs (e.g., fast heartbeat, muscular tension) in oneself as well as in others and slowing down, as trained by mindfulness practices (Mälkki, 2019).
    - Providing orientation and a feeling of being connected with others: inform learners under stress that the symptoms they are experiencing are functional products of a neural control system that enable them to adapt and survive (Porges, 2017, p. 66ff.). Helping them understand that unpleasant emotions and their reactions are "normal" for a transformative learning process (Mezirow, 2012, p. 89) and that they are not alone.
    - Supporting slowing down and interrupting defense reactions through conscious breathing: slowing down and particularly prolonging exhaling, as well as fostering other physical exercise, can activate the ventral vagal circuit and help to become less reactive to threats (Porges, 2021, p. 83ff., 88ff., 118ff.).
- Supporting positive experiences and pleasant emotions, offering rewards connected with achievement, curiosity, and creativity by trying out new ways of being playful and joyful, involving the whole body. Educators and learners can also reframe the challenges as learning opportunities and possibilities of gaining rewards (Hanson, 2013, p. 31ff.). This also helps the ANS to come back to a window of tolerance more rapidly or to become less reactive to threats, meaning building up resilience (ibid., Siegel, 2020, p. 281ff.; Porges, 2021, p. 61 ff.).

For educators in higher education this intrapersonal perspective on stress regulation means encouraging individual learners as well as themselves (as mutual learners in coregulation) to face the situation of the "liminal spaces of not-knowing" and to embrace unpleasant (edge-)emotions and ongoing stress reactions as well as possible. While the effect of these different practices for creating safe enough spaces depend mainly on the individual learner's window of tolerance, learners are situated in concrete relationships and communicative situations with peer-learners and educators who influence their feelings of safety. The above reflections on the intrapersonal level already show that positive and supportive social embeddedness is crucial for transformative learning. This leads to the second level of creating safe enough spaces: the interpersonal level.

From Rational Discourse to Transformative Conversations – The Interpersonal Level of Safe Enough Spaces

Transformative learning does not come easily, quite on the contrary: "We find it very difficult to stand outside ourselves and see how some of our most deeply held values and beliefs lead us into distorted and constrained ways of being" (Brookfield, 2009, p. 133). To set the stage for this kind of learning experience

(especially) in higher education settings, Mezirow (e.g., 1991) advocates rational, reflective discourse. To reflect on our deeply held beliefs and potentially distorted ways of being and living learners are in need of "a community of rational discourse" (Brookfield, 2000, p. 132) where others "serve as critical mirrors" (ibid, p. 146). It is the coercive power of the better argument and a (tentative) consensus that frame Mezirow (1991, 2012) idea of transformative learning and the space where it can take place. The Habermasian notion of rational discourse with the conception of the ideal speech situation (Habermas, 1984, 1987) is located at the center of the theory (Eschenbacher, 2020).

Mezirow's notion of discourse (e.g., 1991; 2012) is an overly rational and cognitivist framework for dialogue, where somatic, affective, and unconscious dimensions take a back seat, if they are even in the car. The importance of these dimensions has been explained in the previous section. In the context of Mezirow's cognitivist framework, the question of how to create safe enough spaces in interpersonal relationships when there is no ideal speech situation remains unanswered. Yet recent experience shows that for climate communication in the context of sustainability crises, for example, rational arguments are crucial to make the problems clear to the public and to take away the argumentative basis of climate change deniers. However, in transformative learning processes, providing safe enough spaces for learners instead of rationally authoritative channels is a challenge. Can there even be safe enough spaces where we exchange arguments and transform our most deeply held assumptions and beliefs based on the force (!) of the better argument? What if exchanging arguments is helpful and suitable only within a discourse where one can argue from a place of safety and an embodied feeling of coherence (see section "Balancing Challenges and Resources – the Intrapersonal Level of Safe Enough Spaces")? What if learners experience a sense of loss and not only lose their self-understanding but also their place of safety? What if weighing evidence and exchanging arguments is not the only way forward on our road to learning transformatively? What if learners cannot make a choice rationally because they lack the necessary information, e.g., about what their lives will be like and what it will be like to *be them* in the aftermath of learning transformatively?

The very idea of undergoing a transformative experience reflects the aforementioned challenges: If an experience is both personally and epistemically transformative, as defined by Paul (2016), p. 17, it is by definition impossible to make a rational choice regarding whether to undergo the experience or not: "You can't navigate these decisions by stepping back, rationally evaluating your different subjective possibilities, and then choosing the act that maximizes the expected subjective values of your future lived experience. [. . .] Instead, you grope forward in deep subjective ignorance of what your future conscious life will be like" (ibid., p. 110). The experience of *not-knowing* (Eschenbacher and Fleming, 2020) and disorientation is key to transformative learning and very much connected to the liminal space. As is the experience of disorientation: "You know that undergoing the experience will change what it is like for you to live your life, and perhaps even change what it is like to *be* you, deeply and fundamentally" (Paul, 2016, p. 3). The basic unknowability of what one's subjective future will look like *after* the potentially transformative experience comes with an experience of incoherence *before* one enters the transformative learning process, triggered through a disorienting dilemma (Mezirow, 1991). This experience of not-knowing is not only an intrapersonal impression, but it is lived in the very concrete situation of communicating with others while searching for an adequate form of interpersonal dialogue about old and new meaning perspectives.

For this reason, transformative learning has both threatening and empowering dimensions (Mezirow, 1990, p. xiii), as it is not only a dangerous endeavor but also provides a theory of adult learning that fosters liberation and emancipation. From this perspective as well, then, transformative learning requires safe enough spaces; (1) on the intrapersonal level of embodied feelings of safety and stress regulation within the embodied window of tolerance and (2) on the interpersonal level of communication, where learners can engage in critical reflection in their attempt to find themselves and their way in the world again. Bernstein (2016), p. 121, argues that engaging in radical questioning "can be terrifying, dangerous, and liberating: *terrifying* because it means giving up the familiar banisters and guidelines that we normally accept in orienting our lives; *dangerous* because, when such questioning is truly radical, it seems to leave us with nothing; *liberating* because it frees us from illusions and enables us to confront our subjectivity and inwardness without illusions." This learning process, which could ultimately lead to liberation – also from societal conditions in a more socially critical sense (see section "Challenging and Transforming the Embedded Dysfunctional Tendencies in Higher Education From Within – the Systemic Level of Safe Enough Spaces") – requires safe enough spaces on the intrapersonal level (enabling learners to explore their own guiding assumptions), as well as at the interpersonal level (learners in the liminal space of not-knowing should not have to defend their assumptions against the coercive power of the better argument within a group of other learners).

The need for dialogue and interpersonal relationships that provide safe enough spaces for transformation is evident. "In the search for a different format, one that is less limited to rational means, we shift the focus from exchanging arguments within discourse to the concept of conversation" (Eschenbacher, 2020, p. 373), in our case the approach of "transformative conversation" (ibid.). This idea rests on Arcilla (1995) concept of *edifying conversation*, understanding the edifying dimension as central for transformative learning. Conversation, for Arcilla (1995), p. 105, is "the power to converse reasonably with others for the purpose of edifying oneself." It is the desire for self-knowledge gained in a conversing community that paves the way for our learning. Instead of seeing participants as critical mirrors, learners feel they are in need of each other, although in a different way.

Arcilla (ibid., p. 7) argues that learners "all need each other to help them rediscover a sense of self-direction which they must nevertheless claim for themselves." Free from the goal of identifying the better (i.e., more powerful) argument to convince the other or detect potential flaws, one creates space with others to struggle with one's own way of thinking and living. Not having to defend one's own frame of reference gives room for exploring

parts of the frame of reference that is currently in use. In that sense, learning from the other is less about being convinced through arguments. It is more about listening to the conversation, how others are seeking self-understanding and making meaning of what they are experiencing. In the context of unsustainability crises, this could be for example the insight that if we – as learners and educators – do not want to end up in a world of social and ecological collapse (Andreotti, 2021), we have to change our individual and collective ways of consuming, of relating to other human and non-human beings, and of doing politics. But how we exactly do this and what it means for our personal life, is up to our decisions (Vare and Scott, 2007), which in the best case should not just be contested through the force of the better argument (e.g., a low-carbon style of consumption), but explored in their richness of meaning regarding how we relate to these challenges and their potential solutions. We come to realize that there is no such thing as one way of looking at or being in the world. It is about "the invitation to disentangle oneself, for a time, from the urgencies of the here and now and to listen to the conversation in which human beings forever seek to understand themselves" (Oakeshott, 1989, p. 41). This listening to the conversation allows learners to seek self-understanding, to explore the parts of selfhood that are incoherent. It provides a space where exploring their own frames of references becomes a real possibility, not in order to defend it but to understand and eventually transform them. Arcilla (1995) suggests that the adult educator should join that conversation as a fellow conversationalist.

What do edifying conversations look like? In what ways do they differ from a Habermasian notion of discourse that is at the heart of transformative learning as we presently know it from Mezirow? This different type of conversation is "an exploratory, associative, open-ended, tolerant exchange of intimations free from the demand that it issue in conclusions binding on all" (Arcilla, 1995, p. 7). Without the demand for a consensus, even a tentative one, educators and learners create a space to accept the kind of invitation our edge-emotions offer us (Mälkki, 2019). In the context of sustainability, the invitation is to explore assumptions and formerly unproblematic notions of normality, or a sustainable world. Providing an opportunity for edifying conversations as well as staying within the window of tolerance can be identified as preconditions for the transformative learning process when facing crises of unsustainability. Only then can learners enter a process of critical (premise) reflection and radical questioning. They can face the *dangerous*, *terrifying,* and *liberating* dimensions of learning transformatively by edifying themselves, "in response to events that befall us" (Arcilla, 1995, p. 100). Through the process of edification, learners can face the incoherence they experience as disorienting when they face potentially transformative decisions and experiences. As an extension of transformative learning's notion of discourse, the concept of transformative conversation (Eschenbacher, 2020) proposes edification within interpersonal conversations as a means to create safe enough spaces besides the idea of exchanging arguments within rational discourse.

The danger of rational discourse as suggested by Mezirow is that the risk related to changing frames of references is not equally distributed. It solely rests on the learner who has something to learn or to reflect upon critically. As adult educators and learners, we need to be constantly aware that we need to put our own self-understandings at stake. This attitude can best be described as "fellow conversationalists engaged in questioning themselves before taking things for granted, in order to receive their being at a loss as a present" (Arcilla, 1995, p. 2). Only if learners have a chance to rediscover a sense of self-direction and self-efficacy facing the current crises, can they also engage in a rational discourse. When learners – or fellow conversationalists – have this sense of self-direction, they can exchange arguments from a place of safety and better engage in discourses that belong to the public sphere and that ask for a tentative consensus on how *we*, as a society, want to live our lives together.

This perspective on transformative conversations as a complement to rational discourses at the interpersonal level hints to the necessity of establishing a different culture to foster communication about sustainability issues in higher education in order to create safe enough spaces for learners. The following practices can help provide a safe enough space:

- Recognizing that the force of the better argument (i.e., changing lifestyles toward less resource intensive and low-carbon lifestyles) within a rational discourse can make learners feel unsafe and thereby block transformative learning processes and critical thinking;
- Negotiating (or even co-creating) what feels safe enough between educators and learners;
- Practicing open-ended conversations about transformed self-understandings to regain a sense of self-direction;
- Learning to embrace one's being-at-a-loss as an opportunity for transformation;
- Appreciating different ways of making meaning as opportunities to learn from and with fellow conversationalists;
- Seeking self-understanding through listening to and joining edifying and transformative conversations;
- Enabling critical (self-)reflection through edifying conversations;
- Providing a space where learners can disentangle themselves for some time from the urgencies of the here and now;
- Nurturing a culture of edifying conversations in order to gain back feelings of coherence, e.g., through stimulating questions or guidelines for communication within the groups of learners;

Although learning environments in higher education can offer protected contexts where these practices for safe enough spaces at the interpersonal level can be explored, experimented with, and broadened, they also represent organizational and systemic structures that bring along additional challenges, foreground power relations, and may trigger tensions. This is also true for the intrapersonal level. All kinds of intrapersonal and interpersonal practices supporting transformative learning are embedded within a greater system (e.g., academic) and informed by their barriers and conditions. For this reason, it is necessary to look at this organizational and systemic level as well.

Challenging and Transforming the Embedded Dysfunctional Tendencies in Higher Education From Within – The Systemic Level of Safe Enough Spaces

Creating and holding safe enough spaces for transformative learning in higher education for sustainable development (HESD) builds not only on neurobiological foundations on the intrapersonal level and on fostering transformative conversations on the interpersonal level. Safe enough spaces for transformative learning are also necessary on an organizational and systemic level. In the context of higher education systems learners have to deal with inherent tensions and experiences of disorientation. There is a strong call for higher education institutions (HEIs) to take into account sustainable development. Students are very willing to participate in this commitment and an increasing number of HEIs are trying to integrate sustainability at the institutional level. Nevertheless, their efforts are fragmented and rarely do they achieve integration at a systemic level, following a "whole-institution approach" (e.g., Sterling, 2021). This in turn leads to a disconnect between what these HEIs claim and the learning context they offer their students, generating tensions between what students are asked to learn and what they hope to learn, and to experiences of disorientation. From the perspective of strong sustainability, these tensions are caused by the systemic dysfunctionalities of the academic system itself, linked to the rise of neoliberalism in higher education, understood as a specific trend of academic capitalism and respective economization principles, such as competitiveness and the dominating focus on technocratic-rational knowledge approaches (Jessop, 2017). These tendencies contribute to making learning environments in higher education institutions ambivalent and – for some learners – rather unsafe places to develop in.

Economization principles shape dominant discourses in academia that are still driven by rational debates, facts, and logic; they disqualify more emotionally sensitive approaches as ideological (Kläy et al., 2015). In view of the current dominant capitalist market-oriented paradigm of education (Jessop, 2017; Biberhofer, 2019a), structural embedding of transformative learning and creating safe enough spaces is thus challenging. The capitalist market-oriented purpose of education is manifested for instance in dominant framings defining smart growth as the main purpose of higher education and positioning students as future workers with adequate higher skills as the means of reaching the goals of an entrepreneurial, growth-oriented agenda (Biberhofer, 2019b). For example, higher education institutions should act as service providers accountable in particular to the demands of the labor market (Patrick, 2013). Respective learning practices emphasize individualized learning environments and frame students as consumers of knowledge (Biberhofer, 2019b, p. 21). These broader dynamics in higher education institutions – or in the words of Brookfield (2012) the dominant capitalist ideologies – are influencing students and contradicting efforts to seriously address crises of unsustainability within higher education. They are based on the "distinctive academic reward systems of research quality assessment and promotion, improving reputation and status, incentivization through funding and resource flows, and meeting the requirements of educational quality standards and benchmarks" (Bessant et al., 2015, p. 427). Consequently, these neoliberal tendencies also challenge efforts to create safe enough spaces for deeper transformative learning journeys in the context of education for sustainable development (ESD) which integrates more critical perspectives, e.g., on degrowth (Getzin, 2019).

Although the debate about HESD has developed intensely in the last 30 years (e.g., Barth et al., 2016) and has contributed impressively to mainstreaming sustainability in higher education institutions, important issues have been neglected and have brought up the question whether ESD is "business as usual" after all (Huckle and Wals, 2015). The growth tendencies in the economic system function not only as a very stable ideology, hegemony, and paradigm that influences society in general; they are also mirrored in mainstream ESD (Getzin, 2019). As HESD operates within higher education in general, it is often embedded in the dominant, neoliberal paradigm mainly influenced by economic interests (Sterling, 2021). A good example of this is the debate on key competencies for sustainability. There has been a long discussion about which key competencies for sustainability are relevant in the context of higher education, and how they can be operationalized for using them as evaluation schemes for single courses or programs (Wiek et al., 2016). Although we acknowledge that defining and assessing key competencies for sustainability has been important for supporting concrete HESD implementation, focusing only on them does not take into account the areas of tension, ideologies, and dominant discourses in higher education institutions themselves.

Indeed, when competencies are considered in isolation from the tensions and ideologies that prevail in HESD, optimization tendencies dominate over relationality – i.e., the way we are embedded in and relate to our fellow conversationalists, our non-human living environment, our learning organizations, and democracies (Lange, 2004). These tendencies support an overemphasis on individual career potentials instead of collective actions to question and change societal structures or address the above-mentioned dysfunctionalities of academia. Simons and Masschelein (2006), p. 419, argue that the individualization of social problems (i.e., addressing sustainability problems as individual learning problems for which key competencies have to be identified) goes along with the paradigm of entrepreneurial self-government, where "people are not addressed (anymore) as social citizens (whose freedom or autonomy is guaranteed through social normality or who have a normalized relation to the self) but as entrepreneurial selves and entrepreneurs of the self." This thought is in line with the paradigm of ecological modernization within ESD (van Poeck et al., 2014), where social problems are reduced to learning problems that can be solved through adequate competency development.

The identification of systemic dysfunctionalism – for which the economization of higher education (Jessop, 2017) and the connected dominant focus on key competencies are two examples – is also crucial for overcoming predetermined, prescribed, and authoritative approaches toward education and providing safe enough institutional spaces for transformative learning. Therefore it is necessary to "reframe the raison d'être

of higher education institutions based on a profound critique of the capitalist growth paradigm and a debate on the purpose of education beyond creating economic assets" (Biberhofer, 2019a, p. 11). This means focusing on critical thinking as well as recognizing, addressing, and disrupting the embedded culture of neoliberal economization within higher education in general; and this has important implications for educators.

Messerschmidt (2013) argues based on critical theory that within academia educators should not just unfold a distantiated critique of societal developments because then they exclude themselves from the effects of these developments. Instead, they should – in the sense of an engaged critique – explore how they as academics and their higher education institutions are embedded in these processes, how they are influenced by them and how they affect their daily practices (ibid., p. 165ff.). "If teachers convey how they perceive themselves as actors under conditions of neoliberal educational governance, this can lead to a [useful] discussion about their own dealing with this embeddedness under the criticized conditions" (ibid., p. 166, translated by the authors). This practice is crucial for creating and holding safe enough spaces in HESD because it brings together the organizational and systemic level, the interpersonal level, and the intrapersonal level. Educators – in the sense of fellow conversationalists – can then become role models who show how it is possible to deal with these contradictions (including at a very personal level) and illustrate that all are caught in structures that contribute to neoliberal tendencies and fuel crises of unsustainability. For students this may open up important perspectives to reflect on tensions, frictions, and ambivalences they face within their own daily lives in higher education institutions, such as competitiveness or excluding the perspectives of the Global South. If educators make their own ambivalences transparent within such a form of engaged critique, they strongly contribute to creating (and holding) a safe enough space in which fruitful dialogues and transformative conversations can take place without excluding the emotions that students have when they learn about and for sustainability, with the wish of being able to act sustainably at the same time. Additionally, this can make the dysfunctionalities of higher education more visible for students as well as educators, and thereby reduce feelings of uncertainty and insecurity with regard to trying out new approaches to contributing to institutional change.

What can transformative learning contribute to this kind of engaged critique that challenges the systemic dysfunctionalism of neoliberal higher education institutions? How can transformative learning experiences allow students and educators to explore and find their way through these ambiguous and conflicting arenas? And what key points must HESD integrate in the context of transformative learning in order to deal with the above-mentioned tensions and conflicting arenas? Transformative learning could offer a way to address these tensions because it provides opportunities, on the one hand, to question individual frames of reference and their connectedness to and embeddedness in collective structures, and on the other to highlight the disjunction between them and the vision of sustainability. Brookfield (2012) argues for seeing frames of reference not only as influenced by biographical experiences but also by the capitalist ideologies many societies are based on. "Ideologies are manifest in language, social habits, and cultural forms. They legitimize certain political structures and educational practices so that these come to be accepted as representing the normal order of things" (Brookfield, 2000, p. 129). Mezirow (2012) asks learners to engage in critical self-reflection and critical discourse with others in order to uncover and change previous meaning perspectives into more adequate ones, as well as to be open to experimenting and trying out new ways of being. This can best be enabled if learners and educators work as "fellow conversationalists" who cooperatively explore the ways in which neoliberal tendencies influence their own meaning perspectives and how they relate to sustainability values. An example of such a neoliberal meaning perspective is the overemphasis on individual consumer responsibility. This means that students are individually responsible for solving the climate crisis by lowering their own carbon consumption, without having to reflect on, question, challenge, and contribute to changing the dominant growth paradigm, structures, and political discourses, even within the university. When educators start to engage in such critique (i.e., in recognizing that they themselves are also sometimes entangled in this narrative) and follow the ambition of being a fellow conversationalist (not striving for a consensus about controversial issues but encouraging students to self-reflectively explore ways of supporting each other in their edification) they can also open up space for communication that feels safe enough for students to engage in self-questioning.

This could serve as an ideal starting point for educators and learners to reflect upon how higher education institutions could be opened to a higher degree of participation, where all people involved can start to engage in challenging and disrupting the systemic dysfunctionalities. For Brookfield, transformative learning and ideology critique is closely connected to transformative action: "Without consequent social action, critical reflection is castigated as liberal dilettantism, a self-indulgent form of speculation that makes no real difference to anything" (Brookfield, 2000, p. 143). What would universities as learning environments look like if they were to resist neoliberal tendencies of economization and enable such transformative action? How can students and educators challenge hegemonic discourses within their own institutions and what forms of empowerment do they need in order to establish counter-hegemonic discourses? How could concrete structures be changed to help HEIs adopt a whole-institution approach?

Based on the notion of an engaged critique and the attempt to support learners in transformative actions, discussions can emerge on how to change dysfunctional discourses as well as hidden power structures within higher education institutions. Transformative actions could for example include initiating and/or strengthening advisory competence and institution-wide funding schemes supporting initiatives to address unsustainability crises within different study programs or research projects. The basic aim of these transformative actions should be the empowerment of all people involved. Empowerment is described as "a process in which participation is believed to lead to great perceived control in social and

political systems" (Christens et al., 2013, p. 171). Empowerment within higher education institutions implies that participation should not only be about being part of innovative initiatives but also about questioning power structures within the higher education system, and about gaining control over how the social and political systems that we are embedded in develop (Avelino, 2021). Such an understanding strengthens the collective dimensions of empowerment, avoiding an instrumental (neoliberal) logic of simply changing some elements in the structure (such as focusing only on individual competencies), and enabling the creation of safe enough spaces as deliberate *transformative* spaces as a starting point for institutionalizing change (Pereira et al., 2020). Pereira et al. suggest that these "transformative spaces are designed to generate ideas that challenge the *status quo* and the dominant systems, and hence change the systems conditions that created the problems in the first place" (ibid., p. 174). Transformative spaces are communicative spaces for knowledge generation where people strive for "designing the engagement and dialogues in ways that involve and consider emotions and allowing for empathy" (ibid., p. 173) in order to create a viable culture of finding solutions to sustainability problems that accepts contestation and negotiation about different strategies, without being trapped in the search for consensus (ibid., p. 172).

We build on Pereira et al.'s (ibid.) definition of transformative spaces to suggest recommendations for creating (staging) and maintaining safe enough spaces for transformative learning on the organizational and systemic level. This demands that learners and educators start with a different mindset and actions than those expected of learning and teaching in the neoliberal HE context. In particular, for educators it means fostering safe enough spaces through practices that allow learners (and themselves) to:

- Recognize the unsustainable effects of neoliberal tendencies and the dynamics of economization;
- Accept that these dysfunctionalities affect all actors involved in higher education institutions in subtle ways;
- Start to question dominant and hegemonic discourses as well as power structures together, as fellow conversationalists;
- Strengthen engaged critique by opening up self-reflective explorations of how the more systemic dynamics are affecting individual and collective meaning perspectives (in the sense of ideologies);
- Open up space for participation and empowerment designed to change prevalent discourses and structures, to gain back control of the social system of the educational institution;
- Cultivate transformative spaces as starting points for institutional change for sustainable development.

We are aware that higher education institutions are a privileged and protected space for experimenting with respective forms of institutional change. Nevertheless, cultivating and creating such transformative, safe enough spaces where systemic

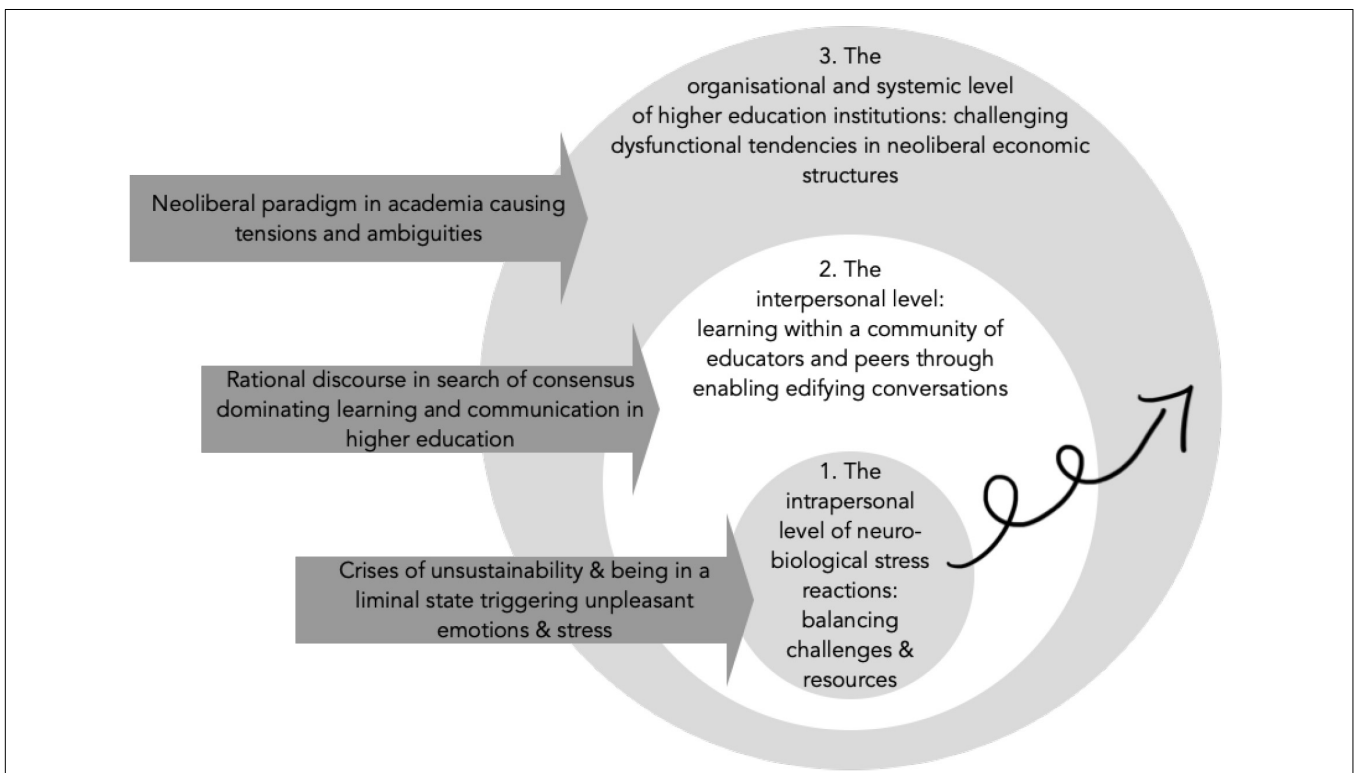

FIGURE 3 | Three levels of safe enough spaces for navigating the transformative learning journey, including challenges to be tackled.

change can be initiated requires high sensitivity and skills among educators, as well as their willingness to guide such processes and serve as a role model. The transformation of higher education institutions itself is therefore a challenge and will face a number of hurdles and obstacles.

The complexity of challenging and transforming the dysfunctional systemic and institutional level of higher education goes hand in hand with the other two levels of safe enough spaces in HESD discussed earlier in this article. Challenges need to be faced at all levels: not only at the organizational and systemic level of higher education institutions, but also at the intrapersonal and the interpersonal level (see **Figure 3**). While the crises of unsustainability and being in a liminal state evoke unpleasant emotions, cause stress, and challenge the process of balancing stress factors and resources on the intrapersonal level, the dominance of rational discourse that rules over learning

TABLE 1 | Recommended practices for creating and maintaining safe enough spaces on all three levels.

1. Intrapersonal: Neurobiological/stress reactions (see section "Balancing Challenges and Resources – the Intrapersonal Level of Safe Enough Spaces")	**2. Interpersonal: Edifying conversations (see section "From Rational Discourse to Transformative Conversations – the Interpersonal Level of Safe Enough Spaces")**	**3. Organizational/Systemic: Higher education institutions (see section "Challenging and Transforming the Embedded Dysfunctional Tendencies in Higher Education From Within – the Systemic Level of Safe Enough Spaces")**
What are the main challenges?		
Stressors: crises of unsustainability and being in a liminal state, in particular: - uncertainty, not-knowing, complexity, multiple losses. . . - unpleasant emotions and stress	Rational discourse in search of consensus dominating learning and communication in higher education; liminal state of not-knowing	Neoliberal paradigm in academia, causing tensions and ambiguities
What does "space" mean in each case?		
An individual, intrapersonal, physiological state where someone feels bodily safe – for a certain time – and where growth, learning, creativity, regeneration, and access to internal and external resources are possible	The interpersonal space of dialogue where learners can disentangle themselves for some time from the urgencies of the here and now, and experience edifying conversations	Higher education institutions as open learning environments, where their respective discourses can be challenged and changed
What constitutes a safe enough space?		
Feeling bodily safe, as a physiological state of the ANS: - ventral vagus circuit of ANS is in charge, allowing one to cope with challenges in the "window of tolerance" - social engagement system is activated and enables us to connect with others, - not being in defense mode Having (subjectively) sufficient resources to cope with the challenges	Negotiating (or even co-creating) what feels safe enough between educators and learners Edifying conversations that enable participants to regain a sense of self-direction and self-coherence while facing a feeling of loss and not-knowing	Pedagogical approaches that address the dysfunctionalities in the system and use the educational institution as a starting point for change
What practices can create and maintain safe enough spaces?		
Balancing challenges and resources Change/reduce challenges: - Providing temporary zones for "time-out" from stress(ors) - Building in periods for regeneration - Facilitating an optimal point of learning where resources and challenges are balanced Activate/provide resources: Activating the social engagement system passively through - Trustful, supporting relation- ships conveyed *via* cues of safety - A quiet environment, removing distractions Activating the social engagement system actively by - Strengthening self-awareness, staying present and self-/co-regulation - Providing orientation and a feeling of not being alone - Slowing down and interrupting defense reactions Supporting positive experiences, pleasant emotions connected with achievement, creativity, reward and joyfulness. Reframing challenges into opportunities Overall: involving the whole mind–body in transformative learning	From rational discourse to transformative conversations - Recognizing that the force of the better argument within a rational discourse can make learners feel unsafe and block transformative learning processes - Negotiating (or even co-creating) what feels safe enough between educators and learners - Practicing open-ended conver-sations about transformed self-understandings to regain a sense of self-direction - Learning to embrace one's being at a loss as an opportunity for transformation - Appreciating different ways of mak-ing meaning (that do not necessarily have to converge in consensus) as opportunities to learn from and with fellow conversationalists - Seeking self-understanding through listening and joining edifying and transformative conversations - Enabling critical (self-)reflection through edifying conversations - Providing a space where learners can disentangle themselves for some time from the urgencies of the here and now - Nurturing a culture for edifying conversations in order to gain back feelings of coherence	Challenging and transforming the embedded dysfunctional tendencies in higher education - Recognizing the neoliberal tendencies and dynamics of economization and their unsustainable effects - Accepting that these dysfunctionalities affect all actors involved in higher education institutions in subtle ways - Starting to question hegemonic discourses as well as power structures together, as fellow conversationalists - Strengthening engaged critique by opening up self-reflective explorations into how systemic dynamics are affect-ing individual and collective meaning perspectives (in the sense of ideologies) - Opening up space for participation and empowerment designed to change prevalent discourses and structures, in order to increase control over the social system within the educational institution - Cultivating transformative spaces as starting points for institutional change

and communication challenges the emergence of edifying conversations on the interpersonal level. However, it is the neoliberal paradigm in academia that constitutes the base layer and fundamental limitation for all of the three levels, causing tensions and ambiguities that cannot be addressed by individuals on their own. All of the three levels are intertwined and thus efforts to create and maintain safe enough spaces need to tackle all levels in their interconnectedness.

RECOMMENDATIONS FOR CREATING AND MAINTAINING SAFE ENOUGH SPACES

The sections above have investigated the question how to create and maintain safe enough spaces in view of crises of unsustainability in order to embark on intertwined individual and collective transformative learning journeys on three complementary levels: (1) balancing resources with the challenges in order to feel bodily safe enough on the intrapersonal level, (2) enabling transformative (edifying) conversations in addition to rational discourse on the interpersonal level, and (3) challenging the dysfunctionalism of the academic system at the organizational and systemic level. The findings are summarized below in the form of recommendations for practice (**Table 1**) and discussed with a particular focus on the educator.

The practices on the different levels are intertwined and reinforce each other. For example, the social engagement system (ventral vagus circuit) can be activated through open-ended edifying conversations, and feeling connected and not alone as a member of an HEI. Vice versa, if someone experiences a trustful, supporting relationship and their ANS is mitigated by the ventral vagus circuit, edifying conversations can take place and tensions and dysfunctionalities in an HEI can be addressed constructively. Using edifying conversation on the interpersonal level can support questioning dominant discourses on the organizational and systemic level while staying in the window of tolerance of the ANS.

Taking into account the intrapersonal, interpersonal, and organizational and systemic levels, safe enough spaces are thus framed as temporal, physical, mental, individual, and communal "islands" within a situation that is not safe *per se* and that is exposed to multifaceted crises of unsustainability. These islands allow both learners and educators to distance themselves temporarily from the mentioned stressors on all three levels in order to experience regeneration in a mutual learning setting. This allows them to embrace unpleasant (edge-)emotions and stress as a starting point for transformation while navigating through the crucial phase of liminality within transformative learning. If facilitated well at all three levels, a transformative learning process will support the mutual learners as well as their higher education institution on their intertwined individual-collective journey by enabling them to:

1. Recognize, accept, and be with "what is": the unpleasant (edge)-emotions, or stress reactions caused by incoherence or dysfunctionalities connected with tensions and ambiguities.
2. Reframe these (temporarily) as invitations for transformative learning rather than as (life-) threats calling for defense reactions.
3. Embrace and balance them voluntarily as well as possible, rather than polarize them or act (involuntarily, automatically) with defense reactions.
4. Explore multiperspectivity within themselves and within a group, not necessarily striving for consensus, rather for better and deeper understanding and new ways of meaning-making within oneself, in a group of learners, and in the educational system.
5. Experiment with new forms of being, thinking, feeling, and acting in a group with mutual support and connectedness, without being directly exposed to inadequate assessment procedures and forced into defense reactions.

To sum up, learners and educators can regain the control needed for changing their meaning perspectives intrapersonally, interpersonally, or systemically. All three levels support self-coherence, self-efficacy, self-directedness, and critical (self-)reflection and therewith emancipation – which is key to transformative learning theory (e.g., Mezirow, 1991, 2012). At the same time the three levels offer the possibility of acknowledging our imperative for being (inter)connected with other humans (Porges, 2017) but also beyond, being embedded in complex social–ecological–technological systems. And we address the importance of integrated mind–body transformative

TABLE 2 | Responsibilities for creating and maintaining safe enough spaces for transformative learning.

Who	Educators	Learners and peer-learners	Institutions
Respon-sibilities	- Ensure that they "feel safe enough" themselves - As coaches/facilitators of transformative learning: be with "what is" and take responsibility for the overall learning process - Negotiate (or even co-create) what feels safe enough between educators and learners - Integrate and lead practices for establishing and maintaining safe enough spaces in an educational setting that is dysfunctional - Encourage learners to co-create safe enough spaces	- Ensure that they feel "safe enough" themselves - Take responsibility for their own learning process Participate in the practices - Engage in negotiating and co-creating safe enough spaces (e.g., by avoiding trying to position themselves as having the better argument) - Engage supportively with peer-learners	- Acknowledge the necessity of, allow and provide resources for safe enough spaces/"islands" - Be open to changing discourses and practices

learning, taking (edge)-emotions seriously, and fostering positive experiences and emotions.

We would like to stress here that educators, learners, and their educational institutions need to engage together in creating and maintaining safe enough spaces for transformative learning journeys to face the multifaceted crises of unsustainability. **Table 2** gives an overview of who is responsible for what practice at each of the three levels.

To be able to provide and maintain safe enough spaces and at the same time to feel safe enough themselves, all involved parties, and particularly educators, need to develop competences according to their responsibilities. They must also be aware of their limitations. It is particularly important for educators to develop their competences for facilitating transformative learning, including coaching skills (Förster et al., 2019), and to balance this with their other roles, e.g., as evaluators. In particular, it is crucial that:

1. Educators do not intentionally trigger a crisis or a massive disorientation to force learners into a transformative learning process. Rather, the goal is to support people for whom a disorientation or a crisis has already occurred (Mälkki and Green, 2014, p. 20).
2. Educators are able "to be (present) with" the learner's state of not-knowing, not judging but accepting it. This includes understanding that learners must face disorientation, a feeling of loss or incoherence, or tensions and stress reactions. Educators must respect and trust the self-efficacy and self-directedness of the learners and at the same assist their process. Therefore educators must be careful in applying "the being with," e.g., by listening with active intervention and by engaging the learner in edifying conversations.
3. Educators strive on the one hand to feel safe enough themselves to be able to support others' transformative learning journeys; on the other, it is crucial that they be supported by their institution.

The basis for being able "to be with" the learner is "to be with" oneself, which is a mind–body state. This requires cultivating and practicing self-awareness and presence to oneself, as well as self-regulation and self-reflection. In this manner, educators are able to (a) better recognize whether learners are in a transformative learning process, and (b) perceive their emotional and stress reactions. This includes recognizing one's own reactions in contact with learners in the liminal state, as well as one's own stress. Indeed, this influences the important ability to co-regulate the ANS toward feeling bodily safe enough.

At the same time, we would like to unburden educators and make a plea for humbleness in facilitating transformative learning. Here are some points to consider:

- What is possible for each individual learner is not in the educator's sole and mighty hands.
- Each learner may be in a different state of transformative learning and even if there are general models of the steps in a transformation process, in reality such processes are very personal, unique, and context-bound (Förster et al., 2019).
- Educators intervene in complex systems and effects are not linear.
- Educators can provide a space over time to strengthen individuals' self-efficacy and resources, and alleviate stressors, but whether it really functions is not in their hands.
- Supporting transformative learning in the current educational system is a transformative learning journey in itself and the educator is wearing multiple hats, e.g., as an evaluator, facilitator, or mutual learner, which may cause stressful tensions.

Last but not least: our plea for safe enough spaces is not a plea to abandon reason-driven and deliberative debates in higher education institutions. On the contrary, critical thinking and accessing emotions belong together. For critical thinking we humans need the ability to regulate emotions and stress. This requires feeling safe enough and knowing how to return to our window of tolerance or enlarge its width when faced by unpleasant emotions or stress-reactions. Therefore, emotional education is an important complement to rational education, also within HESD.

CONCLUSION

The multifaceted crises of unsustainability in general and the climate crisis in particular trigger different forms of stress and unpleasant emotions among learners in higher education. There is a need for other pedagogical approaches that enable learners to cope with these emotions constructively so that they can contribute to critical thinking and transformation. Based on the theory of transformative learning we have suggested creating and maintaining safe enough spaces in which learners are encouraged to change their meaning perspectives. We have elaborated on what these safe enough spaces can look like (1) on an intrapersonal level of feeling bodily safe, (2) an on interpersonal level of engaging in edifying conversations besides rational debates, and (3) on a more organizational and systemic level, where neoliberal ideologies can be addressed and challenged. These different levels do not follow a sequential order but are deeply intertwined and influence each other. Based on these elaborations, this manuscript also offers recommendations regarding how learners, educators, and higher education institutions can create and maintain safe enough spaces.

For higher education, especially HESD, creating and maintaining safe enough spaces holds huge potential, as it offers the possibility of addressing the students' emotions and empowering them to help change their universities and – at a larger scale – the socio-economic system we live in. This does not mean eliminating rational considerations on problems of unsustainability. On the contrary: Transformative learning theory emphasizes that the aim of any educational process should be a more reflexive, inclusive, and rational way of seeing the world and being in the world. However, emotions can also hinder critical thinking and block transformative learning, leading to denial or cognitive dissonance (Mälkki, 2019). For this

reason we acknowledge the critical importance of emotions in transformative learning and the need for safe enough spaces to deal with stress. Opening up safe enough spaces within higher education institutions would therefore also mean to acknowledge the importance of stress, emotional responses, and embodied reactions to wicked problems such as climate change. These emotions are usually ignored in the logic of rational dominance in higher education, and addressed only to a limited extent in HESD. These safe enough spaces should allow all learners and educators to find themselves and gain new stability in relations, as well as develop a culture of safety to cope with stressful situations. As a result they can reenter the (more public) discourses about sustainability, elaborate solutions more bravely, and engage in the transformation processes of sustainability.

Nevertheless, the ambition to create and maintain safe enough spaces has some limitations. Firstly, this perspective may be mainly useful for learners in countries of the Global North. Learners in countries of the Global South may have different needs that should be considered. On the one hand they are least responsible for global dynamics of unsustainability, but are often hit by the most serious consequences, which brings the issue of global environmental justice to the forefront of debates. On the other hand, some of the educational formats in countries of the Global South might well be more advanced than current Global North formats in supporting sustainable development. Secondly, it is necessary to repeat that educators are not therapists. They should continuously and carefully consider the thin line between emotional sensitiveness in pedagogical approaches for transformative learning and therapeutic intervention. As they normally have neither the mandate nor the training for therapeutic intervention, they should cautiously observe learners' reactions and signs that they are leaving their "windows of tolerance," and avoid digging deeper if learners show signs of fight-or-flight reactions such as resistance to questions, exhaustion, or even panic. Additionally they need to recognize if and when it is necessary to recommend therapeutic support. Thirdly, the ambition to create and maintain safe enough spaces for transformative learning involves providing further training and supportive institutional conditions for educators so that they can work on their personal development as professionals. This task is embedded in an academic system where research and citation rates are privileged quality developments in higher education. Therefore, it is also necessary to change the structure of incentives in the sense of "transformative science" (Schneidewind et al., 2016).

Our analysis and suggestions are mainly derived from different theoretical perspectives. We strongly recommend that empirical research be conducted to further understand how to create safe enough spaces in education and society and how to concretely implement the above-mentioned practices. Empirical studies could include group discussions as well as biographical interviews with learners, educators, and leaders within higher education institutions, to deepen our insights about how to create and maintain safe enough spaces for transformative learning in light of the multiple crises of unsustainability.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

RF contributed to the section "Balancing Challenges and Resources – The Intrapersonal Level of Safe Enough Spaces" and "Recommendations for Creating and Maintaining Safe Enough Spaces". SE contributed to the section "From Rational Discourse to Transformative Conversations – The Interpersonal level of Safe Enough Spaces". PB, SG, and MS-B contributed to the section "Challenging and Transforming the Embedded Dysfunctional Tendencies in Higher Education From Within – The Systemic Level of Safe Enough Spaces". MS-B was responsible for the introduction and the conclusion as well as for the coherence of the whole article. RF and SG designed the figures. All authors developed the idea of this publication and proofed the final manuscript.

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Lights, Camera, Reaction: Evaluating Extent of Transformative Learning and Emotional Engagement Through Viewer-Responses to Environmental Films

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In sustainability education affective responses to climate change are rarely discussed, and this is to the detriment of students. One way to address this gap in higher education for sustainability is learner-centred teaching using transformative learning principles. The processes for implementation may vary. Our preliminary study evaluated the contribution of environmental films paired with viewer-response activities, such as reflections and discussions, to create emotional engagement and facilitate transformative learning in an online course where content focused on sustainability and climate change. Data for the study were gathered through two questionnaires, student reflections, and interviews. Our study found that the process of film watching, reflection writing, and engaging in discussion was conducive to incorporating five of the six elements of transformative learning: individual experience, promoting critical reflection, awareness of context, dialogue, and authentic relationships. We conclude that films are an effective means of conveying complex content in an online course pertaining to climate change and sustainability. We propose pairing films with viewer-response strategies, especially reflections to allow students to identify their feelings, biases, and preconceived frames of references and stimulate the path toward transformative learning in higher education.

Keywords: films, sustainability, higher education, reflection, emotional engagement, online learning, transformative learning

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INTRODUCTION

The science is clear – anthropogenic greenhouse gas emissions are increasing global temperatures, destabilising many Earth systems, and endangering human societies reliant on those systems (Masson-Delmotte et al., 2021). Yet despite this consensus, attempts to stimulate action in political or social bodies that would counteract climate change has been painfully slow (Moser, 2020). Part of this inaction is due to an inability to imagine new ways of living (Yusoff and Gabrys, 2011) and, especially in the wealthy West, to acknowledge affective or emotional responses to climate change (Norgaard, 2011; Head, 2016). This lack of affective awareness is most clearly seen in the way students are instructed about these environmental issues (Ray, 2020; Verlie, 2021). Despite at least a decade of research from psychologists demonstrating that knowledge about the impacts of climate

change is affecting human mental health (Doherty and Clayton, 2011), affective responses to this crisis are rarely discussed in sustainability education, and this is to the detriment of students.

Since the adoption of the principles of Education for Sustainable Development (ESD) by the United Nations (2005–2014), there has been an interest in bringing transformative learning into higher education (Balsiger et al., 2017). There have been several studies as well as a teaching framework called "Work that Reconnects" that have strived to connect transformative learning to sustainability topics such as natural resources management (Diduck et al., 2012), ecological crisis (Hathaway, 2017), and sustainable consumption (Sahakian and Seyfang, 2018). Currently a framework has been proposed by the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019) for implementing ESD beyond 2019, which includes transformation action as a key component.

Transformative learning as a theory was first advanced by Mezirow (1978), drawing influences from Kuhn's (1962) conception of paradigms, Freire (1970) ideas of conscientisation, and Habermas' (1971) domains of learning (Kitchenham, 2008). Transformative learning builds on these ideas and recognises the key role of an individual's frames of reference (perspectives), through which individuals view and interpret their experiences and derive meaning (Mezirow, 1991). A key component of this is reflecting on assumptions that have been accepted without critical thought and "overcoming limited, distorted, or arbitrarily selective modes of perception and cognition" (Mezirow, 1991, p. 5). Transformative learning theory is not without its criticisms (Howie and Bagnall, 2013). One such criticism by Taylor (1997) is the missing role of emotions, which Mezirow (2010, p. 29) acknowledges, restating that transformative learning theory "involves how to think critically about assumptions supporting one's perspectives and to develop critically reflective judgment in discourse regarding one's beliefs, values, feelings, and self-concepts."

This revised idea of transformative learning may be the pathway to engaging students in climate change and sustainability education. Climate change educators from around the world have sought to engage students emotionally (Ray, 2020; Verlie, 2021) because the lack of motivation to act on climate change is not apathy or scepticism, but rather a reflection of "socially constructed silence" (Pihkala, 2018, p. 549). One way to overcome this silence is to cultivate spaces to discuss climate change and the emotions it evokes (Norgaard, 2011; Verlie, 2019; Hendersson and Wamsler, 2020). Hathaway (2017) points out that feelings of fear, guilt, shame, and even dread are natural and understandable when confronted with the ecological crisis, which relates to the feelings that often accompany disorienting dilemmas – the first phase in transformative learning (Mezirow, 2010). Creating such spaces in higher education to examine feelings and recognise the shared experience of climate change impacts will require a combination of balancing power structures (Weimer, 2002, p. 74) and integrating the core elements of transformative learning, which are individual experience, promoting critical reflection, dialogue, holistic orientation, awareness of context, and authentic relationships (Taylor, 2009). These elements form the framework for the 10 phases of learning in the transformative process, the first five of which are: a disorienting dilemma, self-examination (including feelings), a critical assessment of assumptions, recognising the connection between one's discontent and transformation process and that others have navigated similar changes, and exploration of options for new roles, relationships, and action (Kitchenham, 2008; Mezirow, 2010).

Following this, our study evaluated the extent of transformative learning in an online course where content was primarily conveyed through films. While agreeing on what constitutes transformative learning may be difficult in practice (Drikx and Smith, 2009, p. 64), our study proposes that transformative learning can be fostered in the classroom with the process of watching films as the disorienting dilemma trigger, followed by reflection writing to enable the second and third phases of transformative learning, and finally peer-to-peer dialogue to stimulate the fourth and fifth phases. The extent of transformative learning can be evaluated by examining students' emotional and cognitive reactions as well as their ability to confront biases and preconceptions in self-reflections and engage with communication of complex themes in discussions.

MATERIALS AND METHODS

The novel undergraduate environmental film course had originally been planned for in-person offering. It was designed to convey content regarding climate change and sustainability through films in popular culture and allow undergraduate students to critically engage with their affective responses to these complex issues. Anticipating interdisciplinary interest in the course, the syllabus was constructed to be introductory in scope to engage students from various faculties within the university. However, the shift to online teaching due to COVID-19 precautions presented the unique challenge of engaging students with these films in an online environment and formed the motivation for this exploratory study. Therefore, funding was sought through a learning innovation and teaching enhancement grant to investigate how effective films can be as a paedagogical tool to promote experiential learning within an online teaching environment. However, the design of the course more aptly fits within the transformative learning framework than experiential learning according to the comparison of frameworks by Strange and Gibson (2017).

Course Design

The learning objectives of the course intended students to:

1. Critically examine assumptions that have been part of (their) existing knowledge base.
2. Recognise the underlying complexities associated with human development and environmental sustainability and communicate the accompanying emotions.
3. Understand and explain the roles of, and challenges associated with, contemporary film in defining, analysing, and resolving environmental issues.

4. Critically analyse and evaluate both fiction and non-fiction films' environmental claims and proposed solutions from different disciplinary perspectives.

Each week of the course focused on a different theme paired with films that exemplified that theme, scaffolding the topics of sustainability from global scales of change to local scales of change to issues of overconsumption, extraction, extinction, and pollution, and finally, how to change the world. The themes for each week along with the corresponding films are outlined in **Table 1**. Films were used as the course media because (1) films allow the educator to play the role of facilitator rather than instructor, and facilitation helps create a balance of power with and among learners (Weimer, 2002); (2) they are multi-sensory tools, which can be an effective way to communicate the complexities of environmental problems in accessible ways (Weik von Mossner, 2017); and (3) they provide the opportunity for active and meaningful discussion, promoting understanding through interaction with others (Petkari, 2017). The balance of power is vital to creating learning conditions to facilitate learner-centred teaching, which is focal to transformative learning (Taylor, 2009; Aboytes and Barth, 2020).

The course combined environmental films with viewer-response strategies inspired by and adapted from reader-response paedagogy (Davis, 1992). Students watched the films on their own, at their own pace, and were provided a week to reflect on the films. Students were also required to contribute posts to discussion themes every 2 weeks. The Framework for the Implementation of ESD Beyond 2019 (UNESCO, 2019, Annex II 4), rephrases Mezirow's concept of a disorienting dilemma as "a certain level of disruption opting to step outside the safety of the *status quo* or the 'usual' way of thinking." Mezirow (1991) adds that critical self-reflection, based on premise reflection, can help reassess previously unexamined assumptions. To enable this, students were pre-assigned weekly reflection prompts before each week's film to promote expression of initial reactions (thoughts and feelings) and exploration of changes in both perspective and self-awareness. The prompt questions were designed to not only encourage students to reflect on content but also on the premise of learning to become more aware of their own preconceptions as viewers and learners. The discussion board themes also had prompt questions to spark conversation and debate. The aim was to enhance the dialogue between two or more students after having immersed in critical self-reflection (Aboytes and Barth, 2020).

TABLE 1 | Course content themes for each week and corresponding films assigned to students.

Week	Theme	Film(s)
1	Introduction	*Human Psychology of Climate Change* (YouTube video)
2	Global scales of change	*Anthropocene: The Human Epoch* (Baichwal et al., 2019)
3	Local scales of change	*Biggest Little Farm* (Chester et al., 2018)
4	Implications of change at every level	*Soylent Green* (Fleischer et al., 1973)
5	Humans are fallible	*I Heart Huckabees* (Russell et al., 2004)
6	Consumption	*No Impact Man* (Gabbert et al., 2010)
7	Extraction	*Avatar* (Cameron et al., 2009) or *Carbon Rush* (Miller, 2012)
8	Extinction	*Jane* (Morgen, 2017) or *The Lorax* (Pratt et al., 1972)
9	Transitions	*Energy Transitions* (YouTube videos)
10	How to change the world	*A Force More Powerful* (York et al., 1999)

Study Design and Analysis

This exploratory research study ran concurrent to the course and was prompted by the desire to explore the effectiveness of films as a paedagogical tool and to investigate the impact of viewer-response activities (reflections and discussions) on emotional and cognitive engagement of undergraduate students. Films for the course were selected based on their connection to the themes of the course and their availability through the university's streaming service (Criterion) and YouTube. Further selection criteria included diversity in types of film (e.g., documentary, fiction, live action, and animated) as well as a spectrum of emotional messaging (e.g., uplifting, disheartening, and thought-provoking) to ensure structured and intended student exposure to disorienting dilemmas (Aboytes and Barth, 2020).

Participants were gathered from the pool of students in the environmental film course, which had an enrolment of 29 students. The study received guidance and approval from the Office of Research Ethics. In accordance with ethics requirements, the prospective participants were provided an information letter with a brief overview of the research, and a participation form to record their consent for the various components of this research, including participation in two questionnaires (administered online through Qualtrics), permission to use reflection assignments, and participation in an exit interview (administered online through Microsoft Teams). To prevent undue influence or pressure as well as acquiescence bias in responses, the instructor was not involved in any part of the recruitment, consent, or data collection. The research assistant managed all communications with potential and consenting participants, collected data, and de-identified study files. It was communicated to the students that the instructor would not have access to the study files until all marks were published for the course. Even after the course was over, the instructor would only receive de-identified files.

In total, there were twelve participants from three faculties (ten from the Faculty of Environment and one each from the Faulty of Arts and the Faculty of Health). Not only were these participants from diverse disciplinary backgrounds, but they also ranged in total years at the university: one participant was in their first year, three in their second year, four in their third year, and four participants graduated shortly after completing this course. The small sample size limits the validity of statistical analyses but provides valuable information as a preliminary study.

The questionnaires were made available to the participating students at two points in time, once at the beginning and once at the end of the term. Both questionnaires were identical and designed to gauge changes in opinion over the duration of the term. The questions consisted of short answer and five-point Likert scale statements for which students had a choice to rate each statement on a scale of 1–5 where 1 was strongly disagree and 5 was strongly agree. The one exception was for the question asking about climate change concern where 1 was not concerned at all and 5 was very concerned. The questionnaires were analysed quantitatively using R-software for statistical significances within three categories: (1) climate change, (2) emotional awareness, and (3) films. In the analyses, the answers were grouped together for response comparison within the categories and over time, from beginning to end of term.

The individual reflections from consenting students were analysed to evaluate emotional and cognitive engagement as well as to assess the extent of transformative learning. Each reflection contained five questions, four of which had standard wording (**Supplementary Material**). The flow of the questions follows Mezirow's (1991, p. 109) premise that continued learning is dependent on "what we have learned, how we have learned it, and whether our presuppositions are warranted." Question 1 always asked about students' feelings and thoughts during and after the film, Question 2 always asked students to convey the key message from the film in accessible language, Question 3 was film-specific, Question 4 asked students to reflect on any changes in perspective, and Question 5 asked students to reflect on what they learned about themselves by watching the film. The reflections were analysed for sentiment using R-software and the Bing Liu Lexicon (Hu and Liu, 2004). Sentiment analysis allows for automatic determination of a writer's feeling in text by evaluating the number of positive and negative words used in the text. The quantitative nature of sentiment analysis allowed for analysis of variance (ANOVA) using R-software to explore statistical significance in sentiment from week to week for the 10 weeks of reflection submissions. Additionally, text query of the reflections was conducted using stemmed words "feel" and "think" (including past tense), "learn," "aware," and "bias" to explore trends in student emotional and cognitive awareness. Starting at Week 5, the students received a rubric (**Supplementary Material**) to provide further clarity on the evaluation criteria for each question. Of particular interest in transformative learning were Questions 4 and 5. The exception to the standard reflection prompts is the last reflection for Week 10 (**Supplementary Material**).

Given the structured nature of the course where each reflection had standard prompts and corresponded to a specific film, a theoretical approach to thematic analysis was applied as opposed to an inductive approach (Braun and Clarke, 2006). The thematic analysis for Question 4 ("*Has this film changed your perspective? Elaborate and give examples of how*") was coded under two categories: change in perspective or no change in perspective. On the other hand, the thematic analysis for Question 5 ("*What are 2 things you learned about yourself while/after watching this film?*") was coded for self-awareness under four categories: Influenced, Learning, Aware, and Transformed. For Week 10, the questions transitioned to: "*What is your outlook now on environmental sustainability? What actionable learnings do you feel you will integrate into your education going forward?*" The questions were designed to evaluate the extent of transformation from self-examination to empowerment and/or individual action [i.e., phase 5 of transformative learning: exploration of options for new roles, relationships, and action (Mezirow, 2010)] at the end of the course.

Additional data were gathered through semi-structured interviews after the completion of the course to assess students' perspectives of films for content delivery and engagement with viewer-response activities, including reflections and discussion posts. The online interviews, each averaging about one hour, were conducted one-on-one with the research assistant on the Microsoft Teams platform. During the interviews participants were asked open ended questions (**Supplementary Material**) encouraging them to reflect on various aspects of the course as well as the impact of learning from films in an online environment. Data from the interviews were qualitatively analysed through NVivo.

RESULTS

The results demonstrated that while students found films to be an engaging tool for online course delivery, it was the viewer-response activities (reflections and discussions) that most helped them gain a deeper understanding of the content and themselves – their perspectives, their preconceptions, and their biases. Films were found to be effective at eliciting feelings that correspond to a disorienting dilemma and the weekly reflective writing helped students align their thoughts and feelings, stimulating the transformative learning process by engaging with emotions and shifting perspectives. Analysis of interviews showed that participants enjoyed the discussion posts because the posts allowed them to engage with differing perspectives from their peers. The results also emphasise the important role of the instructor as a facilitator – in providing guidance (a rubric), feedback, and encouraging critical reflection.

Disorienting Dilemma of Climate Change in Film

With respect to films, the questionnaires asked the students about engagement, enjoyment, and messaging. The results showed that students think highly of films as an effective way to learn online, a tool for conveying complex messages, and an engaging and enjoyable experience. These opinions did not change significantly at the end of the term (**Table 2**). The students also strongly disagree that everyone gets the same message from films. Therefore, students recognise that while films can convey complex messages, individual viewer experiences may vary.

With respect to climate change, students were asked in the questionnaires about their concern, their motivation, and feelings of agency related to climate change. Additionally, students were asked whether they felt guilty when performing actions that are contrary to addressing climate change and if they feel they are

responsible for addressing climate change. While there were no statistically significant differences in the responses to these questions between the beginning and end of term questionnaires, there were some notable patterns within each questionnaire. One was the statistically significant difference between concern and agency as well as between motivation and agency related to climate change (**Table 3**). Students who participated in this research (and this course) are highly concerned and motivated to do something about climate change but are less confident in having agency over the situation. There were also significant differences between feelings of guilt and feelings of not being the cause of climate change at both the beginning and end of term (**Table 3**), which demonstrates that not only do the students feel guilty for taking actions contrary to addressing climate change, they also feel responsible for actions that contribute to climate change.

These feelings were confirmed in the reflections for Week 2 in reaction to the documentary film, *Anthropocene: The Human Epoch* (2018). When asked to reflect on the prompt question, "*How do you feel about inheriting a world where climate change is a primary concern for the future of the human race?*", participants responded with a variety of feeling words, including anxious, saddened, distraught, burdened, overwhelmed, distressed, angry, frustrated, disappointed, hopeless, irritated, upset, fearful, worried, stressed, cheated, resentful, and daunted. One analogy that stood out from the reflections was, "*It is essentially like inheriting a hoarder's items and trying to dig yourself out of the mess they have created.*" The variety of feeling words exhibited in this week's reflection demonstrated the power of climate change impacts on the participants and the power of film to bring these feelings to the surface, to elicit the disorienting dilemma of climate change. Two of the twelve participants also added

TABLE 2 | Opinions of films as an engaging and enjoyable tool for conveying complex messages in online learning, students were asked to rate each statement on a scale of 1 (strongly disagree) to 5 (strongly agree).

Category	Statement	Likert scale mean: term beginning (n = 10)	Likert scale mean: term end (n = 11)
Film as a tool	Films are a good tool to convey complex messages.	4.5 (0.7)[a]	4.7 (0.5)[a]
Messages	Everyone gets the same message from watching a film.	1.6 (0.5)[b]	1.5 (0.7)[b]
Engagement	Films create an engaging experience for the viewers.	4.4 (0.7)[a]	4.4 (0.7)[a]
Learning online	Watching films is an effective way to learn online.	4.4 (0.5)[a]	4.5 (0.7)[a]
Enjoyment	I enjoy watching films.	4.8 (0.4)[a]	4.7 (0.5)[a]
Enjoyment of complexity	I enjoy watching films with complex themes.	4.7 (0.5)[a]	4.5 (0.5)[a]

Values with the same alphabet superscripts indicate no statistically significant difference, different alphabet superscripts indicate a $p < 0.05$ significant difference.

TABLE 3 | Likert scale results from the pre-term questionnaire grouped under five groups: opinions concerning climate change, feelings concerning climate change, opinions concerning reactions to film, opinions concerning communication abilities pertaining to films, and opinions on emotional awareness.

Category	Statement	Likert scale mean: (n = 10)
Opinions concerning climate change		
Concern for climate change	How would you rate your concern about climate change?	4.9 (0.3)[a]
Motivation	I feel motivated to do something about climate change.	4.8 (0.4)[a]
Agency	I feel I can do something to prevent climate change from getting worse.	3.5 (1.1)[b]
Feelings concerning climate change		
Guilt	I feel guilty when my actions are contrary to what is recommended for addressing climate change.	4.5 (0.5)[a]
Responsibility	I feel that I am not the cause of climate change and should not be responsible for addressing it.	1.7 (0.8)[b]
Opinions concerning reactions to film		
Emotional response	I tend to respond emotionally while watching a film.	4.2 (0.9)[a]
Questioning facts	I tend to question the facts and opinions presented in a film.	3.8 (0.8)[a]
Questioning beliefs	I like films that make me question my beliefs or prior knowledge.	4.2 (0.8)[a]
Opinions concerning communication abilities pertaining to films		
Reflection	I tend not to reflect on my feelings after watching a film.	2.1 (1.1)[a]
Communication (message)	I am able to share the key message of a film with someone who has not watched the film.	4.0 (0.8)[b]
Communication (reaction)	I am able to coherently explain my reactions to films.	3.9 (1.1)[b]
Opinions concerning emotional awareness		
Acknowledgement	I admit and accept my emotions.	4.5 (0.5)[a]
Allowance	I let myself feel without getting caught up in my emotions.	3.2 (1.4)[a]
Responsibility	I take responsibility for my emotions.	4 (1.2)[a]

Students were asked to rate each statement on a scale of 1 (strongly disagree) to 5 (strongly agree). There were no significant differences in the results between pre- and post-term questionnaires. Values with the same alphabet superscripts indicate no statistically significant difference, different alphabet superscripts indicate a $p < 0.05$ significant difference.

optimism and seeing a glimmer of hope as feelings, one of whom said "*I am optimistic because of the generation that the world is being handed to. I have seen so many young people rising up to take action and call upon those in power to make a difference.*"

Presented with the openness and vulnerability of students' emotions to climate change, the instructor implemented feedback in each week's reflection based on (1) acknowledging the sharing of feelings, (2) relating the response to question instruction and rubric (once implemented), and (3) encouraging further exploration or providing open-ended inquiries. For example, "*I like how you've described the mix of feelings and connected each to different aspects of the film using one example from the film – I encourage you to describe the specific scenes/concepts that are connected to your feelings/thoughts to help explain them further*" or "*Thank you for sharing these feelings and thoughts! I like how you use examples from the film to share your reactions. One point [I would] like you to explore further in your own time is when you mention 'can we as environmentalists even win?' – I wonder how winning should be defined for environmentalists.*"

Engaging Emotion and Cognition Through Reflective Writing

Film content affects students' emotions, which is self-reported in the questionnaire results, explicitly expressed in the reflections, and supported by sentiment analysis of reflection writing. Students reported responding emotionally to films and enjoying films that make them question their beliefs or prior knowledge (**Table 3**). Students also reported tendencies to reflect on their feelings after watching a film and being able to communicate both the key message of the film and their reactions to the film. They are also likely to admit and accept their emotions and take responsibility for their emotions. They are, however, less likely to let themselves feel without getting caught up in their emotions. There were no statistically significant differences in self-reported emotional awareness responses in the questionnaires between beginning and end of term.

Text queries of the stemmed words "feel" and "think" showed that students tend to reflect through "thinking" more than "feeling" (**Figure 1**). The sentiment analysis for student reflections revealed that students had overall negative emotions for Weeks 1, 2, 4, and 7, whereas their emotions were overall positive for the remaining weeks (**Figure 2** and **Table 4**). The themes for Weeks 1 and 2 were Climate Change and Global Scales of Change, more specifically the damage and destruction that has been caused by humans over time, conveyed through two short YouTube videos and the documentary *Anthropocene: The Human Epoch* (2018). The theme for Week 4, Changes at Every Level, was conveyed through the 1973 film, *Soylent Green*, which projects into the future (year 2022) the grim consequences of overpopulation. In their reflections, students were asked to discuss similarities and differences between the fictional year 2022 of the film and the actual year 2020 that had just passed.

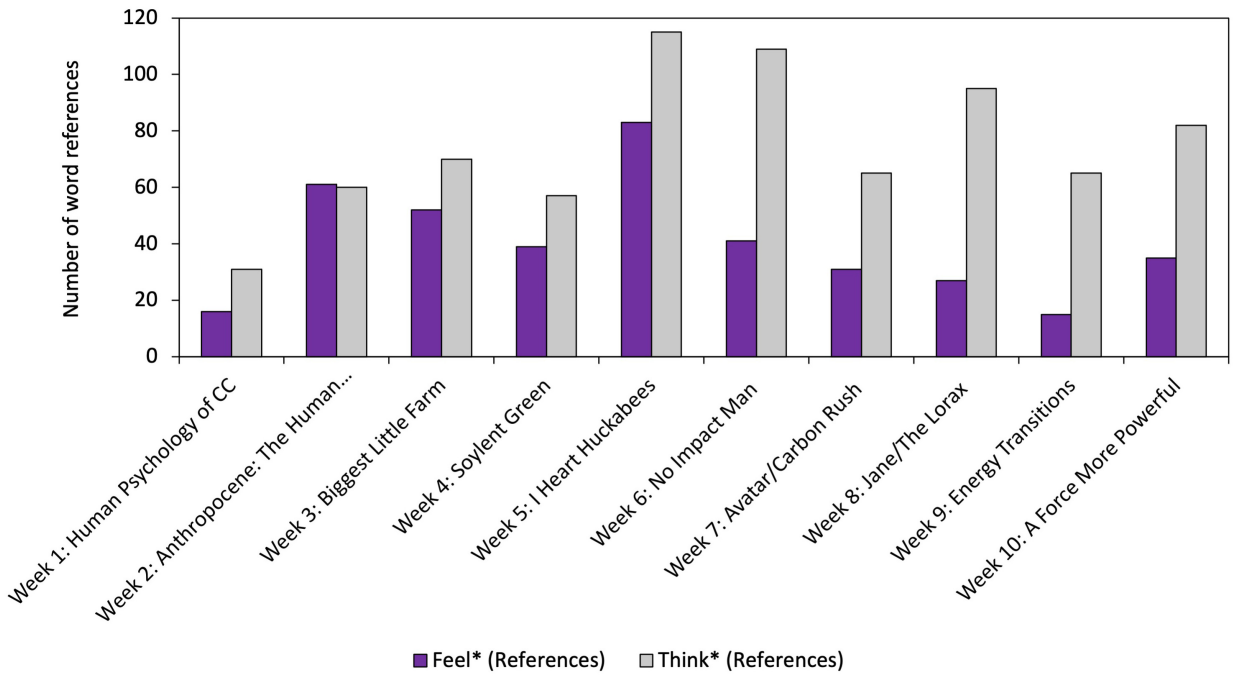

FIGURE 1 | Frequency of "feel" versus "think" words in reflection assignment over 10 weeks, using stemmed text query (which includes words with the same root, e.g., feeling and thinking).

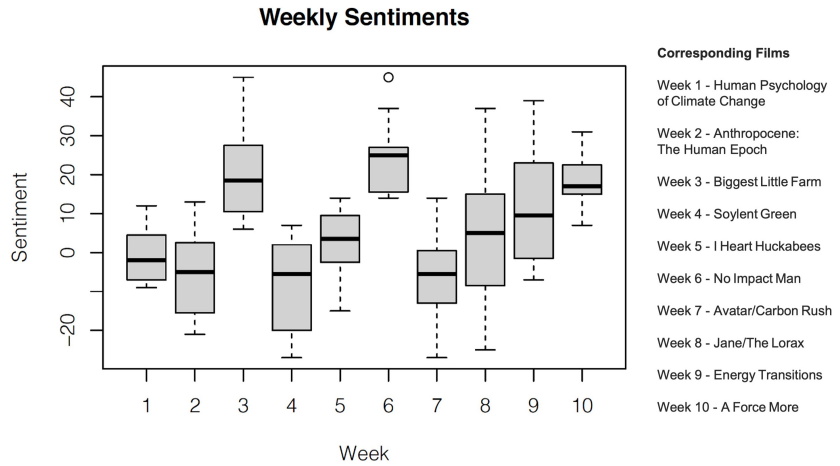

FIGURE 2 | Stem-and-leaf plots of sentiment analysis for weekly reflections using R-software and the Bing Liu Lexicon (Hu and Liu, 2004).

TABLE 4 | Analysis of variance Tukey HSD statistics summary comparing sentiments in reflection texts between the 10 thematic weeks.

Films	Week	2 (−)	3 (+)	4 (−)	5(+)	6 (+)	7 (−)	8 (+)	9 (+)	10 (+)
Human Psychology of Climate Change	1 (−)	n.s.	0.013	n.s.	n.s.	0.001	n.s.	n.s.	n.s.	0.045
Anthropocene	2 (−)		<0.001	n.s.	n.s.	<0.001	n.s.	n.s.	0.011	<0.001
Biggest Little Farm	3 (+)			<0.001	0.013	n.s.	<0.001	0.037	n.s.	n.s.
Soylent Green	4 (−)				n.s.	<0.001	n.s.	n.s.	0.001	<0.001
I Heart Huckabees	5 (+)						n.s.	n.s.	n.s.	n.s.
No Impact Man	6 (+)						<0.001	0.002	n.s.	n.s.
Avatar or Carbon Rush	7 (−)							n.s.	0.011	<0.001
Jane or The Lorax	8 (+)								n.s.	n.s.
Energy Transitions	9 (+)									n.s.
A Force More Powerful	10 (+)									

The p-values are indicated for statistically significant differences ($p < 0.05$) whereas differences that were not significantly different ($p > 0.05$) are noted by n.s. (not significant). The (–) symbol indicates an overall negative sentiment in the reflections for that week, whereas the (+) symbol indicates an overall positive sentiment in reflections for that week.

In their writing students expressed shock at the number of similarities they found, including wealth disparity, inequitable access to food, loss of biodiversity, and warming oceans. One participating student wrote "*It's frightening to think that it was easier to spot similarities than it was differences*" while another expressed dismay, saying "*This film paints quite the dystopian picture of the future in all aspects of life. Should we not correct course, I can definitely see at least the environmental aspects of this dystopia becoming more real. It is unfortunate that there are visible similarities at all.*"

There were statistically significant differences between Week 3 and many other weeks of reflection (Weeks 1, 2, 4, 5, 7, and 8). The film for Week 3 was a documentary titled *The Biggest Little Farm* (2018), an uplifting film about a couple resolving to move out of the city, buy a farm, and learn to farm sustainably. For the reflections in Week 3, students were asked to envision their ideal world in 50 years and the participating students had overall positive visions, two of which were:

"*My vision for the world in 50 years is that we will be living more equitably than we are now. As well that everyone is living free of fear and doubt, we have time for family, friends and leisure.*"

"*Hopefully, things will be a little less centralized though, so we're less dependent on expensive repairs from one company and more dependent on our community networks. It would be really cool to have like solarpunky [sic.] neighbours who come over to fix my rooftop solar panels and then stay for a drink that I brewed at home.*"

However, some students see more than one trajectory, each dependent on the current actions of human beings, which is exemplified by the following paragraph from a student's reflection that uses the films to help visualise the future pathways:

"*I have two visions for the world 50 years from now. The first vision is one that relates more to the Anthropocene film that we watched last week, where humans are going to extract so many resources that the consequences will be immense, and the world will be destroyed. My second vision is inspired by [The Biggest Little Farm] and the David Attenborough 'A Life on Our Planet' film, which makes me feel that we still have the power to reverse everything that we have done, so if we take action now in 50 years we will be living in a beautiful and healthy world.*"

The sentiments in Weeks 6, 9, and 10 were also significantly more positive than Weeks 1, 2, 4, 7, and 8. The film for Week

6 was another documentary, *No Impact Man* (2009), which was an uplifting story about an author from New York who decides to embark on a zero-waste journey for a year with his family (wife and toddler daughter). The movie follows their journey, struggles, and successes in reducing their reliance on mass consumerism and even electricity. The themes for Weeks 9 and 10 were Transitions and How to Change the World. These uplifting stories demonstrated a corresponding positivity in students' reflection writing. The themes for Weeks 7 and 8 were extraction and extinction with films like *Avatar* (2009), *Carbon Rush* (2012), *Jane* (2017), and *The Lorax* (1972), which narrated through powerful imagery the impacts of extraction on communities, particularly indigenous populations, and the ultimate negative consequences of human negligence on both people and environment.

The participating students acknowledged the importance of reflection in understanding the films, as a student stated, "*I usually do not take the time to reflect on the movies that I watch, and by doing so in this course, I realized that I am able to better convey the message of the film and I can better understand the meaning of the movie by reflecting about it.*" They also recognised the value in reflecting after watching each film, as one student pointed out "*My reflections from each week have been really helpful to better understand my initial reactive thinking to films. . .I found that my immediate reactions were not always the same after a few [days'] time.*" Additionally, participants recognised the importance of reflections in expressing their feelings, as one student aptly wrote "*I find that in university and academic spaces, feelings are often regarded as insignificant or irrelevant, especially in most research, where you are expected to remain bias-free and impartial. However, through the reflections, I've learned the importance of recognising my feelings and my biases to get a better understanding of my thoughts on the issue.*"

Shifting Perspectives and Communicating Complexity

While students reported enjoying films that made them question their beliefs or prior knowledge, they did not strongly believe that they questioned facts or opinions presented in a film (**Table 3**). Analyses of the reflections showed that students also require guidance and prompting to allow deeper exploration of their existing frames of reference (beliefs, prior knowledge, perceptions, biases, and stereotypes). Text queries for the stemmed words "bias," "aware," and "learn" (**Figure 3**) indicate that students did not use the word "aware" very frequently in their texts, with a count of less than 10 references each week, except for Weeks 4 and 7, which were both weeks of strongly negative sentiment. The frequency of the word stem "bias" only begins at Week 5 when the rubric was introduced, increases during Weeks 7–9, and drops again to less than 10 references for Week 10. The reference count for the word stem "learn" is greater than both "bias" and "aware" from Weeks 1–6 and has a large surge

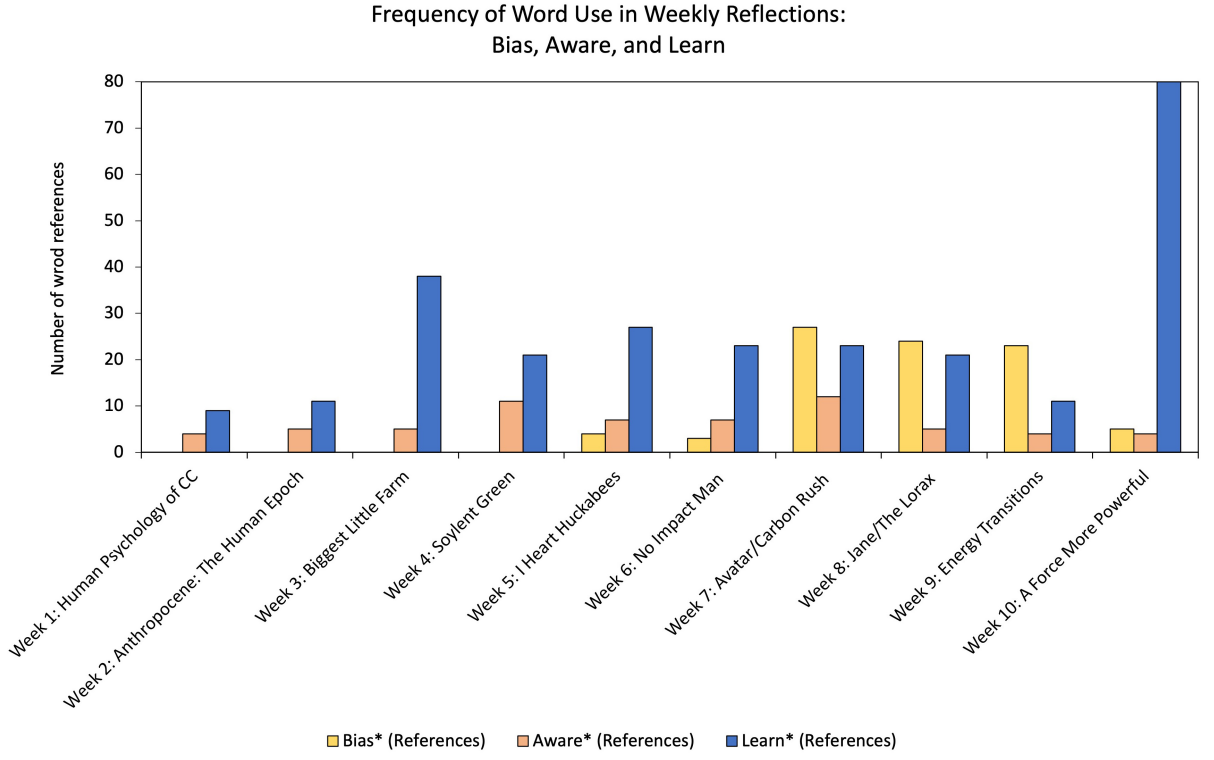

FIGURE 3 | Frequency of "bias," "aware" versus "learn" words in reflection assignment over 10 weeks, using stemmed text query (which includes words with the same root, e.g., biased, awareness, and learning).

in Week 10 where the question focused on what they learned through the course.

The thematic analyses on reflections from Week 2 (*Anthropocene: The Human Epoch*), Week 6 (*No Impact Man*), and Week 10 (*A Force More Powerful*) convey a compelling progression in perspective shifts toward individual action (**Table 5**). In Week 2 participants divulged more feelings than in Weeks 6 or 10. The feelings related to climate change were powerful, as was discussed above. While they acknowledged that individuals are also responsible for contributing to climate change, the participants strongly believed that governments and corporations hold the primary responsibility and power to make changes. However, at Week 6 after watching *No Impact Man*, there was evidence of influenced self-awareness that resulted in demonstrated shifts in perspectives toward individual action. Participants reflected on how individual action should not be negated and that living in line with their values is a life to aspire to. The impact of this perspective shift carried into Week 10 final reflections that asked about actionable change.

It is important to underline that shifts in perspective are not necessarily changes in opinion. The participants still hold the opinion that there are bigger contributors to climate change who have the responsibility and power to create change. However, they are also recognising the value of their own role as individuals. The writing changes from a hopeless narrative in Week 2 to one of optimism and understanding in Weeks 6 and 10, which is also noted in the sentiment analysis. Coding analysis of the reflections for perspective changes and self-awareness showed an improvement over the duration of the term. All participating students exhibited growth from being influenced to becoming aware and transformed through guided reflection of films (**Figure 4**). The analyses also show that some students participating in the study were already predisposed to transformative learning from the first week of the course. Shifts in perspective are not necessarily indicative of complete transformation in learning but do infer the potential to achieve transformation and can be compared to the 10 phases of the transformative learning process to determine the extent of transformative learning. Select excerpts from Week 10 reflections (**Table 6**) help further demonstrate the extent of transformative learning at the end of term after the consistent process of watching a film, reflecting on the film, and discussing the film with peers (online) over a 10-week period. The excerpts are categorised as: the value of individual action, tangible action, and reflection and critical thinking.

One key component of the reflections that students found valuable was being asked to write the key message of the film in accessible language. The responses to the question improved the participants' ability to talk about climate change, as one participant wrote, "*the reflections allowed me to start very good*

TABLE 5 | Select quotes from Week 2, 6, and 10 reflections that exemplify the journey of transformative learning from awareness of context and reality to exploration of options for new roles, relationships, and action (phase 5 of the transformative learning process).

Film	Reflection excerpts
Week 2: Awareness of climate change reality and understanding complexities	
Anthropocene: The Human Epoch (2018)	*I feel bad about the current system of natural resource extraction but not on an individual level. I know that my purchasing habits… do not make even the slightest difference to the dominant system.* *It's unfortunate, but I am forced to also contribute to the extraction of resources. I have to heat my home, fuel my car, and feed myself, so I am left with no other option. I just have a hard time understanding how it was allowed to get this far. Governments, especially those in first world countries, I believe should be to blame.* *I often feel as if extraction is inevitable as so much of our life and daily activities rely on resources. However, I often try to feel optimistic about technological developments which minimise resource extraction. I often feel that there is a pressure on individuals to feel responsible for climate change. I think that corporations should be bearing much more of the responsibly as their climate impact is much higher than the individuals. I would argue that corporations are often also responsible for making environmentally damaging products more readily available/affordable/accessible than sustainable alternatives.*
Week 6: Critical assessment of assumptions and recognizing empathic connections	
No Impact Man (2009)	*Yet, watching this film inspired me as it reminded me of the importance to live in full accordance with my own values. Even if one person living with a low environmental footprint will not make a change, Colin reminded me that social change begins with one person or a small number of people which encourages more people, and so forth (the snowball effect).* *I am coming to recognize the empowerment, optimism, and positivity derived from recognizing the value of individual action and the individual and larger benefits of reducing one's consumption, which I have listed above. This film has inspired me to address my never-ending desire for material items and focus on loving/using the pieces of [sic.] that I already own.* *I want to focus more on relationships, connections and community in ways that actually benefit my health like cooking a good meal together or going for walks and exploring natural spaces.*
Week 10: Compassion and exploration of options for new roles, relationships, and action	
A Force More Powerful (1999)	*I have learned to be more understanding of where people with different opinions are coming from regarding environmental action (or lack thereof). I feel more engaged and educated on what people are currently doing to solve the climate crisis in their own ways. Prior to this class, my personal opinion was that we need to focus mainly on corporate responsibility, and pressure the government to better regulate businesses' ecological footprints. While I still support this, my viewpoint has now also made room for better understanding the importance of individual responsibility and individual actions within the context of sustainability – especially after watching films such as The Biggest Little Farm and No Impact Man.* *One actionable way I will move forward is to talk about climate change as an opportunity for us to improve the ways we live our lives. This idea was present throughout many films; in No Impact Man, we saw Michelle fall in love with biking through the city, in Biggest Little Farm, we saw John and Molly create their dream life. I found these moments in the film endearing but also relatable.*

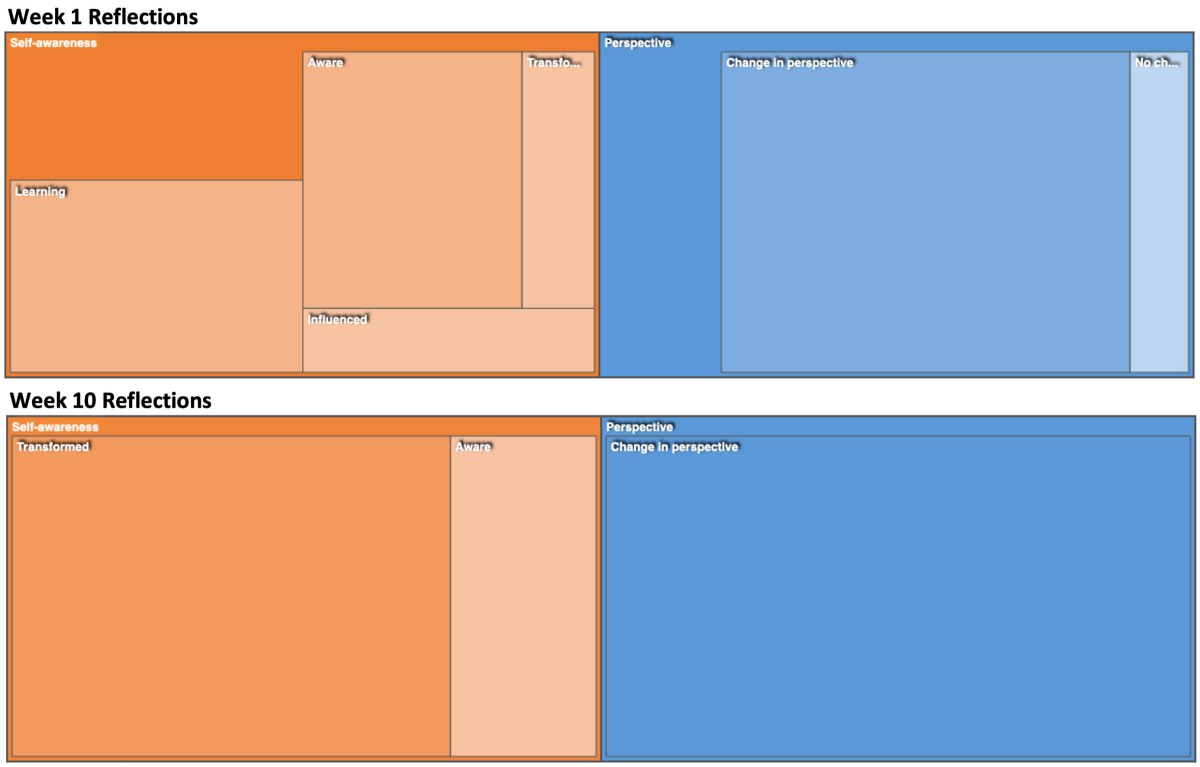

FIGURE 4 | Changes from Week 1 (beginning of term) to Week 10 (end of term) in coding categories for perspectives and self-awareness coding in weekly reflections. Awareness is defined as self-examination and a critical assessment of assumptions (second and third phases of the transformative learning process). Transformed is defined as the recognition of connection between one's discontent and transformation process and exploration of options for new roles, relationships, and action [fourth and fifth phases of the transformative learning process as defined by Mezirow (2010)].

TABLE 6 | Select quotes from Week 10 reflections articulating transformative learning through key takeaways from the course.

Key takeaway	Week 10 reflection excerpts
Value of individual action	*The most important takeaway from this course was learning the value of individual and small-scale action. In my education and my future, I intend to actively participate in local environmental action and recognize how it contributes to systemic change.* [Participant 3] *Going forward, I want to bring my new energy and passion for individual action into my education and learn more about what I can do as an individual for the planet. I want to get more involved, such as volunteering with an environmental organization, and figure out where my interests lie in contributing as one person.* [Participant 5]
Tangible action	*One environmental sustainability practice that I have taken on after watching the film "No Impact Man" was buying non-plastic bags for produce in the grocery stores. I saw these in the store one day after watching the film and thought that this was something simple that I could do to reduce my plastic waste and to make the environment cleaner.* [Participant 6] *. . .informative to hear about an issue as it "lives" in a real conversation, rather than in an op-ed or research report. I am excited to take this learning with me in my organizing work, and think this will be a core component for a new training I'm helping plan for Divest Canada and Climate Strike Canada!* [Participant 11]
Reflection and critical thinking	*I will reflect about the impact of an item before buying it. This will allow me to decide whether the item is worth all the impact that it might have caused in its life cycle. I will try as much as possible to always recognize the biases that might be influencing how a message is presented in a movie or social media. I will practice translating key messages into accessible language because this will allow me to educate (or at least start a conversation) other people who are not familiar with environmental jargon. I will try my best to always think holistically about the decisions that I take in my life to better understand the environmental repercussions of my actions.* [Participant 11] *The actionable learning concepts that I intend to bring with me in furthering my education is that of critical analysis, in addition to hope/seeking out change. Through this, I would like to be more critical about different topics that I approach and take a closer look into them (fact checking them, fully comprehending what I am being to and do I agree with this).* [Participant 12]

conversations with my family regarding the films that I watched. This was due to the fact, that we had to write in accessible language the key message of the movie, which allowed me to approach my family with the right words for them to understand what I wanted to tell them." Another participant shared, "*One effective communication tool that I thoroughly enjoyed in this class was explaining complex messages in an accessible way. I feel that this skill has helped me have better conversations*

with friends and family members and explain complex issues so that they can understand. I enjoy finding metaphors that friends/family members could relate too [sic.], and it seems that they also find this effective." Additionally, the interviews revealed that one of the online discussion boards were a memorable aspect of the course as they allowed participants to engage with varying perspectives presented by their peers. Select excerpts from interviews (**Table 7**) reveal the lasting impact of the films, reflections, and discussions with peers.

DISCUSSION

Transformative learning strives to explain by what processes perspectives are changed or transformed in adult learning structures (Mezirow, 1991). The process employed in this study to stimulate perspective change in higher education was film watching, followed by critical reflection, and discussing with peers repeated on a weekly basis for 10 weeks in online learning. According to Taylor (2009, p. 4), there are six core elements of transformative learning, which are incomplete without a balance of power in the classroom (Weimer, 2002). We categorise the findings of this research into five of the core elements for further discussion: individual experience, promoting critical reflection, awareness of context, dialogue, and authentic relationships.

Individual Experience

Students are concerned about climate change and do not feel they have agency, though they are motivated to address climate change. Students also experience guilt when their actions feel contrary to addressing climate change. Quesada-Embid (2016, p. 57) describes this as "green guilt," which is the "emotional sentiment associated with an awareness of not making choices according to what is best for the environment and sustainability when one wants to." We showed in this preliminary study that the use of environmental films evoked the feelings of guilt, fear, and dread that Hathaway (2017) found to be natural in the face of ecological crisis. American environmental humanities scholar Ray (2020, p. 2) discovered that when she led her class in a reflective exercise to envision "what it would feel and look like to live in a climate-changed future in which all the positive results of all their collective efforts had come to pass," her students failed to give her any positive visions. Ray's students were unable to give her an answer not because they were unwilling to engage with her question, but rather because they were overwhelmed by their emotional reaction to a climate-changed future. In the reflections from Week 3, we showed that students were able to engage with the question of envisioning the future 50 years from now and demonstrated that while some are hopeful, others saw the divergence of futures depending on human actions today and express worry for the worst-case scenarios. Ray (2020) concludes that movement toward acting on climate change will require engagement with feelings about this issue. We found that environmental films were able to provide that engagement and enabled participants to experience how others are navigating a changing world – through both uplifting and disheartening documentaries – and express the emotions accompanying these

TABLE 7 | Select quotes from exit-interviews elaborating on student engagement with films in an online learning environment and the attitudes toward the viewer-response activities of reflection and discussion.

Theme	Interview excerpts
Films: a multi-sensory tool for engaging self-paced learning	*We should be using films more and documentaries more and validating them as a means of educating students. Because, for one, not everybody learns in the same way, and I think being able to sit down and watch something and playing pause it and taking notes and having a visual accompaniment and audio that you don't get from staring at a page and trying to soak up information.* [Interviewee 2] *I really liked having an additional medium for how I've got to learn content, because a lot of my other classes you had to read studies, or you just had slideshows with no visual or other auditory stimulation so having films to view was just very engaging in that way. It just helped keep my attention. And it was very interesting to be able to view those.* [Interviewee 8] *I think it was cool to take insights from how different directors of different kind [sic.] of eras of filmmaking, where we're like portraying different ideas.* [Interviewee 11] *I think films present such a unique opportunity for students to learn in a different way.* [Interviewee 12]
Reflections: a way to encourage thoughts and feelings	*There were things that were asked every single week like what were your thoughts and feelings about it? I especially like the feelings question because I think often in the courses that I've taken there is absolutely no room for reflecting on your feelings. So, I liked how we had to examine the emotional impact and how certain techniques or certain narratives that the directors put forward influenced our feelings and I think emotions are not normally covered.* [Interviewee 3] *But really, in writing the reflection that was where I was really able to think through my ideas and my thoughts and my feelings about the films. So yeah, I thought I thought it was a good assignment too. To really be able to articulate my own thoughts and feelings.* [Interviewee 5] *I found that the reflections really helped me develop my critical thinking skills and I found that it was interesting to see how I would initially react to something once we watched the movies. I would initially answer the questions right after I viewed whatever the film for the week was, and then I would go back before I submitted it and review my answers and see how my line of thinking changed just over the course of a few days.* [Interviewee 8] *I also thought that they were really good for like the big emphasis on actually reflecting and not as much, just like summarizing what happened.* [Interviewee 11]
Discussions: a way to share and engage with different perspectives in online learning	*I really liked the discussion boards because you got to actually see, well, I guess read, about or see what other people thought about the same movie. That was the nice replacement for those in class conversations that would have been happening, which would have been even better. I think to have those conversations like live and get to debate about it back and forth. But given the situation, I think this was a good alternative option for that, or replacement for that.* [Interviewee 2] *I really enjoyed the group discussion, especially in online platform. Allowed me to engage with peers and it was so cool to see how passionate everyone else was about the different topics and their points of views and how engaging with my peers like they would bring up such incredible points and points of views. It just really allowed me to engage with the content on a different level, like not necessarily on an academic level, but a personal level.* [Interviewee 12]

experiences through reflections. This is aligned to sociologist Norgaard's (2011, p. 9) work, which aims to integrate "the emotional and psychological experiences of noticing or thinking about climate information." The caution to facilitators when engaging with student emotions is to not "*use* fear, guilt, or shame as motivating forces [as this may] distance, disempower, and undermine solidarity" (Hathaway, 2017, p. 300). Instead, we recommend instructors acknowledge student feelings without judgement and provide students with a rubric. A good rubric can outline expectations and encourage students to further explore their reactions to course content. In this study, we found that the introduction of a rubric in Week 5 led to further self-awareness in reflections.

Whether students realise or not, their writing reflected the sentiment of the films they were assigned, which varied week to week from documentaries to fictional stories and from doom-and-gloom to uplifting narratives. According to Verlie (2019, p. 758), the process of recognising and discussing emotions related to climate change and the future was a crucial step for her students in learning how to "live-with [*sic*.] climate change." She believes that for her students (and others) to change their behaviour and act on climate change, they first need to acknowledge the emotions (both positive and negative) that climate change evokes. The written reflections demonstrated that students do indeed let themselves feel as they self-reported in the questionnaires. However, they express more cognitively than emotionally. While the reflections carried strong sentiments that related to the intended sentiments of the films being viewed, students demonstrated a higher frequency of cognitive processes (using "think" words) instead of emotional processes (using "feel" words) in their writing. Kron et al. (2010) argue that the focus on feelings (experience of emotion) consumes mental resources that may also be concurrently required for cognitive tasks, thus leading to a reduction in intensity of feelings. Therefore, the act of writing a reflection for a course under the pressure of deadlines and meeting rubric criteria may explain the lower frequency of "feel"-related text. In which case, assessing students' reflective writing can be complemented with sentiment analysis, which proved to be a useful quantitative assessment in this preliminary study. Nonetheless, the process of reflecting on thoughts and feelings surrounding sustainability themes each week allowed students to become more aware of themselves as viewers and learners, which connects to phase 2 of the transformative learning process: self-examination (Mezirow, 2010).

Critical Reflection and Awareness of Context

Students recognised that reflective exercises allowed them to improve their critical thinking skills and their ability to articulate their thoughts, which they were then able to share on the online discussion forums. According to Quesada-Embid (2016, p. 58), critical self-reflection that bridges the personal with the academic and open dialogue are the paths to addressing the sentiment of "green guilt" and encouraging individuals to take impactful and meaningful steps to addressing climate change. Therefore, the critical reflections and discussion posts in this course are in line with the path prescribed, while the films are conducive to bringing the feelings of "green guilt" and other sentiments to the surface.

Students came into the course with existing frames of reference that were built on beliefs or prior knowledge that may have been taken for granted. However, the reflections from this preliminary study demonstrated progress in student self-awareness over the term. According to Mezirow (1997, p. 27):

"...the process by which we construe our beliefs may involve taken-for-granted values, stereotyping, selective attention, limited comprehension, projection, rationalization, minimizing, or denial. These considerations are reasons that we need to be able to critically assess and validate assumptions supporting our own beliefs and expectations and those of others."

The surges in the words "learn" and "bias" starting at Weeks 3 and 5, respectively, indicate the response of students to the feedback provided by the instructor from previous reflection submissions as well as the introduction of a comprehensive rubric. The rubric provided clear expectations and urged students to explore further learning about themselves, especially their beliefs, biases, preconceptions, and prejudices they have as a viewer of the films and as learners acquiring knowledge through films. Student bias is a subject of interest in business ethics (Tomlin et al., 2021) and medical sciences (Motzkus et al., 2019) where implicit biases have an impact on clinical decision-making but have not yet been explored in-depth in other fields of study. Because films are subjective, they can convey varying messages along with implicit biases, which are important for students to recognise and compare against their own existing frames of reference as well as their values.

According to the Framework for Implementation of ESD Beyond 2019 (UNESCO, 2019), the stages of individual transformation are: acquisition of knowledge, awareness of certain realities, understanding complexities of realities through critical analysis, empathic connections to realities through experience, and resulting in compassion and solidarity. The excerpts demonstrating the journey of students from Week 2 to Week 6 to Week 10 illustrate the transformation of participants in this study from awareness of context to empathic connections (**Table 5**). As was advanced by Drikx and Smith (2009, p. 65), the role of teachers and facilitators is to help learners make deep connections with the content and create the potential for transformative learning, though ultimately it is on the students to take that leap in their learning experience. Nonetheless, facilitators play a critical role of creating the safe space for sharing feelings and thoughts without judgement and encouraging students to question their preconceived frames of reference, which has been explored through arts-based approaches to transformative learning (Butterwick and Lawrence, 2009), has been advanced through this preliminary study in sustainable education, and is recommended for further investigation with films in higher education regardless of field of study.

Dialogue and Authentic Relationships

Films are an engaging learning method, reflections allow for exploration of thoughts and feelings, and discussions are a way for sharing and engaging different perspectives, which are all

in line with the core elements of transformative learning as described by Taylor (2009, p. 4). Participating students enjoyed engaging with their peers' differing points of view, which was consistent with findings of Sullivan and Longnecker (2014) who implemented class-maintained blogs that increased class interaction and enjoyment of intellectual exchange with other students. The participants also emphasised the importance of online discussion as a replacement to in-person conversations in classrooms. This was a surprising result as discussion posts were obligatory and counted toward the students' grade, impelling students to post to the discussion themes on a biweekly basis. However, the inclusion of online discussion as a viewer-response activity provided the social presence component that students need for personal connection (Ensmann et al., 2021), especially given the shift to fully online learning during the COVID-19 pandemic. One key advantage of the online film course was that there was sufficient time and space provided for reflection and discussion, which is one of the most often cited favourable learning conditions for transformative learning (Aboytes and Barth, 2020).

There were many moving parts in this course and its research design. The course assessments warranted heavy time commitment for the instructor toward marking reflections and balancing meaningful feedback conducive to student-teacher dialogue, acknowledging difficult emotions, and pushing students to move beyond superficial or surface level awareness toward deeper personal growth and perspective transformation. This resonates with the experiences of Drikx and Smith (2009, p. 65) who found that "engaging, accepting, and helping students work through emotional dynamics" is a challenging dimension of transformative teaching, especially in an online environment. The balance of power relations in the feedback dialogue between instructors and students is important to maintain as a learning condition to encourage a sense of agency and empowerment (Aboytes and Barth, 2020). Therefore, this research recognises that educators who engage in fostering transformative learning should do so with forethought and planning as it requires intentional action and a genuine concern for student learning (Taylor, 2009). Additionally, it requires educators to appreciate and evaluate their own assumptions and beliefs about the content being taught as well as the purpose of fostering transformative learning (Taylor, 2009).

Study Limitations and Recommendations for Further Study

An important limitation in this exploratory study was the low participation rate (12 participants out of 29 enrolled students). Difficulties in recruitment were a common occurrence with other studies also trying to recruit in the term when this course took place as was communicated to the investigators by the grant funders. The students had also received advertising for one other study being conducted by a fellow classmate in the same term. Additionally, the course was an optional special topics course with a course code that was shared with another course in the same term offering; therefore, enrolment in the course was lower than anticipated.

While the course was advertised to all six faculties of the university, students from only three faculties enrolled and participated in the study, a majority of whom were from the Faculty of Environment. Therefore, it is recognised that by the act of having enrolled in this course, the pool of students for the study was skewed toward interest in, and concern for, climate change and its impacts, which may contribute to the ceiling effect. Here, we use the definition of Ho and Yu (2015), that the ceiling effect is insufficient precision of measurement to enable distinguishing differences in the upper regions of a score scale. In this case, the effect of a small, self-selected sample influenced survey results with Likert scale responses being very close to the upper threshold limit and the lack of significant changes over the term. Precautions were taken to limit acquiescence bias by starting the survey with a short answer response and providing participants with a five-point Likert scale as opposed to binary choices of agreement for the statements. Additionally, the survey statements varied in positive and negative wording, encouraging participants to consider the question and reduce response bias. In this preliminary study, low participation and ceiling effect limit the rigour of the statistical analyses presented. Additionally, the results demonstrating transformative learning are limited to the time duration of the course and the interviews (total of 5 months). The lasting impacts of some transformations observed in this study would need to be verified over a longer duration or through follow-up interviews with participants to gauge follow-through of intended individual actions.

It is unlikely the ceiling effect would have been avoided if the sample size within the pool of students in this course offering had been larger than 12 with the survey design that was used. For future studies, we recommend expanding the sample size to participants recruited from disciplines other than the Faculty of Environment and using a seven-point Likert scale instead of a five-point Likert scale to increase reliability and validity of the questionnaire responses (Taherdoost, 2019). A larger study with control groups could also provide deeper insight into the impact of films and viewer-response activities on transformative learning. If the course had been in-person, the progression of watching the film, writing the reflection, then discussing would have been synchronous and likely more compressed in time than it was in the online offering. For future studies with in-person classes, we recommend honouring the linear progression and providing time and space for students to reflect on the films immediately after watching it before implementing peer-to-peer discussion. The act of reflecting allows students to process their thoughts and feelings, develop their own point of view, and acknowledge their biases, which we posit leads to more open-minded and respectful dialogue. Further studies can explore this hypothesis by manipulating the three-component linear sequence.

CONCLUSION

We conclude that films are a very effective and engaging tool for online course delivery, which should be integrated more

readily and with intention in higher education classrooms, especially in courses with complex topics like sustainability or climate change and courses that take place online. Films may also serve as a venue for triggering a disorienting dilemma, which is the first phase of the transformative learning process. However, films alone are not effective at engaging student cognitive and emotional awareness or setting them on the path toward transformative learning. It is critical to pair films with viewer-response activities, such as individual reflections to explore their feelings and articulate their thoughts, allowing them to explore their preconceptions, biases, and existing frames of reference through guided prompts, and online discussions where they can articulate their perspectives and learn from the perspectives and experiences of their peers. The viewer-response activities enable progress from the second to the fifth phases of transformative learning process. Using films to convey content with viewer-response strategies encourages a balance of power within the classroom as the learning model is not one-way from instructor to student, but rather a three-way learning model that focuses on student-centred learning. Student emotions and biases are elements not frequently explored or evaluated in higher education. Allowing for emotional exploration is recommended in sustainability education as course content contains complex topics relevant to both the students' academic and personal lives. Therefore, the process of film watching, followed by reflection writing and peer-to-peer discussions was shown to be effective at challenging student preconceptions and frames of reference in this preliminary study and, with appropriate implementation and nurturing by the educator, may facilitate transformative learning in sustainability education.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Waterloo Office of Research Ethics. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SE made primary contributions to the manuscript working collaboratively with MM-R. Both authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2022.836988/full#supplementary-material

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In Search of Transformative Learning for Sustainable Development: Bibliometric Analysis of Recent Scientific Production

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Transformative learning is a key element when it comes to making progress toward sustainable development. This goal requires an education that fosters the empowerment of people and the transformation of institutions, prepares for the necessary changes, facilitates resilience and encourages sustainable actions. The aim of this paper is to review the academic production on transformative learning in relation to the pursuit of sustainable development. To do so, a bibliometric analysis was conducted of the publications included in the Scopus databases for the 2003–2020 period, in order to explore its evolution, identify the main themes of which the field of knowledge is composed, and identify its main references and the network of collaborations between researchers and universities worldwide. During this period, scientific production has increased considerably, with a particular focus on adult education and competency development. At the same time, English-speaking dominance and the prevalence of Western origin has been observed. There is a need for more global, connected, and pluralistic research that is focused on diverse sociocultural contexts, research that factors in inequality and environmental justice and which calls into question the current socioeconomic model. A debate should also be started on which means of publication are the most appropriate for defending the quest for sustainability.

Keywords: bibliometric mapping, transformative learning, sustainability education, review, educational research

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INTRODUCTION

The quest for development is the main challenge we must face today, as reflected in the consequences we are already experiencing as a result of climate change and the loss of sustainable biodiversity that has unfolded into a global pandemic (IPCC, 2019; Platto et al., 2021). This major environmental and humanitarian crisis comes at a great cost to ecosystems, the planet's resources, the climate and people (IPCC, 2022; Worldwatch Institute, 2017). In addition to this, there are inequalities between countries and between different social strata (Stiglitz, 2015).

The IPCC's sixth report already blames humans directly for severe global warming, warning of the need to take urgent action (IPCC, 2022). Thus, moving toward more sustainable societies involves a profound change in our lifestyles and in the socioeconomic model that drives them

(Jackson, 2016; Balsiger et al., 2017; Chomsky et al., 2020), which is already being encouraged by the United Nations through the 2030 Agenda for Sustainable Development (United Nations, 2015).

In this transition, education is a key element as an enabler in many areas related to the pursuit of sustainability (Vladimirova and Blanc, 2015), driving solutions to turn our destructive and divisive societies into ecologically resilient, socially just and economically viable ones (Burns, 2018). In a world increasingly dominated by neoliberal policies and consumerism, where inequalities and environmental damage are increasing (IPCC, 2022; Kopnina and Cherniak, 2016; UNDP, 2019), this ambitious goal requires an education that empowers people, who must strive to recover a notion of autonomous and critical citizenship, capable of making decisions that break with current patterns.

It seems natural, then, that education for sustainability has looked to transformative learning as a way to redirect approaches to learning, since, as Thomas (2009) highlights, there are strong connections between the two. In order to make the necessary transition, it is essential to begin by encouraging a major process of reflection which, as proposed by Mezirow (2003), the father of transformative pedagogy, encourages a change of the ways in which we interpret our experiences. This learning occurs when people critically examine their habitual expectations, review them, and act according to the new point of view (Cranton, 2016).

Within this framework, civic empowerment and the development of sustainable competencies require pedagogical approaches that focus on learning processes more so than on the accumulation of knowledge, in order to educate people with capacities for participation, adaptation, innovation, creativity, and resilience through skills such as critical and holistic thinking, problem solving, and teamwork (Thomas, 2009; UNESCO, 2015). Education that deals only with cognitive knowledge is not enough; the affective, attitudinal and actional component must also be considered, making it possible to bring to light unconsciously assumed patterns of action, values, and attitudes. This approach to learning must be based on a systemic and critical perspective on the prevailing socioeconomic models and current ways of living (Varela-Losada et al., 2016). People in complex situations must be encouraged to explore new ideas and approaches and to participate in sociopolitical processes, with the aim of progressively moving their communities toward sustainable development (Rieckmann, 2018).

It should not be forgotten, therefore, that while transformative learning is often presented as a form of individual change, transformation toward sustainable development clearly requires societal change (Balsiger et al., 2017). Some authors even go beyond human and social transformation and speak of the search for new, intimate, interconnected, and reciprocal relationships between humans and the living planet (Burns, 2018). Hence, change must start from collective and organizational learning, from reflection and the questioning of frames of reference, paying particular attention to the social and political context in order to break with unsustainable practices and institutions anchored by power (Boström et al., 2018).

The quest for sustainability must, essentially, be based on the transformation of people's values, beliefs and behaviors, which is why research in social sciences and in education are key factors (UNESCO, 2013). Thus, it is necessary to study how education can promote sustainable development, especially through transformative learning.

Research on Transformative Learning Within the Context of Sustainable Development

Interest in the pursuit of sustainability in education has been growing in recent years, as has the publication of multiple reviews of the literature. Some of them are focused on education regarding specific environmental problems, such as conservation education (Ardoin et al., 2020) or climate change education (Monroe et al., 2019). However, studies with a more general focus on education for sustainable development have also been published (Gusmão Caiado et al., 2018; Martins et al., 2019), from a higher education context (Wu and Shen, 2016) or from lower levels of education (Ardoin et al., 2018).

Similarly, interesting reviews of the literature have emerged that make significant contributions to the field of transformative learning for sustainability (TLS). Thus, the recent review by Chen and Liu (2020) focused on systematically analyzing the studies that used the concept of action competence as the instructional approach. Their findings highlight the importance of working with authentic contexts on interdisciplinary topics and point out how the reviewed studies indicate that action-oriented pedagogy and transformative pedagogy cultivate students who

TABLE 1 | Summary of the main information of the dataset analyzed.

Description	Results
Timespan	2003:2020
Sources (journals, books, etc.)	57
Documents	129
Average years from publication	5.36
Average citations per documents	26.71
Average citations per year per doc	3.175
References	7,706
Document types	
Article	124
Review	5
Document contents	
Keywords plus (ID)	202
Authors' keywords (DE)	405
Authors	
Authors	305
Author appearances	343
Authors of single-authored documents	34
Authors of multi-authored documents	271
Authors collaboration	
Single-authored documents	38
Documents per author	0.423
Authors per document	2.36
Co-authors per documents	2.66
Collaboration index	2.98

are active participants, enhance their ability to deliberate on causes and effects and build their visions in order to find strategies to solve problems. Additionally, the purpose of the review by Boström et al. (2018) was to contribute a theoretical approach to understanding the conditions and constraints of social change toward sustainable development. To this end, they conducted a critical review of the literature in the field of sustainable development learning from a transformative learning approach, integrating three additional dimensions: institutional structures, social practices, and conflict perspectives. In addition, Rodríguez-Aboytes and Barth (2020) researched how it has been conceptualized and operationalized in education for sustainable development and collected evidence on how to support transformative learning. This important review highlights how social learning, the role of experience, and the development of sustainability competences are inherent to transformative learning.

In this context, bibliometric studies also make significant contributions, as they provide insight into the state of a field of knowledge and the production patterns of countries and institutions, recognizing their strengths and supporting decisions that help overcome possible biases and limitations (Maz-Machado et al., 2020). Thus, analyses have been carried out from a bibliometric point of view to find out more about research in education for sustainability (Hallinger and Chatpinyakoop, 2019; Prieto-Jiménez et al., 2021) and environmental education (Yanniris and Huang, 2018; Lopera-Perez et al., 2021).

Even so, it is necessary to continue to promote research that seeks sustainable development, especially by furthering the role of the social sciences and education (Boström et al., 2018). This is the framework for this research, which conducts a bibliometric analysis of publications since the beginning of the century in the area of TLS, in order to explore this field and supplement the literature reviews already carried out. This analysis will be used to determine its evolution, identify the main themes that articulate the field of knowledge, and recognize its main references and the network of collaborations between researchers and universities worldwide.

MATERIALS AND METHODS

In order to characterize the scientific literature on TLS, the metadata of the selected publications were analyzed and the bibliometric maps were constructed. This process was carried out in two phases:

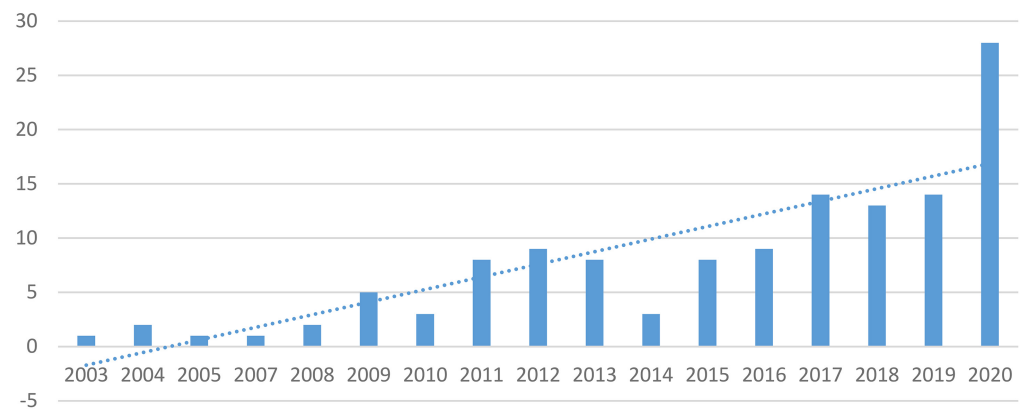

FIGURE 1 | Scientific production of transformative learning in the context of education for sustainability (prepared by authors).

TABLE 2 | Most relevant sources and most local cited sources (prepared by authors).

Most relevant sources	No. of articles	Most local cited sources	No. of citations
Sustainability	16	Environmental Education Research	280
Journal of Transformative Education	11	International Journal of Sustainability in Higher Education	177
Environmental Education Research	10	Adult Education Quarterly	166
International Journal of Sustainability in Higher Education	10	Journal of Cleaner Production	142
Sustainability Science	7	Journal of Transformative Education	107
Adult Education Quarterly	5	Sustainability	63
Australian Journal of Environmental Education	5	Futures	53
Journal of Teacher Education for Sustainability	5		
International Review of Education	3		
Journal of Environmental Planning and Management	3		
Local Environment	3		

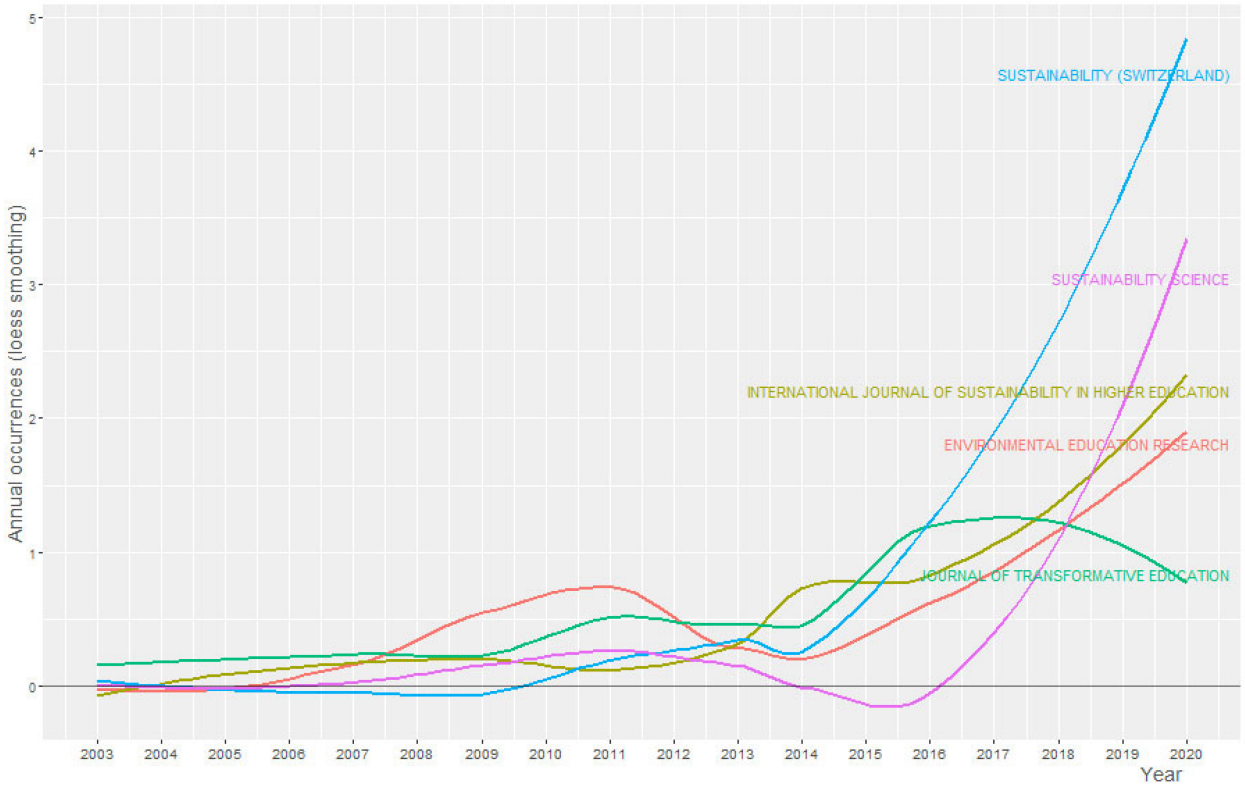

FIGURE 2 | Sources growth (prepared by authors).

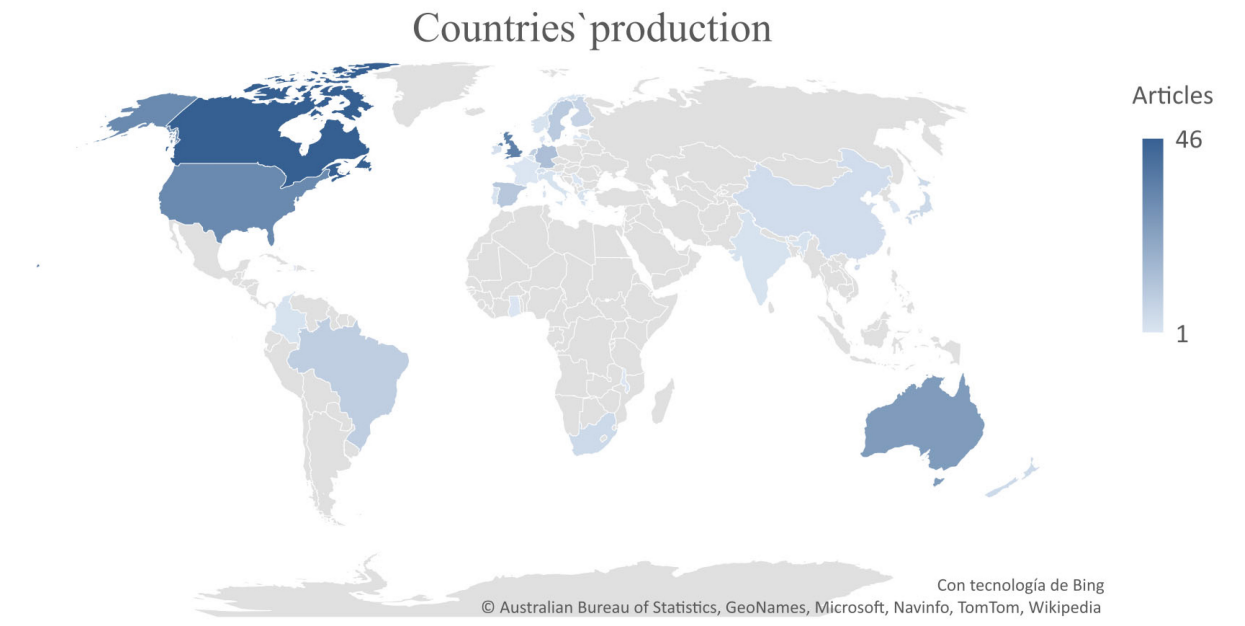

FIGURE 3 | Production by country (prepared by authors).

Search and Selection of Articles

Data were extracted through the Scopus database. This database provides extensive coverage of the broad variety of scientific journals that exist in the field (Mongeon and Paul-Hus, 2016). It has, therefore, been used in the literature as a source of bibliometric data for a large-scale analysis of research evaluations and research landscape studies (Baas et al., 2020; Kipper et al., 2020; Gao et al., 2021; Sobral, 2021). Furthermore, bibliometric research on databases confirms its value in citation tracking and citation analysis (Chadegani et al., 2013). Thus, this database was searched by selecting only *articles and reviews* in the social science arena. The following keywords were used as a search string: TITLE-BS-KEY *"transformative learning"* AND *sustainability* OR *"sustainable development."* These keywords were selected because they should help identify articles with a significant focus on the topic of interest. As a time frame, articles published from 2003 to 2020 were selected (eliminating those with early access), taking as a starting reference the publication of Mezirow, which marked a milestone in the dissemination of transformative learning (Mezirow, 2003). The first selection was then refined by reading abstracts to select those related to the topic of interest. This resulted in a final sample of 129 documents, the main information on which is provided in **Table 1**.

Analysis and Bibliometric Mapping

The metadata characterizing the selected documents (titles, authors, affiliation, country of origin, keywords, references, and citations) were extracted through the Scopus platform. The R-package bibliometrix v. 4.0.3, which performs scientific mapping for large research streams, was used to analyze these metadata and their connections (Aria and Cuccurullo, 2017). In order to facilitate the compressibility of the information obtained, tables and graphs were created and processed using Microsoft Excel. R-package bibliometrix was also used to obtain, by means of co-occurrence analysis, the citation and keyword maps and the thematic evolution figures. VOSviewer v. 1.6.15 was also used to obtain the cartographies showing the cooperation networks and the maps of relationships between keywords, by means of cluster analysis.

RESULTS

Evolution of the Research on Transformative Learning for Sustainability

The scientific literature in this area of research has evolved significantly over the period studied, as can be seen in **Figure 1**. Interest in transformative learning in the context of education for sustainability has grown steadily over the last 2 decades, with a major increase in the year 2020, which has doubled the scientific output compared to previous years.

Main Sources

When focusing on the main sources of publication in this research area (see **Table 2**), of note are an interdisciplinary journal (*Sustainability*) and a specialized journal in the research topic at hand (*Journal of Transformative Education*). Next are two journals focused on environmental education and education for sustainability (*Environmental Education Research* and *International Journal of Sustainability in Higher Education*). Looking at the same table, it is clear that these two sources are the ones that provide the most references to papers on transformative education for sustainability.

As can be seen in **Figure 2**, the exponential growth of interest in TLS in recent years in two interdisciplinary journals, Sustainability and Sustainability Science, is remarkable.

The Context of Scientific Production

Looking at **Figure 3**, it stands out that the countries with the highest scientific production on TLS are four English-speaking countries: Canada (with 46 articles), United Kingdom (35), United States (32), and Australia (26). Just after them are Germany (14), followed by Spain (11), Sweden (10), and Brazil (9).

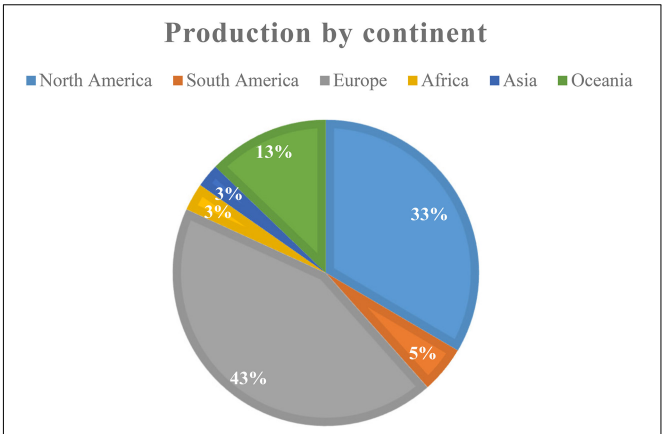

FIGURE 4 | Scientific production by continent (by number of articles; prepared by the authors).

TABLE 3 | Main affiliations of published research.

Affiliations	Articles
University of Manitoba (Canada)	11
University of Saskatchewan (Canada)	7
Wageningen University (Netherlands)	7
University of Plymouth (United Kingdom)	6
Leuphana University of Luneburg (Germany)	5
California Polytechnic State University (United States)	4
RMIT University (Australia)	4
University of Helsinki (Finland)	4
Arizona State University (United States)	3
Athabasca University (Canada)	3
Deakin University (Australia)	3
Griffith University (Australia)	3
Örebro University (Sweden)	3
The Kings University (United Kingdom)	3

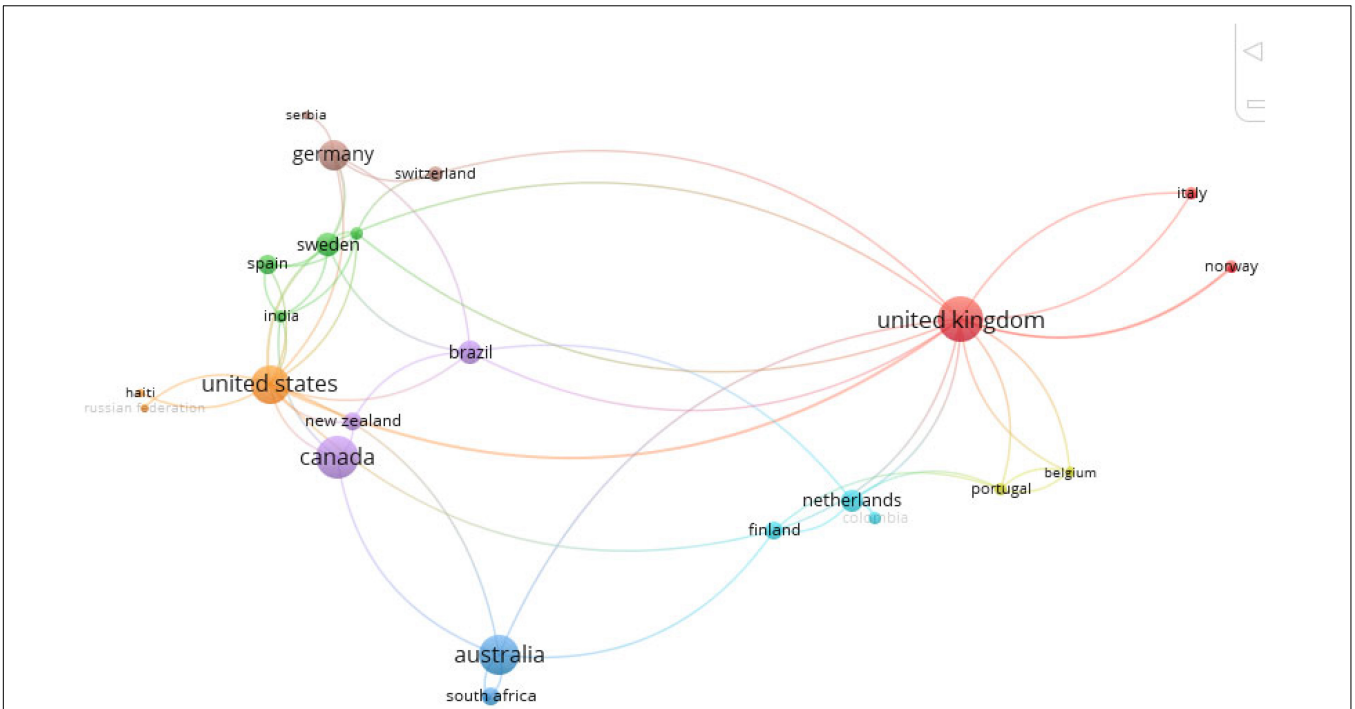

FIGURE 5 | Collaboration network (only the countries that show some collaboration in the publication of a document appear in the image; prepared by authors).

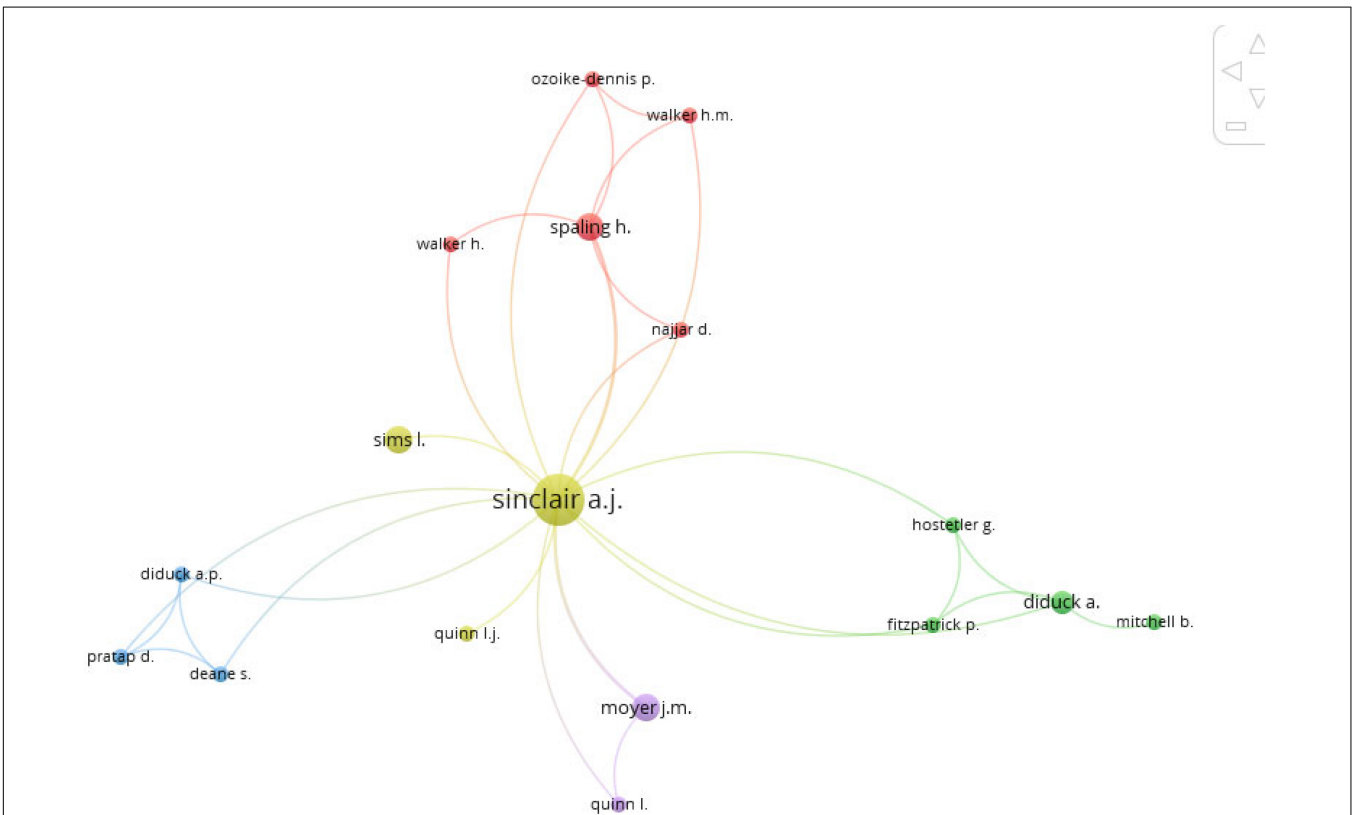

FIGURE 6 | Co-authorship network (only authors who collaborate in the publication of a document are shown in the image; prepared by authors).

Figure 4 also highlights the scientific production originating in the northern regions of the planet. Europe and North America account for more than 75% of the articles published in Scopus on the topic of interest.

It is also interesting to note the main universities that are researching transformative learning in the context of sustainable development (see **Table 3**). These include two Canadian universities (Manitoba and Saskatchewan), one from the Netherlands (Wageningen), and one from England (Plymouth). Once again, there is a lack of universities from countries classified by the United Nations as developing countries (United Nations, 2020).

Collaboration Network

Starting from the geographical context and looking at the map of collaborations in **Figure 5**, it stands out that the main nodes of cooperation are, again, in the four most productive English-speaking countries (United States, Australia, Canada, United Kingdom), although Germany, Brazil, and Sweden figure prominently.

Figure 6 also shows the co-authorship network (with at least one published paper), which shows a rather small number of collaborations. In the central hub, the role of A. J. Sinclair is notable.

Main References

The papers with the greatest impact can be seen in **Table 4**. Of note is the number of papers focusing on the study of TLS at the university level (Moore, 2005; Ferrer-Balas et al., 2008; Cotton et al., 2009; Thomas, 2009; Blake et al., 2013; Howlett et al., 2016). Another important point of interest is the creation of a framework for developing key sustainability competences (Wiek et al., 2011; Giangrande et al., 2019). Additionally, public participation in resource management is also a relevant issue (Diduck and Mitchell, 2003; Sims and Sinclair, 2008; Diduck et al., 2012, 2013). It is worth noting that two of the most frequently cited papers focus on transformative learning in relation to tourism (Coghlan and Gooch, 2011; Pritchard et al., 2011).

In **Figure 7**, on the most prolific authors, highlights the role of A. J. Sinclair, who has published ten articles in the period under review, sharing authorship with researchers of great impact such as Diduck and Sims, some of them with wide dissemination. In fact, he appears as a central hub in **Figure 6**, which shows the co-authorship network. Also relevant is the position of S. Sterling, who has published five articles in this period, one of which is on the list of papers with the greatest impact.

It is also interesting to see which are the most-cited authors locally (in the article selection itself). Here, J. Mezirow—the main promoter of transformative pedagogy—clearly stands out with more than 200 citations, as does S. Sterling, with 129. A. J. Wals, with 106, also plays an important role. Although the latter author does not appear on the list of documents in this selection of articles, he is one of the main references on social learning and higher education in the framework of sustainability.

TABLE 4 | Most-cited documents related to transformative learning for sustainability (TLS).

References	TC	TC per Year
Wiek et al., 2011	825	75
Pritchard et al., 2011	254	23.0909
Ferrer-Balas et al., 2008	191	13.6429
Thomas, 2009	166	12.7692
Sterling, 2010	152	12.6667
Moore, 2005	144	8.4706
Coghlan and Gooch, 2011	101	9.1818
Lange, 2004	95	5.2778
Cotton et al., 2009	94	7.2308
Brundiers and Wiek, 2011	87	7.9091
Diduck et al., 2012	60	6
Diduck and Mitchell, 2003	55	2.8947
Howlett et al., 2016	54	9
Diduck et al., 2013	49	5.4444
Percy-Smith and Burns, 2013	43	4.7778
Bell, 2016	41	6.8333
Sims and Sinclair, 2008	39	2.7857
Boström et al., 2018	36	9
Giangrande et al., 2019	35	11.6667
Blake et al., 2013	35	3.8889

Main Themes

Taking the keywords as a reference when analyzing the themes around TLS, different categories can be formed (see **Table 5**). There is a category closely related to the learning approach, where general terms such as transformative learning appear, but also more specific ones, such as critical reflection, social learning, and holistic education. There is also a category containing education-related terms such as Education for Sustainable Development or Higher Education. Additionally, there is a separate category related to sustainable development handling or policy, where terms such as sustainable development and public participation are placed. Lastly, there is a small, separate category containing keywords related to research, such as study abroad or action research.

Taking the keywords plus (keywords added by the databases automatically generated from the titles of the articles cited) as a reference, no significant new terms seem to be included, except in the category of sustainable development handling/policy, where more descriptive words such as local participation or community resource management do appear.

Figure 8 shows the keyword network, yields a similar depiction of the field of study. Thus, a main cluster can be observed with the most important elements that characterize transformative learning, such as transdisciplinarity, critical reflection, and social learning, and another fundamental cluster focused on sustainability, linked to terms such as environmental justice and social change.

In **Figure 9**, on the evolution of the trend topics in the last decade, the keywords related to research (action research, study abroad) were initially highlighted to then give relevance to topics related to adult education, such as public

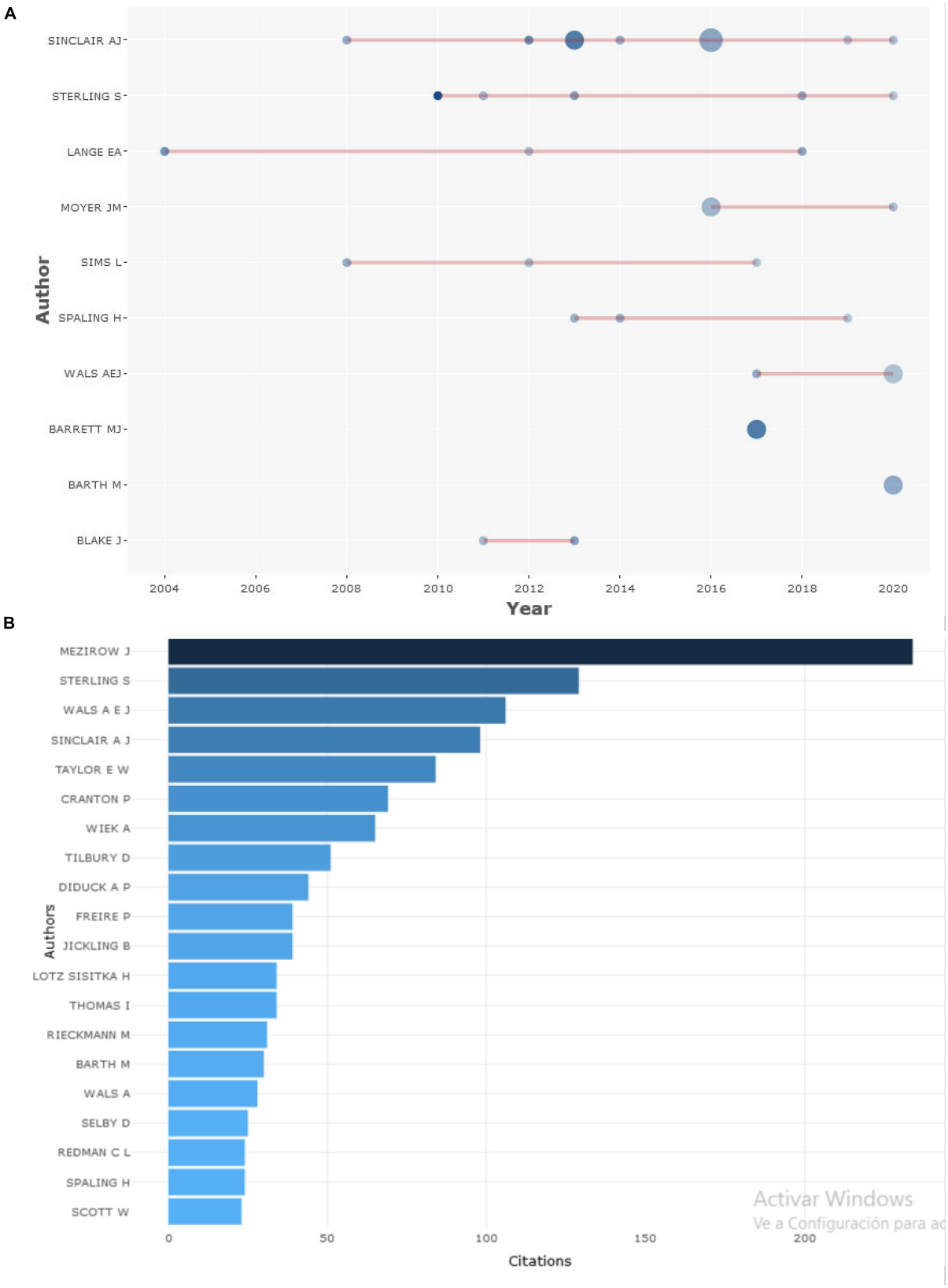

FIGURE 7 | (A) Top-authors' production over the time, where the size of the circles represents the number of papers published that year (the larger the circle the greater the production that year) and the color represents the impact of their publications. **(B)** Citations per most local cited author (prepared by authors).

TABLE 5 | Main themes (Authors' keywords in gray and keywords plus in yellow).

Learning approach		Sustainable development handling/policy		Education		Research	
Transformative learning	76	Sustainable development	39	Education for sustainable development	40	Action research	3
Critical reflection	6	Kenya	5	Higher education	12	Learning outcomes	3
Social learning	5	Social change	4	Education	6	Study abroad	3
Transformative learning theory	5	Canada	3	Environmental education	6	Threshold concepts	3
Transformative pedagogy	5	Public participation	3	Learning	3	Academic research	3
Holistic education	3	Sustainable development	49	Teacher education	3	Action research	3
Transdisciplinarity	3	Local participation	6	Learning	35	Conceptual framework	3
Transgressive learning	3	Kenya	4	Education	11	Theoretical study	3
Participatory approach	7	Canada	3	Teaching	6		
Decision making	3	Climate change	3	Higher education	5		
		Community resource management	3	Student	4		
		Environmental management	3	Educational development	3		
		Social change	3	Environmental education	3		
		United Nations	3	Knowledge	3		

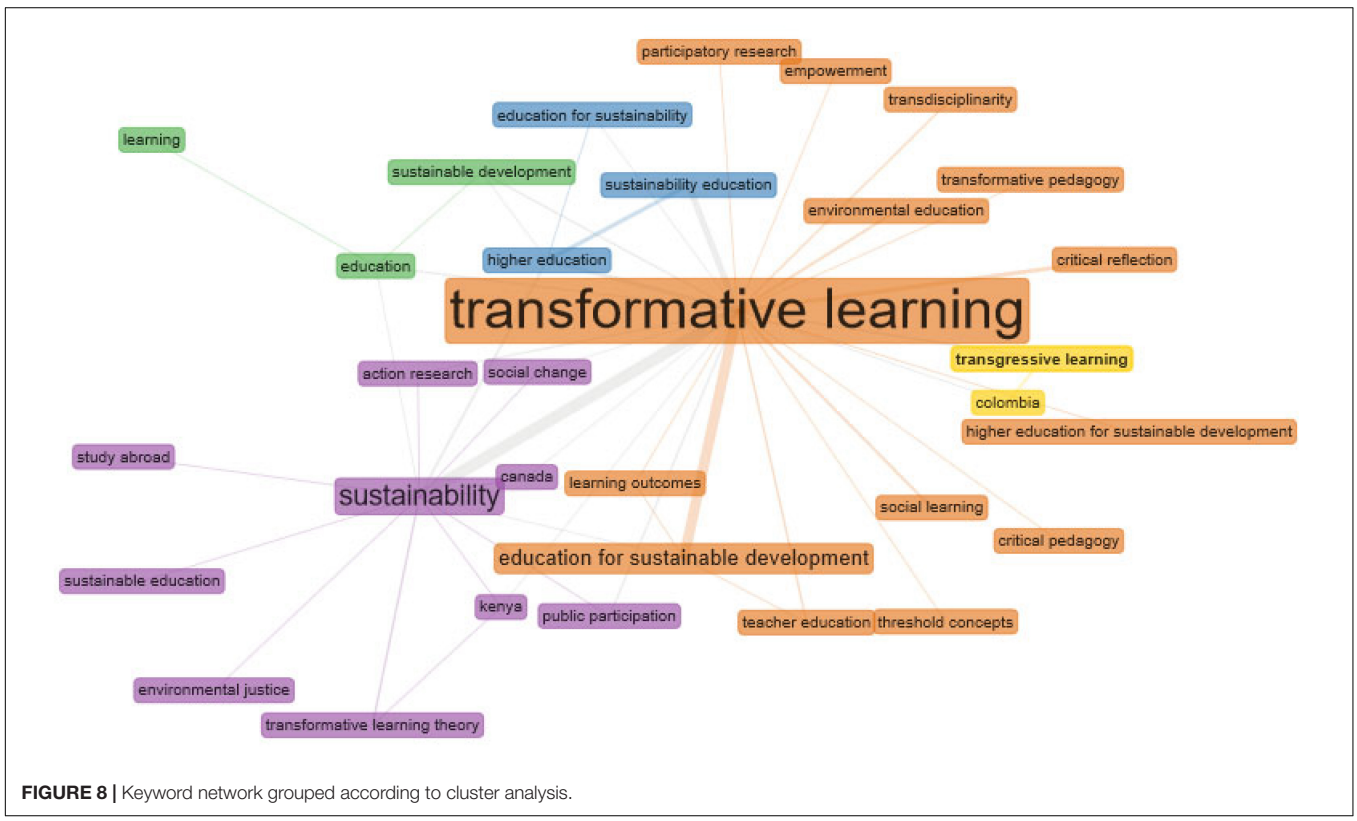

FIGURE 8 | Keyword network grouped according to cluster analysis.

participation and higher education. In the last section, where there is already a considerable increase in scientific production (see **Figure 1**), there is a greater variety of terms, such as social change, transgressive learning, holistic education, and transdisciplinarity, all related to innovative educational trends in transformative learning.

DISCUSSION

Transformative learning has become an element of growing interest in the quest for sustainability, as reflected in the data obtained by this research. The number of articles published on this topic has been increasing over the last two decades, and this increase seems to enrich the aspects addressed (see **Figure 9**). It is particularly important to highlight as a strength last year's production (2020) when 28 articles were published, double the number of articles of the previous year, perhaps driven by recent publications of international organizations that put special emphasis on the importance of this type of learning (United Nations, 2015; Leicht et al., 2018). This growth follows the upward trend in the scientific literature on education for sustainable development (Hallinger, 2020; Prieto-Jiménez et al., 2021), which can be related to the great concern that

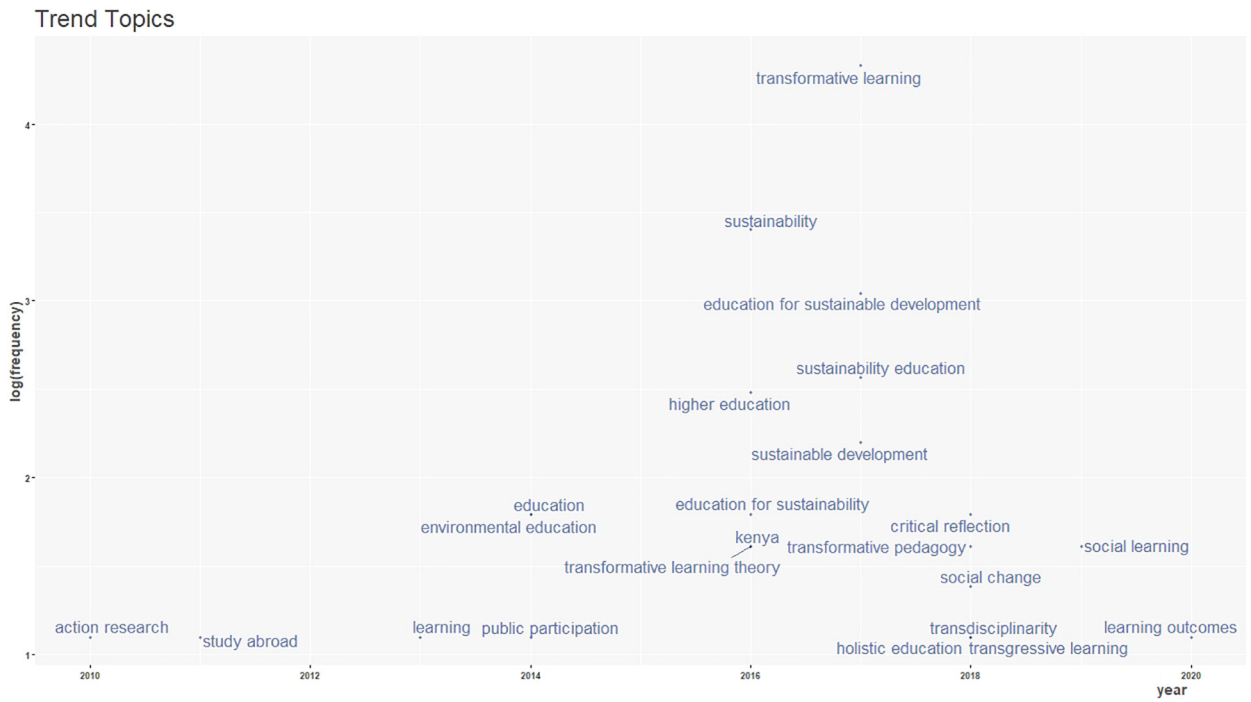

FIGURE 9 | Evolution of trend topics of authors' keywords (minimum frequency of 3).

problems such as climate change are causing in society and the international political sphere. The data obtained also seem to show how this increase in publications contributes to the richness of the field of knowledge (see **Figure 9**).

Other authors, however, are concerned about this increase in scientific production, which seems to be occurring in the different fields of knowledge driven by open access publications. Mahon and Henry wonder about the usefulness of research in the humanities field, which is increasingly unwieldy, where much is written and little is read, and point to the instrumentalist and mercantilist tendencies that pervade the research activity (Mahon and Henry, 2021). Macfarlane (2021) also talks about the rise of neoliberal values and the advance of competitiveness in academia. In the field of sustainability, Shephard et al. (2021) discuss how the current demands of researchers, quality indicators, and the review and publication processes for articles often clash with the values that should advance sustainable development. Moreover, Rodríguez-Aboytes and Barth (2020), now in the field at hand, warn of the superficial use of transformative learning theory in many studies.

In this regard, it is interesting to note the exponential growth in the number of articles on transformative learning in the journal *Sustainability*, which has made it the main source on the topic of study (see **Table 2** and **Figure 2**). This is an open access Swiss interdisciplinary journal of environmental, cultural, economic, and social sustainability of human beings, with an impact index of 3.251 (IF in JCR, 2020), which reflects the quality and interest of many of the articles published, and its main advantage is that it can be read by anyone with internet access. These types of open access journals are publishing a large number of articles but often require payment for each of these publications. It is, therefore, necessary to consider the difficulty for researchers with few resources to publish.

In the current context, the journals that contribute the most articles to this study are the aforementioned *Sustainability* and *The Journal of Transformative Education*, a specialist journal on the subject. However, it is also worth noting that the most-cited publication in our selection is *Environmental Education Research*, a traditional reference in environmental education. It is followed by the *International Journal of Sustainability in Higher Education* and *Adult Education Quarterly* (see **Table 2**). These two journals focus on post-school education, which reflects the importance of adult education in the pursuit of sustainability (Balsiger et al., 2017).

Another important element in the critical analysis of the data obtained is the origin of the selected publications. The four main countries producing the selected literature are four English-speaking countries, in line with the data provided by some studies that warn of the over-representation of English-language journals to the detriment of other languages (Mongeon and Paul-Hus, 2016). Once again, English-speaking researchers are privileged over other contexts. In fact, some studies show, for example, that the vast majority of Ibero-American researchers publish in English, rather than in their own language, Spanish or Portuguese (Badillo, 2021). This same document highlights the fact that this situation has relevant consequences for the vitality of languages, reducing the linguistic diversity of the scientific and academic world and diminishing

access to knowledge. This aspect is particularly important when it comes to advancing sustainability, which requires a transition at all levels and from most of the world's socio-cultural environments.

There is a clear prevalence of Europe and North America and their universities in the publications analyzed (with 75% of the articles published on the topic of study), evidencing the dominance of the West and its cultural hegemony in the ESD discourse (Barth and Rieckmann, 2016). Furthermore, few cross-country collaborative networks were found, and these are dominated by the same regions. Some of the reasons for this dominance are the lack of public funding for social science research in general (and on global environmental change in particular in the southern hemisphere and in emerging economies), as well as the lack of interest in these topics at national research funding agencies, and the lack of interest and motivation of traditional social scientists (Caillods, 2013).

This imbalance has significant consequences for the way in which TLS is researched, notably in relation to the diversity of scientific production and dissemination of knowledge, and, of course, in the way this knowledge can be applied in each context, which seems to compromise the significant need to address socio-environmental problems in a contextual way, requiring interventions based on the sociocultural characteristics of each region. This must be done at the macro, meso, and micro levels, as much of the behavior related to sustainability issues occurs at a crossroads of material infrastructures (e.g., what transport systems are available to me), social norms (how I should move around) and practical knowledge (how I use energy) (Shove et al., 2012; Boström et al., 2018).

As for authors working in the field, the data show that 305 people have published articles in the selection made for this paper, most of them in collaboration with other authors (see **Table 1**), with an average of two to three authors per paper. This seems to suggest that a good number of researchers are interested in TLS. Sinclair and Sterling, in particular, stand out among them. Nevertheless, the data also appear to indicate a need to continue creating collaborative networks where researchers from countries far from the West become more relevant and improving North-South networks, in order to favor more global, pluralistic, and intercultural research (Reid and Scott, 2013; Shephard et al., 2021; Tight, 2021).

When analyzing the papers with the greatest impact and the keywords used to describe the articles, three main TLS research trends emerge: (i) education for sustainability, especially in higher education, (ii) policies that drive sustainability, with a strong focus on public participation in resource management, and (iii) the learning approaches needed to develop transformative learning, with a particular focus on competence development. These trends seem to reflect an urgent need to tackle environmental problems, which requires changes in current decision-makers, without waiting for new generations. One need only think of the climate emergency, which requires a drastic reduction in greenhouse gas emissions by 2030 (IPCC, 2020). And these changes must be based on an education that empowers people, so that they are able to break with current patterns and seek new ways of dealing with everyday situations, both on a personal and a professional level. Thus, in the evolution of the trend topics, innovation in research seems to focus on TLS's defining characteristics: social and transgressive learning, critical reflection, and transdisciplinarity. An excellent way to delve deeper into these aspects would be to read some recently published review articles of great interest (Rodríguez-Aboytes and Barth, 2020; Wolff and Ehrström, 2020).

The analysis of the field also shows some significant gaps. TLS research does not appear to be particularly interested in issues related to inequity and environmental justice, which characterize socio-environmental problems, as well as gender studies that include in the debate the effect of patriarchy or the lack of valuing care for people and the environment. As Boström et al. (2018) point out, TLS must address issues of inertia, power and inequality at the societal and individual level. More publications focusing on these aspects are, therefore needed.

And, of course, it is also essential to continue encouraging research that promotes the questioning of the current socioeconomic model and that brings us closer to alternative positions. In the search for sustainability, it seems increasingly necessary to introduce approaches such as degrowth from a truly transformative perspective.

CONCLUSION

The urgent need to address the socio-environmental crisis involves a radical and rapid transition toward more conscious and just development models. Hence, the importance of transformative education, especially in relation to adult learning, as it is adults who are making today's decisions. This is reflected in the main TLS research trends, with a particular focus on university education and public participation in resource management. Also essential is research on what TLS should look like, where skill development is a key element in addressing socio-environmental issues.

Thus, research on TLS, despite being a relatively new field, has been growing in recent years, providing fundamental elements for change and driven by a good number of researchers. But there are still many challenges, debates, and gaps that need to be addressed, as the evidence shows. The issue of increasing scientific output that is occurring in all fields must be considered. In TLS research, the quality of publications must be prioritized over the quantity thereof, so that the term is not used superficially, as some authors complain (Rodríguez-Aboytes and Barth, 2020). The transformative approach must permeate the practice of education for sustainability, but research must be based on quality approaches to transformative learning, including the re-examination of current systems and patterns, with a social justice and gender perspective, in a way that supports and underpins the necessary change that need to take place in schools and among teachers.

In addition, researchers should be encouraged to reflect on what the most relevant resources are for defending the quest for sustainability. Open access, fee-paying journals are publishing a large number of articles and reaching a wide audience. But

it is important to consider whether this business model is the most appropriate one for TLS, particularly considering the difficulty unfunded researchers, such as researchers from developing countries or junior researchers, face in publishing their research. Should journals with this business model become a benchmark for transformative learning in the pursuit of sustainable development? Are we taking this field of study toward the utilitarian and neoliberal framework that some critics relate to sustainability (Huckle and Wals, 2015)? This is an interesting debate that needs to be considered, and which requires further study.

The quest for diversity in the field should also encourage publishers to publish in different languages. In addition, quality and rigor should be prioritized over quantity. Interdisciplinary and networked research is needed, involving diverse sociocultural contexts, especially from the southern hemisphere and developing countries. Research funding agencies must also take these aspects into account.

Bibliometric analyses such as this one can help people understand the field of study, detect gaps, and facilitate new ideas for research. But their design has several limitations. The results obtained are limited by the search conducted. The search parameters and the database used mark the articles selected and may result in some relevant publications being left out of reach. Therefore, future research should include more databases. It should be kept in mind that the impact discussed in this article corresponds to the term used in the academic field. Analyzing the real coverage (non-academic audience) of the publications would require another type of broader study. The analysis is also affected by the criteria and mappings chosen. For this reason, it is important to remember that although this research can serve as a reference, it is exploratory in nature and must be complemented with exhaustive literature reviews that help provide an in-depth understanding of the conclusions reached and the strengths and weaknesses identified in the results of the analysis conducted.

In short, education alone cannot achieve sustainable development, but it is one of the fundamental instruments for its progress. In order to tackle the socio-environmental problems in which we are immersed, it is essential to seek fundamental changes in the field of education. Hence the relevance of this type of analysis, which highlights the importance of researching new transformative approaches to develop the capacity to deal with the complexity and uncertainty of today's world, encouraging citizens to actively participate in the development of sustainable communities.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

MV-L and PV-M: conceptualization. MV-L and UP-R: methodology. MV-L, PV-M, ML-R, and UP-R: formal analysis and writing–original draft preparation. ML-R and UP-R: writing–review and editing. MV-L and UP-R: supervision and funding acquisition. All authors have read and agreed to the published version of the manuscript.

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Becoming Self-Aware—How Do Self-Awareness and Transformative Learning Fit in the Sustainability Competency Discourse?

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An ever-growing number of scholars are developing and applying competency frameworks in the context of sustainability education. Despite the strong interest, most of the research has ignored the varying meanings of competency, which can be interpreted as a performed ability, but also as personality development. UNESCO (the United Nations Educational, Scientific, and Cultural Organization) recently suggested self-awareness to be a central sustainability competency. However, the sustainability competency discourse is lacking a thorough analysis of how and if personality development related dispositions can be considered as competencies, how can they be taught in higher education, and how can the potentially transformative experiences resulting from such teaching be considered. This article aims at a deep understanding of the concept of self-awareness and its interpretations. We have reviewed the roots and analyzed the current interpretations of self-awareness in sustainability competency research and explored how the competency frameworks connect to transformative learning. In addition, we give tangible examples from art based and creative practices of design education, in which we have examined how self-awareness is defined and how it connects to transformative learning. The interpretations of self-awareness addressed two perspectives: awareness of oneself and awareness of one's relation to others and a wider society. Based on our research, becoming self-aware is a process that nourishes transformative learning. We additionally understand self-awareness as a process of internal growth instead of only a performable ability. This needs to be considered when developing the sustainability competency frameworks and their applications in education.

Keywords: self-awareness, sustainability competency, transformative learning, sustainability education, design education, higher education

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INTRODUCTION

The challenges of sustainability require transformations that are not only technical and political, but also personal (O'Brien, 2018; Ives et al., 2020). In higher education, the personal sphere, or self-awareness, is regarded as essential in relation to sustainability (UNESCO, 2017; Brundiers et al., 2021). The personal sphere is also vitally important in sustainability education because severe

sustainability related topics raise anxiety among young people (Ojala, 2013; Brundiers and Wiek, 2017). Scholars have approached and conceptualized these and other educational goals by framing the learning as transformative (Sterling, 2011) and by approaching the educational challenge as a question of competency building (Wiek et al., 2011; Brundiers et al., 2021).

The competency building approach has proved powerful for conceptualizing the goals of sustainability education in higher education institutions. The competency framework suggested by Wiek et al. (2011, 2016) has been widely used in research on sustainability education (Redman and Wiek, 2021). In their framework Wiek et al. (2011, 2016) suggest that students should have the ability for systems thinking, anticipatory thinking, strategic thinking, values thinking, interpersonal collaboration, and integrated problem-solving.

This framework has been further developed by many other scholars (see Redman and Wiek, 2021). As a result, a later addition to the sustainability competencies has been self-awareness competency, proposed by UNESCO in the publication *Education for Sustainable Development Goals* (UNESCO, 2017), and discussed by Brundiers et al. (2021). This addition brought the personal sphere explicitly into the framework. However, it is often unclear what is meant by self-awareness in the context of sustainability education. Most of the articles discussing self-awareness only mention the concept as part of UNESCO's key competencies for sustainability. Brundiers et al. (2021) recognize self-awareness and intrapersonal factors as essential for sustainability education but remain doubtful about whether these factors should be called competencies. On the other hand, in a recent document published by the European Commission, self-awareness related factors are directly connected to competency-based education (Bianchi et al., 2022). To clarify the connection between self-awareness and competencies a deeper understanding of what is meant by self-awareness is necessary (see Redman and Wiek, 2021). In addition, clarification of what is meant by competencies is needed.

The theory of transformative learning might also be helpful when aiming to clarify what self-awareness is in the context of sustainability in higher education. Many scholars have proposed transformative learning as a key element of sustainability education despite the sometimes-superficial application of the theory in sustainability education research (Aboytes and Barth, 2020). UNESCO (2017, p. 10) definition of self-awareness as "*the ability to reflect on one's own role in the local community and (global) society; to continually evaluate and further motivate one's actions; and to deal with one's feelings and desires*" attaches the meaning of the concept to awareness of a person's position in the world, the strengthening of a person's agency and a person's metacognitive capabilities to deal with emotions. There are similarities between these abilities and the fundamental idea of transformative learning as a process of becoming aware of previously unquestioned assumptions, or frames of reference, and thus transforming them to become more open and reflective (e.g., Mezirow, 1990). Becoming aware of one's own assumptions and the position in the world also lays the foundation for social action (Wolff and Ehrström, 2020). Stuckey et al. (2013) have suggested that "*deeper self-awareness*" would be a potential result of a transformative learning process. However, in the context of sustainability education research, no thorough analysis seems to exist on the connection between self-awareness and transformative learning.

In addition to theoretical analysis, there is a need to understand what self-awareness is in teaching, and what learning settings and conditions might support students' self-awareness. Moreover, it is crucial to understand what becoming self-aware requires from students and what emotional reactions transformative learning experiences might cause. Pedagogies that consider the holistic and relational orientation of transformative learning through cognitive, non-cognitive, embodied, and social learning experiences, are already practiced in design education (Grocott, 2022). Design at its core is a reflective practice (Schön, 1983), and a change-oriented and future-directed discipline, in which creative practices are applied to facilitate sustainable change (Irwin, 2015; Ceschin and Gaziulusoy, 2019; Light et al., 2019). In the context of this paper, design education focuses on the social dimensions of design, and frames the role of design in the engagement of communities in active, situated, and participatory transformation (see DiSalvo et al., 2017; Grocott, 2022). Therefore, the field might provide fruitful examples for sustainability education on how transformation (of self and society), self-awareness, and emotions could be considered in teaching. Accordingly, to respond to the need for research on self-awareness and transformative sustainability learning, design education serves as an example.

Our aim with this article is to give a profound understanding of the concept of self-awareness and its interpretations. The article begins with a theoretical framework, in which we review the two key concepts, competency (and competence) and transformative learning, as well as introduce the nature of design education and practices. This is followed by an examination and analysis of the self-awareness concept from the following viewpoints: (1) how the idea of self-awareness has been developed in sustainability competency research, (2) how the self-awareness concept has been defined in recent studies discussing self-awareness or the associated "intrapersonal competency" concept in the context of sustainability competencies, (3) what practices are used for teaching self-awareness in the context of design education, and (4) how our findings relate to the transformative learning theory. The concluding section discusses the implications of the findings to sustainability competency and sustainability education research and practice.

THEORETICAL FRAMEWORK

Competence and competency are common concepts in contemporary educational policy and research. However, the interpretations of these concepts vary, and they are often also difficult to distinguish between them. The concepts are sometimes combined with a transformative approach and may

include self-awareness. When discussing sustainability, the meaning of these concepts is crucial.

The Ambiguity of the Competence/Competency Concept

Since the beginning of the twenty-first century, educational goals have been defined widely in the form of *competencies*. In educational policy, the concept has been used both to fill the gap between education and work (Allais, 2014), and to create visions of how to respond to major future challenges (OECD, 2019; Bianchi et al., 2022). The concept covers two kinds of educational aims (Schaffar, 2021). On the one hand, it includes the idea of a learner who can respond to unpredictable situations, and on the other hand, it is used to ensure that graduates are competent (have sufficient skills and knowledge) to move on to their future profession (Illeris, 2013; Schaffar, 2021).

The latter idea of what competent graduates are has met with criticism for marketizing higher education, and viewing education purely instrumentally (Allais, 2014; Grice and Franck, 2017). Murtonen et al. (2017) criticize the theoretical foundations of competence-based education for being based on behavioral learning theories. Biesta (2016) argues that definitions of competence turn to the past instead of searching for wisdom that helps the learners to make judgments in a non-predictable future. Similarly, according to Lozano et al. (2012), this competence approach fails to consider the need for social transformation and students' capability to be agents of social change.

The discussion on sustainability competencies faces the same general challenges of the competence/y concept. In addition, according to Sterling et al. (2017) this discourse is characterized by substantial terminological plurality: concepts like competence, competency, capability, attribute, and ability are used as synonyms and to address differing meanings. Sometimes competence and competency are found even within one article, with the word "competencies" (the plural form of competency) being used with competence, which is an uncountable noun. Moreover, it is often left unclarified whether competence/y is linked to students' performance or if it is interpreted in a wider sense, including also developing students' personal values and empowering students to act in accordance with their values (e.g., Shephard et al., 2019).

Mäkinen and Annala (2010) suggest a difference between the competence and competency concepts. According to them, competence refers to outcomes of learning, i.e., knowledge and skills that are needed from a professional of a certain field, whereas competency is about personal traits, focusing on the development of the potential of an individual instead of performance or outcome. Similarly, Schaffar (using the term *competence*) (2021) identifies two interpretations of the competence concept, one having roots in sociology and another in psychology. The interpretation arising from sociological theory emphasizes competence as qualification. Relating to this interpretation, Schaffar (2019) argues that the role of educational institutions is to define competence requirements and measure students' achievements and eventually grant qualifications. The psychological meaning of the concept refers to being competent in a wider sense, and to being capable of acting in future unpredictable situations (Illeris, 2013; Schaffar, 2019; Schaffar, 2021). Illeris (2013) suggests that "being competent" also includes the aspect of development of personality and a person's "*capacities, dispositions and potentials*" (Illeris, 2013, p. 115). Then, according to Illeris (2013, p. 115) being competent is not only about what a person can do in practice, but also "*what a person has the preconditions to be able to do, and how far these preconditions have been developed.*" Accordingly, whereas measurement of a student's competence is central to the first interpretation, being competent in a broader sense evades the idea of measurement (Illeris, 2013).

This article interprets competencies in this broader sense and uses the competency concept to refer to the development of knowledge and skills, but also to the slow processes of developing personal dispositions, values, and individual's potentials. However, this difference is yet to be shown in sustainability education research and Shephard et al. (2019) call for acknowledging that there are two separate goals for education: those that can be performed and those that are more aspirational in character (e.g., willingness to act for sustainability).

According to Illeris (2013), development of competencies in the sense of personality development can facilitate transformative learning. Yet, what could it mean if competencies relate to transformative learning? Is it feasible to combine an economic-political educational concept like competency with a philosophical-psychological educational concept like transformative learning?

Transformative Learning

Jack Mezirow developed the transformative learning theory with a purpose of teaching for change in adult learning contexts. According to Mezirow (1990) and Mezirow (1991), transformative learning is a reflective assessment in which individuals learn to critically reason about postulated meaning and values. In this process, the individuals move through cognitive structures in which they identify and judge earlier assumptions. Mezirow calls the habits or rules for interpretation "meaning schemes." These schemes are transformed through reflection, which also includes validity testing. "Meaning perspectives," on the other hand, imply general sets of habitual prospects or codes controlling what individuals think, how they act and how and what they learn, and involve criteria for making value judgments (Mezirow, 1990). These perspectives are often based on the process of socialization, and date back to childhood. Also meaning perspectives may be altered through reflection. Transformation happens when the individual considers the old meaning schemes or perspectives to be invalid and replaces them with new ones. To learn and make meaning is thus also about unlearning (see, e.g., Macdonald, 2002). While meaning schemes and perspectives delimit what a person learns, meaning perspectives also involve feelings about oneself (Mezirow, 1990). In a critical learning process involving reflection, people think about if what they have learnt earlier is relevant under present circumstances. Therefore, reflection gives coherence and order to activities, and involves critique. The reflections may occur at three levels, aiming at content, process, or premises (Mezirow,

1991; Taylor, 2009). Content reflection includes issues like perceptions, thoughts, emotions, and acts, while reflections on processes focus on how one performs the functions of perceptions (Taylor, 2009). Reflection on premises is the base and may even include questioning of fundamentals like worldviews. Such a fundamental inquiry may be a strongly emotional process, according to Taylor.

Many educational researchers have been interested in transformative learning, developed the approach further and tried out transformative learning methods in practice (Wolff, 2022). The theory has been criticized for focusing too much on individual transformation and neglecting social reality, as well as emotional, imaginative, and ideological perspectives (Mezirow, 2009). For the last 20 years, the initial epistemological features of transformative learning (by esp. Mezirow) have been criticized from particularly postmodern and poststructuralist perspectives, but these initiatives have also failed to see transformative learning in all its complexity (Alhadeff-Jones, 2012). Transformative learning takes time, and cannot be forced (Taylor, 2009). It demands considerable planning and must be implemented without naïve expectations (Alhadeff-Jones, 2012), since the outcome is simultaneously predictable and unpredictable. It requires a wide variety of theories to understand how transformation takes place in complex relationships, interactions, and mutual interdependencies.

Transformative learning has caught increased attention in sustainability education research (e.g., Stuckey et al., 2013; Bell, 2016; Lange, 2019), but it has often been discussed at a shallow level (Aboytes and Barth, 2020). Mezirow did not create transformative learning for a reconstruction of the world (Sterling, 2011), but with a thorough theoretical focus. Transformative learning is an option in sustainability education (Boström et al., 2018), since it develops awareness of extensive power structures and strengthens agency to change society (Lange, 2019). Lange (2019) emphasizes a transformation process advancing from an individual viewpoint to a mutual planetary concern. In sustainability education, she distinguishes between three levels of transformation. First, the "micro-level change" or the learners' joint critical reflection. Second, the "meso-level change" is a more challenging change beyond the individual, including the human role in the entire world. From a sustainability view, this is the most important level. Thirdly, "macro-level change" requires political, economic, technologic, and ideological changes.

Lange (2019) argues that sustainability needs a transformative learning approach, which implies a change from outcomes, measurements, managerialism, and colonization. This is a deep transformation leading to alternative ways of thinking and acting and requires higher education to play a significant role in the fostering of awareness, learning and action.

Self-Awareness and Transformative Learning

Mezirow (1991) was influenced by Jürgen Habermas and his three domains of knowledge: the technical, the practical, and the emancipatory. From the notion of emancipatory knowledge, Mezirow (1981) developed the idea of emancipatory learning, and he related it to self-awareness and to self-reflective learning. The self-awareness concept has its roots in Carl Jung's psychology. Jung (1958) means that what generally is called self-knowledge is very limited, and it depends largely on social aspects. This prejudiced self-knowledge is immune to critique, but humans can obtain a deeper self-knowledge through exploration of their own "souls." According to Jung (1958), human psyches hide unknown potentialities, which can lead individuals to either catastrophe or construction, depending on how the individuals encounter them. If the individuals meet these powers with the right attitude, the attitudes can guide toward good ends. However, individuals easily avoid changes, and therefore, changing humankind is a slow process, according to Jung. However, by insight into one's own actions, and with access to one's own unconsciousness, an individual can influence the unconsciousness of others (Jung, 1958).

There are obvious similarities between Jung's self-knowledge concept and Mezirow's transformative learning theory and its basic critical self-reflection concept. However, Mezirow (1991) sees a difference between the Jungian view and his own. Boyd and Myers (1988) suggest a transformative approach in line with a Jungian theory of a self-made up of components like an ego with hidden instincts, which can be reached through meditation, dreams, and intruding thoughts. Mezirow (1991) calls this an alternative approach to transformative learning.

When Mezirow (1991) explains how the subjective self is built up through socialization, and how much the individuals take for granted in this process, there are similarities with Jung's notion of self-knowledge. The individuals need to understand who they are in relation to this knowledge. Mezirow also sees similarities between his ideas and Jung's in the individual's prelinguistic capacity to go against socially imposed expectations. However, many authors mix the concepts of critical self-reflection and self-awareness and use them as synonyms (e.g., Nagata, 2006; Bezard and Shaw, 2017), even if the concepts are distinct, not at least because of their vastly different theoretical base.

Self-Awareness and Design Education

In the design literature, self-awareness is closely related to professional development, the process of *becoming* a designer, but more broadly to how one *is* and *becomes with* others and the world (e.g., Akama, 2012; Hummels and Levy, 2013; Light and Akama, 2014). Awareness of one's personal sphere and positionality, as well as awareness of one's relation to others is emphasized with the idea that one is being affected by others and affects others at the same time (Light et al., 2019).

In contemporary design education, there is a growing interest in addressing social and sustainability transformation through creative approaches (see Irwin, 2015; Light et al., 2019; Dolejšová et al., 2021). Contemporary design education aims to cultivate future visionaries, experts and actors with skills to navigate uncertainty, in unfamiliar cultural contexts and in relation to sensitive social issues (e.g., Grocott and McEntee, 2019). These aims link to the competency discussion above and students' capabilities to act in a world that is changing and is unpredictable. By learning to facilitate multidisciplinary collaboration, and

participatory and experiential design interventions, in which it is important to acknowledge multiple value systems and relationships (Hummels and Levy, 2013; Pereira et al., 2019), design students are trained to act as agents of change. Most importantly, by applying their professional skills students and designers also support and foster the agency of others (Manzini, 2015).

Art-based and creative practices, which have been highlighted in sustainability science (Bentz et al., 2021, 2022) and transformative learning literature (Cranton, 2016), are well known in design education. These practices are often associated with change-making efforts that are grounded in mutual learning, cultivating the participants to challenge and change their own views, as well as their ability to become sensitive to new perspectives (Light and Akama, 2014; Mattelmäki et al., 2014; Vink et al., 2017). In this context, we do not refer to visual arts approaches or a traditional culture of object design, but to generative tools and sensorial materials, as well as sense-making methods that invite people to experiential, embodied and empathic learning encounters (see Dolejšová et al., 2021; Grocott, 2022). According to Lisa Grocott (2022), in which she connects design and transformative learning, the making and exploring together prompt the learner to be reflective. Such embodied encounters are deeply connected to a quest to make meaningful change (Grocott, 2022). Furthermore, creative practices mobilize knowing that goes beyond the analytical and rational mind and promote a transcendence of the here and now through imagining. Thus, in addition to becoming aware of the current situation, the aim is to foster participants' ability to envision alternative solutions and desirable futures, which can be rehearsed by using various forms of speculative drama, performance or scenario building methods (Halse et al., 2010; Brandt et al., 2012; Dolejšová et al., 2021). In the context of transformative change, these practices of "acting from the future" create an embodied and sensorial memory of what being in that envisioned, changed future situation could feel and look like (Grocott, 2022). In addition, these practices elicit and make visible the invisible social patterns and obstacles, "stucks," that affect people's ability to co-create and encourage a transition toward the desired future (Dutra Gonçalves and Hayashi, 2021).

Such processes of challenging and transcending the perceived and experienced reality by imagining involve reviewing and rethinking personal and collective, deeply held assumptions and mental models in social systems (Vink et al., 2017). This is associated with Mezirow and Jung's ideas about the ability to go against and beyond socially set expectations. In this context, Vink et al. (2017) highlight, in line with the pragmatists Schön and Dewey, that cognitive processes are intertwined with embodied actions (see Wetter-Edman et al., 2018). Vink et al. (2017, p. S2170) hence propose that creative practices have potential in altering people's existing ways of interpreting the world as well as provoking their reflexivity, and eventually enabling change in social systems. In practice, this means that the way design practices can contribute for example to Lange's three levels of transformation (mentioned earlier) is by providing an opportunity for encounters in which a wide range of stakeholders, such as leaders, policy makers, employees, citizens, or marginal groups, can work together. They can jointly explore how deep, individual and cultural beliefs, values and mental models create "cognitive scripts" that shape their actions (Grocott, 2022, p. 45) and support them to imagine and rehearse new ways of being and becoming (see also Meadows, 2008 and transcending paradigms).

METHODS

Having reviewed the theoretical backgrounds of the competence/competency concept, transformative learning theory and transformative education practices from the perspective of design education we now move on to explore the self-awareness concept. For self-awareness to be a useful concept for sustainability education theory and practice, it is essential to create an understanding of what kind of educational goal supporting students' self-awareness is. This study follows an exploratory approach. We have searched various perspectives to find meaningful ways to understand self-awareness and its connection to transformative learning. We selected this approach because our initial article searches showed that the concept was often left without definition or defined with either no or very few references.

Self-awareness was first introduced as a sustainability competency in the UNESCO publication *Education for Sustainable Development Goals* (UNESCO, 2017). To better understand the background of this new competency, we traced how self-awareness and the personal sphere have been discussed in the sustainability competency research before 2017. As a result, we reviewed four highly relevant and frequently cited articles on sustainability competencies and learning outcomes.

We then analyzed how self-awareness competency has been interpreted after the publishing of the UNESCO report in 2017. The use of the concept as part of sustainability competencies is rather recent, and many of the articles give only shallow definitions of the concept. Therefore, the analysis started by a so-called snowball sampling to identify the more relevant articles in relation to the research purpose (Wohlin, 2016). The article by Brundiers et al. (2021), which introduces intrapersonal competency as a synonym to self-awareness, led to two more articles (Frank and Stanszus, 2019; Giangrande et al., 2019) that discussed the meaning of self-awareness and intrapersonal competency. Another important starting point for our search was the systematic review of sustainability competencies by Redman and Wiek (2021). The snowball sampling to identify key articles contributing to the interpretation of self-awareness and intrapersonal competency resulted in a selection of six articles that we analyzed in detail. In addition, we conducted a search in SCOPUS with the phrase "'*higher education' AND self-awareness AND competenc* AND sustainabl**" within the time range from 2017 to 2022. This search resulted in 164 articles. Out of these 164 articles we selected for further reading eleven articles that mention higher education, competencies and sustainability in the abstract. Out of these eleven articles four discussed self-awareness on a level that was useful for building understanding on self-awareness as a sustainability competency. One of these articles was from 2020 two from 2021, and one from 2022. As a result

of snowball sampling and database search, we ended up with ten research articles, which we analyzed to find out how the authors defined the self-awareness or intrapersonal competency concepts (see **Table 1**). Moreover, we also discussed our findings against the UNESCO publication *Education for Sustainable Development Goals* (UNESCO, 2017) to understand the similarities between scientific and political discussion on sustainability competencies.

Based on jointly agreed criteria, one researcher was responsible for the practical article search. The same researcher also inserted the interpretations of self-awareness from the selected ten articles into an Excel table. This table formed the basis of the analysis. During the article selection and analysis process the authors met several times to decide on how to select the articles and discuss initial findings comparing the diverse interpretations of self-awareness. Therefore, all authors contributed to the understanding of the self-awareness concept. This iterative process assured that all the authors agreed on the results.

SELF-AWARENESS AS COMPETENCY?

This section explores how the above discussed notions of transformative learning and self-awareness are present in sustainability competency discourse. We first review briefly how self-awareness and the personal sphere were included in the competency research before UNESCO (2017) recognized self-awareness as a competency. Thereafter, we continue by analyzing the meanings and interpretations given to self-awareness competency.

Development of Sustainability Competencies

Many scholars have suggested a variety of sustainability competencies since the early 2000s. The conceptual competency framework developed by Wiek et al. (2011) was a turning point in the sustainability competency discourse. After its publication, research focus shifted from sustainability learning goals (e.g., Sipos et al., 2008) and competency frameworks (De Haan, 2006; Barth et al., 2007; Rieckmann, 2012) to developing and analyzing the Wiek et al.'s (2016) conceptual competency framework (e.g., Wiek et al., 2016; Wilhelm et al., 2019; Brundiers et al., 2021) and to applying it in teaching and assessment (e.g., Lozano et al., 2017; Redman et al., 2021).

The most frequently cited competency frameworks published before the UNESCO framework (2017) include a reference to the personal sphere of an individual and non-cognitive components of learning. For example, De Haan (2006) emphasizes non-cognitive components in his *Gestaltungskompetenz* (shaping competency) for secondary education: it includes competencies for self-motivation and the motivation of others, for distant reflection on individual and cultural models, and for promoting capacity for empathy, compassion and solidarity. In higher education, Barth et al. (2007) highlight the role and interplay of both cognitive and non-cognitive components of learning and argue for the reflection of values to be an important part of education. Similarly, one of the competencies suggested by Wiek et al. (2011, 2016), values thinking, refers to sustainability as a value-laden concept requiring ethics and acknowledging the complexity of the many viewpoints on how social-ecological systems should be developed.

The competency framework of Wiek et al. (2011) makes a distinction between academic and sustainability key competencies, for example by pointing out that critical thinking should be fostered in all academic programs as a key outcome. Rieckmann (2012) for his part, sees critical thinking as a central sustainability key competency. He thoroughly discusses individual reflection and the role of experience in advancing competencies and argues that competencies develop through action in varying contexts and situations. He defines the term competency as a precondition for self-organized action, differentiating it from the performance of that action and, thus, establishing an implicit connection to the two interpretations of competency (Mäkinen and Annala, 2010).

Apart from critical thinking and individual reflection, which echo the need for viewing the world in a novel way (generally seen as important in sustainability competency literature), explicit connections to transformative learning remain rare. However, Sipos et al. (2008) make a direct connection in their "head, hands and heart" model, which they designed to promote transformative learning. This model emphasizes a critical reflection process and the empowering of students to make them change perspectives. In addition to empowerment, Sipos et al. (2008) suggest "creative" and "fun" as transformative pedagogies of their heart domain.

To sum up, most of the sustainability competency frameworks suggested before the publication of the UNESCO learning objectives (2017) address the development of learners' personal sphere or personal change, but the discussion remains vague (Wilhelm et al., 2019). Similarly, the connections between competency frameworks and transformative learning are weak or even missing (see also Giangrande et al., 2019; Aboytes and Barth, 2020). However, since scholars have recently suggested self-awareness and intrapersonal competencies should be added to the sustainability competency frameworks (Redman and Wiek, 2021), there is a clear need to understand the role of the personal sphere as a part of sustainability competencies. Giangrande et al. (2019) even suggest that intrapersonal competency could be a way to strengthen transformative learning. The following section discusses and analyzes how the scholars have defined self-awareness and intrapersonal competencies, and whether these competencies connect to transformative learning in the way Giangrande et al. (2019) suggest.

Interpretations of Self-Awareness and Intrapersonal Competency in Sustainability Competency Research

To understand how self-awareness is interpreted as a competency we analyzed ten articles in which the concept is discussed after the publication of the UNESCO report *Education for Sustainable Development Goals* (UNESCO, 2017). Our analysis revealed that the authors described self-awareness and intrapersonal concepts with similar meanings. Whereas some authors used

TABLE 1 | Interpretations given to self-awareness and intrapersonal competency and explicit connections between self-awareness and transformative learning (X = the theme was identified in the article/explicit connection between self-awareness/intrapersonal competency and transformative learning).

References	Concept used	Identified themes					Explicit connection to transformative learning
		Awareness of one's emotions, desires, thoughts, values, assumptions and behaviors	Emotional resilience	Awareness of one's positionality	Awareness of one's relation to others and compassion	Reflection supporting motivation and willingness to act	
Giangrande et al. (2019)	Intrapersonal competency	x	x		x		x
Frank and Stanszus (2019)	Self-reflexivity/self-awareness	x				x	
Miguel et al. (2020)	Self-awareness		x	x		x	
Valley et al. (2020)	Awareness of self	x	x	x			
Brundiers et al. (2021)	Self-awareness, intrapersonal competency	x		x	x		x
Frank (2021)	Self-awareness	x					
Fuertes-Camacho et al. (2021)	Self-awareness	x		x		x	
Redman and Wiek (2021)	Intrapersonal competence		x				
Warrier et al. (2021)	Self-awareness		x				
Muff et al. (2022)	Self-awareness				x		

intrapersonal competency and self-awareness as summarizing concepts, Giangrande et al. (2019) used self-awareness as a sub-competency of intrapersonal and Frank (2021) as a sub-competency of personal competency. In addition, even though the meaning of the concepts varied, we identified the following recurring five themes, which emerged in at several of the analyzed articles (see **Table 1**):

1. awareness of one's emotions, desires, thoughts, values, assumptions, and behaviors,
2. emotional resilience,
3. awareness of one's positionality,
4. awareness of one's relation to others and compassion,
5. reflection supporting motivation and willingness to act.

The next section includes discussion on the five identified themes in more detail.

Awareness of one's emotions, desires, thoughts, values, assumptions, and behaviors was the most pronounced interpretation given to self-awareness and intrapersonal competency (Frank and Stanszus, 2019; Valley et al., 2020; Brundiers et al., 2021; Frank, 2021; Fuertes-Camacho et al., 2021). Becoming self-aware was not limited to intellectual processes but seemed to be connected with non-cognitive processes. For example, Frank (2021, p. 1238) defines self-awareness as "*awareness of habits, mental models and inner states and processes [.] and psychological coping mechanisms*" and Giangrande et al. (2019, p. 16) as an ability to "*become aware of states of being beyond your rational mind.*"

Awareness of one's emotions relates further to emotional resilience. Miguel et al. (2020, p. 6) linked emotional resilience to the concept of self-awareness as an ability to deal with *"personal feelings and desires,"* and Valley et al. (2020) as self-care. According to Warrier et al. (2021) self-awareness, as an ability to understand challenging emotions is focal in times of uncertainty. Giangrande et al. (2019) addressed emotional resilience most comprehensively by including several abilities related to stress management and emotional resilience in their proposal of intrapersonal competencies. Redman and Wiek (2021) in their part, limited the interpretation of intrapersonal competency to be only about emotional resilience and self-care. In line with many others, Frank and Stanszus (2019) and Frank (2021) highlighted the importance of self-care and emotional resilience but did not connect these abilities directly to the concept of self-awareness.

Miguel et al. (2020), Valley et al. (2020), Brundiers et al. (2021), and Fuertes-Camacho et al. (2021) proposed awareness of one's positionality, or role in local and global community as a part of self-awareness competency. Valley et al. (2020) include additionally an aspect of cultural and social awareness, which in their context relates to also understanding one's privileges and how social and cultural background affects how one acts in relation to others.

Awareness of one's relation to others and compassion was also relevant on a more personal level, as an ability to feel connection to others (Giangrande et al., 2019) and to find compassion toward oneself and others (Giangrande et al., 2019; Brundiers et al., 2021). Similarly, Muff et al. (2022) highlight self-awareness as an ability to connect with the surrounding world. Also, Valley et al. (2020) recognize one's relationship to others and interaction as essential but differentiate between "awareness of self" and "awareness of others."

Reflection supporting motivation and willingness to act is linked to the action orientation of sustainability education and sustainability competencies (e.g., Rieckmann, 2012, 2018). According to Miguel et al. (2020) self-awareness is about constant evaluation and promotion of one's actions. Frank and Stanszus (2019, p. 9) link self-awareness to affective-motivational processes and propose deep reflection of one's "*inner states and processes*" as a way to make conscious decisions concerning the actions one is willing to take.

Some authors also used other concepts than self-awareness and intrapersonal competency to describe the competencies related to the personal sphere. For example, Frank's (2021) proposal of personal competencies for sustainable consumption resonates with the identified themes. Besides self-awareness, he suggests five other personal competencies: emotional resilience, self-care, the ability to cultivate ethical virtues and the ability to access and cultivate sustainability mindsets.

When comparing the five themes we identified with the initial definition of self-awareness in the UNESCO publication *Learning Outcomes for Sustainable development Goals* (UNESCO, 2017), similarities with three themes are evident. For example, the publication suggests that self-awareness is about being able to "*deal with one's feeling and desires*" (UNESCO, 2017, p. 10), which resonates with emotional resilience suggested in several of the articles we analyzed. In addition, awareness of one's positionality is explicitly present in UNESCO's definition of self-awareness. The publication also connects self-awareness to motivational processes as it suggests that self-awareness is an ability to "*continually evaluate and further motivate one's actions*" (UNESCO, 2017, p. 10). Moreover, the two themes that UNESCO publication does not connect with self-awareness competency, are included in other UNESCO competencies: relating and being sensitive to others is a part of the definition given for collaboration competency and awareness of how one thinks, feels, behaves and what one values is suggested to be a component of critical thinking competency. To conclude, individual definitions of self-awareness are divergent but simultaneously, significant similarities can be recognized in research and in policymaking.

Connections Between Self-Awareness/Intrapersonal Competency and Transformative Learning

Of the ten analyzed articles, only Giangrande et al. (2019) and Brundiers et al. (2021) connect self-awareness or intrapersonal competency and transformative learning explicitly. They suggest that intrapersonal competency may facilitate transformative learning. Beyond these direct connections to self-awareness and intrapersonal competency Valley et al. (2020) highlight the importance of transformative pedagogies and Fuertes-Camacho et al. (2021) see transformative learning as essential to increase reflective practice. However, none of these articles discuss the transformative aspect of self-awareness/intrapersonal competency at a deeper level. We took a closer look at the interpretations of self-awareness/intrapersonal competency

discussed in these ten articles and reflected on them in relation to our review on transformative learning to understand how self-awareness is connected to transformative learning.

Reflection is the most emphasized connection between the interpretations of self-awareness and transformative learning. According to the interpretations, contemplative or reflective practices (Brundiers et al., 2021; Fuertes-Camacho et al., 2021) or self-observation (Frank and Stanszus, 2019) might support the process of becoming self-aware. Similarly, Mezirow (1991) and Taylor (2009) consider that reflection (of content, process, and premises) is necessary for transformation. Moreover, self-awareness, as interpreted in the articles, covers both cognitive and non-cognitive processes, following the approaches of Stuckey et al. (2013) and Cranton (2016), who suggest that processes leading to transformative learning are not only cognitive but also non-cognitive.

In addition, self-awareness as awareness of one's own emotions, desires, thoughts, values, assumptions, and behaviors echoes strongly with Mezirow's (1990; 1991) understanding of transfromative learning. On the other hand, when compared to Lange's (2019) micro, meso and macro levels of transformation, this interpretation of self-awareness could require reflections similar to what Lange calls the micro-level change; self-awareness should not be limited to recognizing one's own thoughts, emotions and values but also include reflection on the personal paradigms that shape them.

For Giangrande et al. (2019), the ability to deepen the connection between the human and non-human world is one dimension of intrapersonal competency. This idea of how one is in the world in relation to others, and how one is aware of one's positionality (Valley et al., 2020; Brundiers et al., 2021) is also in line with Lange's (2019) meso-level change. According to Giangrande et al. (2019), intrapersonal competency also is a means of shifting consciousness, which can be connected to macro-level change (Lange, 2019) from the perspective of aiming toward shift in "*shared beliefs and worldviews*" (O'Brien, 2018, p. 156). The shifting of consciousness relates to what Taylor (2009) called reflection of premises, which might lead to change in worldviews.

It seems obvious that a deep level self-awareness includes a transformative potential. In the context of sustainability competencies self-awareness includes not only awareness of oneself, but also the aspect of positionality (Miguel et al., 2020; Valley et al., 2020; Brundiers et al., 2021; Fuertes-Camacho et al., 2021) and that of supporting one's agency (Frank and Stanszus, 2019; Miguel et al., 2020; Fuertes-Camacho et al., 2021). Thus, the process of becoming self-aware might result in "*new ways of being and acting in the world*" (Grocott, 2022, p. 4). In the next section we present design education practices in which the connection between transformative learning and self-awareness competency is already well established.

Design Education Employing Transformative Learning and Self-Awareness

The following examples are mostly based on studio-based learning, through which students gain first-hand experience of what it means to be self-aware and how their own emotions, assumptions, mental models, and values affect their (design) decisions and interactions with their environment. In line with our identified themes on self-awareness above, actors within design education understand self-awareness through relationality, which develops from the need to understand oneself to better understand others (Akama, 2012; du Plessis, 2015; Grocott et al., 2019). Such a relational stance becomes particularly apparent in Hummels and Levy's (2013) phenomenology-inspired approach, in which they emphasize that design students should adopt a relational way of being and becoming, which means that designers cannot distance themselves to an objective position, but they must understand themselves as parts of many perspectives, agencies and roles in the world. The key message of this approach is that designers themselves should be and embody the change they seek (Hummels et al., 2019), including the willingness and openness to explore their own values and practices, that underlie and influence the collaboration with various stakeholders in various development processes (Hummels and Frens, 2011; Hummels and Levy, 2013).

Perhaps the clearest examples of how self-awareness based on transformative learning theory integrate into design education is the "Transforming Mindsets Studio" experiment (Grocott and McEntee, 2019; Grocott et al., 2019) and a course called "Fundamentals of design for social innovation" (du Plessis, 2015; du Plessis and Rettig, 2021). Looking at the three levels of change proposed by Lange (2019) (see "Transformative learning" earlier in this article), both the examples focus mostly on the micro-level change, but touch the meso- and macro-level aims with the emphasis on educating a generation of designers who can understand human experience more deeply (Grocott and McEntee, 2019) and "*shift their own humanity toward life-affirming habits*" (du Plessis, 2015, p. 2).

du Plessis (2015) reports on how various reflective journaling, visualization activities and improvisational group exercises—focusing on the mind, body, feelings, and intuition—create a space in which students gain awareness of their personal sphere, and therefore can shift perspectives and prototype new ways of engaging with the world. Central in her holistic approach is teaching the students to deal with the challenging side of transformation too, which includes surfacing barriers to change such as oppression or trauma. According to du Plessis, when the students gain personal experiences of the difficulty of going through the transformation process, they have confidence later in work to remain present during potential conflicts and repair relational ruptures (du Plessis, 2015; du Plessis and Rettig, 2021). Her approach demonstrates what developing emotional resilience could be in practice and highlights how focusing on students' intrapersonal development improves their interpersonal and intercultural capacities (Grocott and McEntee, 2019).

In the same manner, the *Transforming Mindset Studio* emphasizes that to foster productive cross-disciplinary collaboration, design students need to know how to learn from others, trust their instincts, take risks, exhibit social resilience, and reflect on actions (Grocott et al., 2019). Grocott and her colleagues give the students space and tools to face and become aware of their limiting beliefs, explore, and tune

behavior patterns, and propose preferred (personal) futures via, for example, prospective writing and embodied and performative exercises conducted in playful, judgment-free and non-analytical spirit (Grocott and McEntee, 2019). In line with the "head, hands and heart" model (Sipos et al., 2008), the elements of play and performativity have a significant role in creating a safe space, in which students can take the psychological and social risk of being vulnerable. Such conditions, based on Grocott et al. (2019), enable the students to deepen their self-awareness and ability to recognize and challenge restrictive mental models.

What makes the *Transforming Mindset Studio* a rare example in the design research literature is that it reports both the exercises that enable favorable conditions for transformative learning, but also what participation in such a process requires from the students. Thus, it can be seen as pioneering work that delves deeper into the benefits but also the challenges of integrating self-awareness in design education. According to Grocott et al. (2019), one of the key findings was related to the students' difficulties in transferring, applying, and maintaining the learning outcomes outside the safe and supporting studio environment. In the post-course interviews, the students reported that to deepen their learning, it would have been beneficial also to lead and teach others the same exercises they had experienced during the course (Grocott and McEntee, 2019).

DISCUSSION: TOWARD A MORE COMPREHENSIVE FRAMEWORK

In this article, we have studied the self-awareness concept from a variety of viewpoints. In the context of sustainability competencies, we analyzed ten articles with definitions of the self-awareness concept. The interpretations showed five common themes addressing two key perspectives: awareness of oneself and awareness of one's relation to others and a wider society. The study also identified a connection between transformative learning and self-awareness. This connection was evident in the examples we provided from design education practices, showing that self-awareness is closely linked to transformation. In the following, we discuss the implications that self-awareness competency and its connectedness to transformative learning have on (a) the development of sustainability competency frameworks, (b) the learning processes of becoming self-aware, (c) the interpretations of the competency concept and eventually, (d) the educational goals related to sustainability.

The development of self-awareness competency can be seen as a continuum of the discussion on the learning goals of sustainability education and especially the affective dimension of learning. Our investigations revealed that the personal sphere has been identified as an integral part of sustainability competencies from an early stage. Currently, it seems evident that acknowledging the personal sphere as an educational goal (e.g., self-awareness, intrapersonal, and personal competency) has received wide acceptance (Redman and Wiek, 2021). Therefore, it is essential to further develop self-awareness as a concept by building on the wide understanding created during the last decades.

Interestingly, there seems to be an attempt to introduce self-awareness competency as a solution to the criticism met by the competency framework suggested by Wiek et al. (2011); (Anderson, 2013; Lambrechts et al., 2018; Giangrande et al., 2019). For example, Anderson (2013, p. 3) criticizes the framework for being "*heavy on the mechanics of problem-solving and light on the judgment and wisdom needed to know which problems deserve attention*" and suggests that development of personal values should be included in the framework. Similarly, Biesta (2016) has argued that by focusing on developing competencies, education fails to contribute to the most important: development of wisdom and ability to judge. Self-awareness competency could also be seen a response to the calls to see the importance of ethical competencies in sustainability education (see Grice and Franck, 2017).

Through design education, we sought to understand more systematically the commonalities and similarities between creative design practices and transformative learning. The aim was also to use practical examples from design education to highlight how self-awareness could be addressed in teaching and incorporated into course exercises. Especially the non-cognitive, creative, and embodied methods combined with imaginative and playful approaches, but also safe and non-judgmental learning environments, are obviously significant components in the teaching and learning processes that facilitate self-awareness. Therefore, the processes leading to self-awareness are both cognitive and non-cognitive, as in the later development of the transformative learning theory (e.g., Stuckey et al., 2013; Cranton, 2016). Transformative learning theory was also recently applied explicitly in design education (Grocott, 2022), highlighting the need for sustainability education to learn from other disciplines and existing good practices.

Our explorations led us to the conclusion that becoming self-aware should be seen as a process that most likely requires, or nourishes, transformative learning. The transformative nature of becoming self-aware was mentioned by Giangrande et al. (2019) and Brundiers et al. (2021), but it was not thoroughly discussed in any of the articles we analyzed. In addition, references to transformative learning theory were mostly missing. If we understand becoming self-aware as a transformative learning process it means that self-awareness is not only awareness of one's own thoughts, emotions, and values but also of the personal paradigms or biases that shape them. However, the articles that discussed self-awareness and intrapersonal competencies did not address how challenging the process of becoming self-aware can be. For the self-awareness concept to be useful in developing sustainability education, it is essential to pay attention to the learning settings; they must provide sufficient support for the students to deal with the emotions that arise from potentially transformative learning processes.

Our explorations on self-awareness draw a picture of a learning process that is very different from the instrumental interpretation of competencies. Redefining the competency framework by adding self-awareness into it shifts the framework toward an interpretation of competencies that is connected to

the development of personality (Illeris, 2013) and development of values (Anderson, 2013) and views competency as an ability to judge (Anderson, 2013; Schaffar, 2021). This follows the interpretation of competency proposed by Illeris (2013), in which he includes development of personality and even transformative learning. However, due to the more prevalent interpretation of the competence/y concept so tightly connected to performance, our exploration of self-awareness leads to a wider discussion on how useful the competency concept is for communicating self-awareness as an educational goal (see also Shephard et al., 2019; Schaffar, 2021).

Furthermore, in line with Schaffar (2021), we question the usefulness of the competency concept in higher education because of its varying meanings and references to differing educational goals. If self-awareness is brought to education as a competency, there is a risk that is becomes translated into a learning outcome that we expect our students to achieve instead of a personal development process which higher education can support but which cannot be forced.

To summarize, in this study we identified that the process of becoming self-aware might lead to a personal paradigm shift. This means that the self-awareness concept is closely connected to transformative learning. This has many implications. **Firstly**, we call for acknowledging the current ambiguity in the use of the self-awareness concept and suggest more careful and accurate referencing when providing definitions for the concept in sustainability education research. **Secondly**, although transformative learning has been recognized as important in sustainability education, transformative learning theory is currently discussed superficially in sustainability competency research. However, according to our findings, self-awareness as a competency nourishes transformation and would need a deep understanding of transformative learning theory when applied in higher education. **Thirdly**, when designing learning settings to promote self-awareness in education, teachers should be able to address the potentially transformative process of becoming self-aware. As we have learned through our explorations, learning that supports self-awareness ought to include both cognitive and non-cognitive processes and the teaching should employ practices that touch upon students' awareness of their personal paradigms, such as contemplative, embodied and social approaches. Moreover, transformative education needs careful planning and open-ended outcomes. This poses requirements for teachers' training and other support structures in higher education institutions. **Finally**, and perhaps most importantly, critical questions remain on the usage of the competency concept in higher education since it currently fails to differentiate between performable abilities and personality development. Conceptual development is needed to ensure that the concepts employed are helpful in translating the diverse educational goals into practice. The personal sphere and strengthening of agency are essential in societal transformation, and, actors in higher education should also be urged to address ways of knowing and learning other than cognitive ways, and explicitly acknowledge non-instrumental educational goals, such as self-awareness.

To conclude, this article focuses on the concept of self-awareness and its connectedness to transformative learning. The approach was exploratory and did not aim to provide a full picture of the concept. The analysis of the implications for teaching practice focused on one particular field, design education. However, this was fruitful, as the field values reflective practices and approaches self-awareness as awareness of oneself in relation to the world instead of focusing merely on the individual. Future research ought to include a more thorough review on the interpretations of self-awareness, intrapersonal competency, and personal competency in sustainability education research, deeper investigations on the applicability of transformative learning theory to sustainability competency research, and more experimental studies on teaching practices that support students' self-awareness.

AUTHOR CONTRIBUTIONS

NJ had the leading role in writing about competencies and self-awareness in sustainability education. MK played a significant role in writing about development of sustainability competencies. MK, NJ, and L-AW took care of the overall coherence and structuring of the text. KH had the main responsibility for writing about design education, which TM commented on and complemented. L-AW wrote about transformative learning and the roots of self-awareness. MF contributed to the section on competencies. All authors contributed to the transdisciplinary process of co-creating, writing, and editing the manuscript.

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Education for Sustainability, Transformational Learning Time and the Individual <–> Collective Dialectic

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In the interest of developing sustainability practitioners, this manuscript challenges the conceptualization of transformative learning for Education for Sustainability (EfS) in relation to single courses or programs. Conversely, I will argue that becoming a sustainability practitioner (i.e., someone who takes action in the interest of the sustainability movement) is life-long and life-wide commitment. Time and how and why it matters is addressed. To develop this point, this manuscript details a case study of an education for sustainability graduate program that I designed and currently lead. The purpose is to further theorize transformative learning as it links individual action(s) and collective change(s) in the border-like but permeable spaces that are in-between. It asks the practical question of the ways educators (and practitioners) might expansively and generatively work together in creating a lifetime of classrooms to continuously bridge individual action and collective change.

Keywords: transformational learning, education for sustainability, individual and collective, case study, time

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> If solutions within this system are so difficult to find then maybe we should change the system itself (Thunberg, 2018).[1]

INTRODUCTION

Our social institutions' aversion to authentically individual actions is a sociological truism. However, in the context of sustainability, powerful social institutions like education, are getting tested by the actions of ordinary individuals, including students. Like is so often the case, younger members of society are active in efforts to force open the black box of individual-collective change and disrupt the habit-forming power of social institutions. Seatter and Ceulemans (2017) recently detected a troubling issue in higher education, positing that "[a]s course titles change from "Environmental Education" to "Education for Sustainability" and "Education for Sustainable Development," there is no evidence that the pedagogical approach has altered."[2] While many now teach sustainability (Brundiers et al., 2021), a paradox is created "when educators approach a sustainability curriculum that has the potential *to transform students' thinking and actions*, with a reductive and non-substantive pedagogy" (Seatter and Ceulemans, 2017) (italics mine).

The "potential to transform students thinking and acting" (Seatter and Ceulemans, 2017, p. 47) is one way to define transformative learning. Relatedly, it is a theory of a socially conscious classroom

[1]Greta the Time Traveler -> https://twitter.com/realmediagb/status/1074689330155786245.

[2]Sustainable education, environmental education, outdoor education and education for sustainable development are seemingly competing terms. In truth, however, they tend to accentuate different assumptions about the nature of the problem and the role of education in its amelioration.

design for Education for Sustainability (EfS) that links the collective and individualized efforts at local participation in an immense and multifarious sustainability social movement.

The emerging question of whether or not learning can still be place-based and relational when it's online reflects one of many negative impacts of COVID 19 on students who are in the midst of, or have just graduated from, various sustainability-oriented programs. For students already focused on global environmental change, the pandemic crisis (and zoom) brought into relief the fact that individual students, student groups and the entire cohort of students lacked the time to analyze what was being disrupted and what this was (or could be) teaching us (Alhadeff-Jones et al., 2011). As the program designer and instructor, this ongoing experience led me to conceptualize time as key factor in education for sustainability. I tried some things to test this hunch, including a guided auditory and visualization exercise, which involved beginning a zoom session by reading short passages from Harding's (2006) book, Animate Earth: Science, Intuition, and Gaia, and asking students to reflect on various passages.

The hoped-for result was something like a calming, guided reflection that would hopefully be a welcome intervention to the oft-challenging, temporal aspects of online learning during a pandemic. A few outcomes emerged. First, Earth time as a source of meditation and visualization on the age of the planet and the processes involved in understanding it as a living system was a welcome disruption. The discussions depicted time in a circular or relational way, as fluid as a river, with eddies representing twirling spheres of humans, non-humans and the Earth. Observations touched on going backward, forward and sideways in simultaneously churning concentric circles of time and learning. Students, one of whom attempted this exercise in a closet, observed change as happening not across "linear" individually-defined lives, but in relation to cohorts, communities and generations. One particularly adventurous student uniquely combined the exercise with climbing a cliff face, commented on going backward to ancestors and forward to descendants. The second outcome is that, despite these gains, I did not think to insist upon critical self-reflection considering the predominant perceptions and uses of time. To put things another way, the Earth time that Harding describes was not used to invoke and comment on the fact that the human system is detached from the reciprocal relationships.

We are in an age of limitless consumption (MacKinnon, 2021) that is destroying ecological balance at a dizzying pace. We neither acknowledge nor juxtapose different ways of perceiving time. How often do we discuss the Earth as a roughly 13 billion years old living system? How often is our species understood as a social system that while only coming into being about 200,000 years ago, appears intent upon separation from all other systems? (Capra and Luisi, 2014). Do we even interrogate the functional basis for the economic social institution whose underlying colonial capitalist's ideas, while only roughly 500 years old, appear so antiquated, racist and unhealthy? Instead, since the industrial revolution, we've warmed the world by more than 1.5°C and destroyed almost 40% of the world's forests. In that same time period, of the 8 million known plant and animal species on Earth. We've put more than 1 million on a path to extinction (IPCC, 2018; IPBES, 2019). In light of crises, consumption and the potential role of higher education, it is especially critical to question the role of time in transformative learning.

In putting forward transformative learning as epochal phenomenon, I must confess some prior assumptions. For me, transformative learning has not been a "Damascus moment" or disorienting dilemma that one confronts and overcomes. Rather in the past I saw transformative learning in chronological, rather than Earth time, a "3 days alone in the forest" kind of exercise where one awaits an epiphany. I think that the injection of time into transformative learning helps me consider sustainability programming as it encourages ongoing ways to learn from one's classroom and other experiences through critical reflection. I also adhere to a neo-pragmatist philosophy of human action, which, like transformative learning links habit and creativity. Both suggest a contemporary human process of employing routine to address complexity and seeking creative solutions when challenges arise (VanWynsberghe and Herman, 2015b). It is normal to compartmentalize the learning that goes on in educational programs and yet sustainability demands otherwise.

Building on an expansive understanding of key sustainability competencies (cf., Brundiers et al., 2021)[3] there are assertions that some capacities in humans that are largely forgotten but fundamental to sustainability (Glasser, 2018; Glasser, unpublished[4]). Pacis and VanWynsberghe (2020) cite alternative ways of knowing and affinity for all life as examples. Calls to cultivate these underlying capabilities is perhaps why Indigenous ways of knowing resonate so deeply at this time, perhaps signaling an opportunity for lifelong and life wide learning to buttress the argument for key sustainability competencies (Kimmerer, 2013, 2017). Adult education uses "lifelong" to recognize the learning that is possible at different stages in one's life and "life wide" suggests the opportunity to learn across the spectrum of spaces we inhabit. Alhadeff-Jones et al. (2011) conceive of the relationships between transformative learning and time along these lines. The authors assert what they call temporal dynamics into transformative learning itself, including critical reflection on the way time impacts experiences. Importantly, they note that "[S]uch temporalities have duplicity: they involve an inner experience (by itself) and an external one (in relationship with others (p. 395).

Linking time, the future and a planetary scale of consciousness is explained in the following quote:

> If we subscribe to a millennial eschatology, our hope will be other worldly; if we are Marxists, we understand change as contingent on revolution, and therefore our hope is for an overturning of the dominant world economic system. . . It makes sense to me that part of what is to be done by futurists is laying bare the temporal models that shape individual and collective hope and the decisions such hope underpins (Bussey, 2017, p. 5).

[3]Glasser and Hirsh (2016, p. 126) define key competencies as, "[A] constellation of abilities, attitudes, knowledge, understanding, skills, and habits of mind that are functionally linked to support both problem-posing and problem-solving and evoke purposeful behavior toward particular end goals."

[4]Glasser, H. (Unpublished). Learning for Sustainability Core Competency Framework.

This "laying bare" of temporal models is the work of a futurists or, according to advocates of a "key sustainability competencies" framework anticipatory thinkers (Wiek et al., 2011, 2016; Lambrechts et al., 2013; Wiek and Kay, 2015; Sterling et al., 2017; Brundiers et al., 2021).

In this manuscript, the concept EfS is used to deliberately emphasizes the fact that higher education must reconnect with society in relationship to time in order to facilitate social change. Unlike "sustainable education" as used by Sterling and Orr (2001, p. 8) we posit the need for education to be "for" the sustainability social movement (Vanwynsberghe and Moore, 2008). Specifically, I would argue that higher education's primary social functions can be adapted in order to make common cause with and provide service to the sustainability movement. EfS then is a real-world, place-based, disruptive and creative process of inquiry that promotes learning understood as knowledge in action. Categories of actions include a critically reflexive approach to the classroom, community engagement, and transdisciplinarity. There is no pedagogy that can singularly promote the complexity of EfS and therefore, as educators, we must experiment and then combine many strategies in order to engage all of the students and contexts.

The focus on the individual-collective dialectic is meant to encapsulate the ways sustainability educators/facilitators/coaches often think about and direct our learners toward action. Relatedly, this manuscript posits the idea that EfS educators should think about our courses or programs as they contain the potential to contribute to the development of a sustainability practitioner over time. The assertion is that there is a trajectory of transformative learning experiences in the interest of the sustainability movement. The classroom writ large is the nexus of this reconnection, the space between the individual and the collective.

Theoretical and conceptual points are elaborated using excerpts from a case study database of one of the authors efforts to design and lead a 2-year, part-time, and 30 credit Masters in Education (MEd) program in the University of British Columbia in Vancouver Canada. The overarching purpose of this program is to be in service to the sustainability movement, which is operationalized in a partnership with the City of Vancouver (and other stakeholders) where policy is analyzed and implemented in order for student projects that generally follow a design-based or social innovation framework. A neo-pragmatist philosophy of human action underlies the program (VanWynsberghe and Herman, 2015b, 2018; Earl et al., 2018). Understood in relation to EfS, a neo-pragmatist theory links disruption and creativity, akin to Seatter and Ceulemans' (2017, p. 52) promotion of "pedagogical approaches that challenge students to participate actively, think critically, and reflect." Warwick (2016) typologizes this student-activating, holistic, and relational approach to EfS in the following way:

- The critical dimension (space for dialogue and systems thinking).
- The creative dimension (space to imagine new sustainable futures).
- The active learning dimension (space to collaboratively act for sustainability).

In light of today's complicated sustainability problems, like urban transportation, decolonization and even the great resignation, this disruptive and reflective approach to teaching and learning in place is more likely to give rise to self-motivated change agents. This is because students will practice acting to create change rather than just learning about what needs to change. This neo-pragmatist application offers expansive learning opportunities, helping a cohort of students to deliberately co-create a program that disrupts normal learning (and research) habits. In the MEd program, we also accentuate a process of active listening, communication, dialogue, systems thinking and social innovation by intentionally bringing together participants (students, mentors, supporters, and funders) from varied sectors such as education, community organizing, law, art, library services, outdoor learning, language acquisition, and filmmaking. We have taken this experiment to some lengths, employing instructional models that include co-teaching situations with city and regional staff whose backgrounds in engineering, planning and policy labs and combined with architects, sociologists, philosophers and adult educators.

TRANSFORMATIVE LEARNING AND EDUCATION FOR SUSTAINABILITY

For the purposes of this manuscript, and as briefly mentioned above, sustainability is a global social movement. As a social movement, sustainability challenges society's dominant ideologies, especially those based on the narratives of modernity and progress, offering a positive program (VanWynsberghe and Moore, 2015a) that can catalyze deep individual and collective learning and put participants on track toward sustainability over a lifespan.

This open-minded and adaptive approach finds its basis in Mezirow's early notions of transformative learning, which are outlined in column 1 in the below table. Mezirow proposed transformative learning in 1978 as a rational, metacognitive process of reassessing assumptions and expectations that influence our thinking, feeling, and acting (meaning perspectives) (Mezirow, 2009). He defines transformative learning as "the process by which we transform problematic frames of reference (mindsets, habits of mind, meaning perspectives, sets of assumption and expectation) to make them more inclusive, discriminating, open, reflective, and emotionally able to change" (*ibid.*, p 92). Transformative learning allows people to shift their meaning perspectives and habits of mind through disruption, dialogue and critical reflection on the source and consequences of assumptions, determining a new truth, taking new actions, and transforming habits to acquire a new disposition (*ibid.*, p. 94).

Curricular and pedagogical approaches to transformative learning are strongly linked in EfS, especially as a caution against passive learning (Bonwell and Eison, 1991; Felder et al., 1997). In EfS, one could spend an entire course relating to students an

incapacitating amount of information about the cliff-edge that humanity's currently peering over because of destructive socio-ecological systems. The key for transformative EfS classroom design is the opposite; that is, educators and students who co-construct their classrooms as important organizational actors in achieving a healthy future for their immediate communities as well as the planet.

The process of achieving transformative learning can be facilitated and encouraged through the creation of classroom design features, pedagogies and competencies that are "intentionally designed to foster select elements or a holistic process of transformative learning" (Kasworm and Bowles, 2012, p. 391). In **Table 1** (see below), an admixture of classroom features, pedagogies and learning outcomes is offered to summarize these relationships as they appear in the literature. The first column is entitled "features of transformative learning" (column 1). In this column, the aim is to highlight specific features that can initiate transformative learning. Column 2 offers pedagogical strategies that realize the aforementioned features. The discussion that follows the table represents a further unpacking of its content.

Taken together transformative learning enables participants to individually and collectively examine taken-for-granted theories, concepts and ways of knowing through real-world action that is in service to a community (Moore, 2005; Sipos et al., 2008; Cranton and Taylor, 2011, 2012; Sterling, 2011; Wals and Lenglet, 2016; Harmin et al., 2017). The EfS classroom must explore (and unsettle) our deeply engrained habits of mind and body behind because unsustainability is due to such destructive habits. Transformative learning supports the use of pedagogical strategies like critical reflection, diaries, discussions, and even role playing to foster a willingness to change oneself and to facilitate social change for a sustainable future.

Conceptual understanding is aided by a further unpacking of transformative learning as it links the individual and the collective. The following section undertakes this effort.

TABLE 1 | Features and potential pedagogies for TL and KSC.

Classroom features of transformative learning	Education for sustainability pedagogies
Disruptive (Mezirow, 2009; Kasworm and Bowles, 2012)	Research in the service of co-learning; critical (i.e., decolonizing); dialogue and role play; internships and other work applications
Dialog (Mezirow, 2009)	Socratic method, group discussion and role play, community-based speakers/problems
Project-based learning (Wiek et al., 2014; Earl et al., 2018)	Policy reviews, social innovation methods, prototyping, ideation, and story-telling
Critical reflection (Mezirow, 2009; Kasworm and Bowles, 2012)	Diaries, self-evaluations, writing; and peer assessments
Holistic, experiential (Sipos et al., 2008; Kasworm and Bowles, 2012)	Traditional ecological knowledge; diaries, logs and self-evaluations; and field trips
Adapt new roles/relationships (Mezirow, 2009)	Service-learning; applied learning; dialogue and role play; internships; and tactical urbanism
Inter-/trans-disciplinary inquiry (Sipos et al., 2008)	Participatory action research, community-based learning; group discussion, role play, group diaries; internships; case studies, and systems mapping

THE TIME BETWEEN TRANSFORMATIVE LEARNING AND EDUCATION FOR SUSTAINABILITY

An important question arises, namely is it possible for individual-level change to help create societal change and vice versa? Transformative learning theorists argue that yes, the individual and the collective can work to shape one another because they are not binaries and each scale can impact the other (O'Sullivan, 2012; also see Cranton and Taylor, 2012; Walter, 2013). How does this interplay work? Firth and Robinson (2016) argue for an updated form of consciousness raising that combines collective knowledge production and challenges to linear time.

> Experiences of time are necessarily connected to experiences of continuity and change, causality and/or free will, and the realm of the possible and desirable. Transformation is limited by the dominant mode of homogeneous empty time (Benjamin, 1955, 1970), and empowered by prefigurative temporalities (Firth and Robinson, 2016). Time has suffered particular mutations in neoliberal capitalism, which are dissimilar to those of the Fordist structure combated by earlier movements. A current spatio-temporal closure – an inability to imagine beyond present constructions of space and time – afflicts oppressed subjects in general (pp. 345–346).

This focus on consciousness raising might explain that the seemingly endless educational efforts that employ the "knowledge equal action" logic for change where scientifically validated information is assumed to produce a similar reaction in everyone. The second sentence of the quote argues that linear time underscores this attachment to such a simplistic formula wherein life itself is about behaving in ways directly tied to knowledge. How can creativity (prefigurative temporalities) make inroads in the face of such a logic?

To start a deeper conceptualization of the transformative learning process we must accept the degree to which our individual thinking is shaped by society and schooling. Social institutions like education reflect a social structure where knowledge is an overpowering force on the behavior of individuals. Normative pressures are everywhere. We feel the need to conform in our dress, our hairstyles, and our body types. Governments pass laws that govern our behavior, with the explicit purpose of affecting our actions. It takes remarkable effort to work against these pressures but it starts with understanding that the behavior of individuals is shaped by the larger institutions and structure of society. To put things another way, change making is made when time is seen as expansive enough to take chances, co-produce knowledge and make a mess of important things, like categories, classrooms, and tools.

Key to conceptualizing transformative learning as the space between the individual and the social is recognizing that society too has to adapt to its environmental conditions just as readily as do individuals *but the timing is different*. Society as a whole comes across problems and can subsequently be deemed inadequate for addressing current pressures. We can expect to see some degree of macro-level creativity at these junctures, including the emergence of and responses to social movements. For example, the climate change/justice/education mobilization is often discussed as necessitating radical alterations in both the production and consumption of economic goods. This a good example of both the problem and the movement because the changes needed call into question the nature of contemporary society. It is against this backdrop that Greta Thunberg offers the words quoted in the at the beginning of the paper to the manuscript, which amount to suggesting that "solutions" are not to be "discovered" in the current system because individual and collective forces effectuate and facilitate the problematic situation in one another.

If the above relationship is an acceptable premise, then we must agree that that there is a social basis to transformative learning. In other words, there is a pre-existing social capacity for learning about and adopting social values that are then acted upon as public commitments. In this way we can begin to consider as deep-seated, and thus as social, transformative learning. Walter (2013), for example, researched the personal narratives of change-making environmental scientists, like Aldo Leopold. In doing so, Walter accentuated the ways in which personally transformative learning provokes a collective process of transformation. To explain the scaled nature of this individual – collective interaction, Walter turned to Lange who argued that:

> [D]isorienting dilemmas are inherently destabilizing, adults reach deep into themselves to become more conscious of their ethical grounding—they return to their "inner compass" (p. 130), and this becomes restorative, allowing not only individual transformation but also a collective commitment to social activism on ecological and global concerns as well (Walter, 2013, p. 28).

Walters uses this quote to explain that famous environmental scientists, such as Rachel Carson, become change makers because they work in parallel with a wide swath of other people who are also in the early stages of shifting their worldview and adopting new values.

Figure 1 depicts in simple terms the interplay between the individual and the collective that we are talking about here. To start, I ask the reader to note the simplified categories of the individual and the collective and the arrows between them. The individual is on a transformative learning journey.

In addition to continuing to understand transformative learning in relation to individual and collective action, this ascending spiral staircase is meant to convey an individual's transformative learning journey. The egg-shaped platforms are landings that depict a learner having reached a milestone, a standard because that demonstrates a contribution to social change. Something that needs to be emphasized is the timing of journey. This is not a journey that fits into a course or even a program. It is rather what adult educators would call a lifelong and life-wide undertaking.

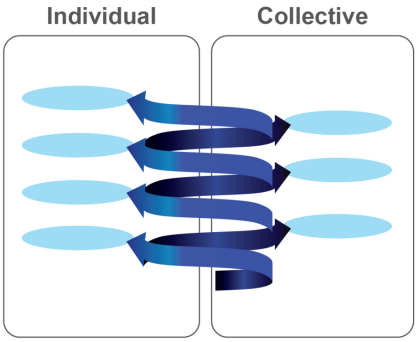

FIGURE 1 | Transformative learning journey.

Taken together, the above figure conceptualizes the ways in which classrooms can contribute individually and collectively over a life-time to transformative learning. Transformative learning bonds together our individual and collective potential in creative efforts to achieve a preferred future. As Mezirow (2009, p. 95) himself states, "[I]magination of how things could be otherwise is central to the initiation of the transformative process." This requires "the generation of energy for radical vision, action, and new ways of being. If we are to survive on this planet, we need new connections to each other and to the natural world" (O'Sullivan, 2012, p. 171). Thus, creativity is key since it involves the production of something novel and appropriate that continues to shift mindsets or lifestyles (Lozano et al., 2017). Creativity can allow us to envision the future we wish to co-create, disrupt deeply entrenched destructive norms, and replace unsustainable habits with ones that are conducive to sustainable well-being. If a process of iteration and adaptation were to become the norm, then this could create space for change agents to be bold in how they work to challenge the *status quo*. Without disruption, society cannot transform at the pace necessary. Habits must be challenged. Doing so is disruptive. Creativity offers solutions to unsustainable habits, including thoughts.

THE EDUCATION FOR SUSTAINABILITY CLASSROOM AS SETTING

This section is the previously mentioned excerpt from the case study of a graduate program in EfS. The focus is on the learning setting because is also emphasized in the theory. The reader may perceive this consideration to be a simplistic change, but the impacts can be profound. One of the features of applying a neo-pragmatist philosophy to EfS is the off-campus placement of the classroom (Earl et al., 2018). As a result, the EfS classroom that is the subject of the case study is ten kilometers away from the University of British Columbia campus and under a major bridge to the downtown core in a building owned by the City of Vancouver. Stepping out of this decidedly non-traditional classroom provides a panoramic view of the downtown and

nearby paths take one toward a new housing development or a large marketplace.

Theoretically, placing the classroom in the heart of the city and away from the main campus is part of questioning the habitual thoughts and actions that lead to the typical campus. We take this to the point of questioning the classroom on campus as anachronistic. The fact is that the physical look and feel of the EfS classroom is profoundly important to linking it to contributing to the sustainability movement and our efforts to consult on and experiment with options for addressing problems that come to light in the course of working with City of Vancouver staff and officials on sustainability priorities. The overall structure supports studio-like applied learning research and action. An expansive orientation to the notion of the classroom accommodates the insightful and often practical views of City of Vancouver staff and officials, Elders, educators, civic leaders, community members, public intellectuals, historians, authors, artists, scientists, developers, social innovators, and entrepreneurs.

Pedagogically, transcending the spatial boundaries of the academy, like other classroom features, is disruptive. Unconventional classroom layouts, that is, there being situated in off-campus locations counter stagnant facts (Mezirow, 2009, 104; Earl et al., 2018). A new classroom space activates different habits in students that are not only relevant to education, but to the constitution of society that our interactions construct and reproduce. Students told me they experienced more freedom and creativity, moving beyond the classroom to apply their knowledge to the real-world. They also appreciated opportunities to interact with outside systems, and their different norms and restrictions. This often took the form of consultation with community stakeholders.

One of our favorite questions asks if this is a classroom? We obviously apply this to our off-campus classroom, but we've also asked this in in middle of the city or as we canoe down the Fraser River or as we peer through a chain link fence at a brownfield site. The point is that, as opposed to the bucolic campus, such learning settings can introduce students to new viewpoints as they interact with people from outside of their normal social spheres. Classrooms then are an initial response to O'Sullivan's call for a "structural shift in the basic premises of thought, feelings, and actions" (2012, p. 164) in order to "touches our deeper levels of knowing and meaning" (Sterling, as cited in Harmin et al., 2017, p. 1490).

Deeper levels and therefore transformative learning may take a long while. One of the students in the inaugural cohort puts it well and I encourage an emphasis on the last line.

> But after some reflection, I would argue that the most valuable piece I will carry forward from this program is not what we learned - it is how we learned. When I walked in to CityStudio on our first day there, the chalk board had many, many things written on it. But the one that has stuck with me throughout my 2 years there was "trust the process." The outcomes are important, but the process in itself is also incredibly important. We learned through processes of self-inquiry, self-reflection, and self-discovery. For the majority of the program, we learned by doing rather than only by listening or reading. Ideas and facts were not just given to us through lectures and readings. Discussions were rich, sometimes difficult, and always allowed us to see our own worldviews and how they relate to our colleagues' [worldviews]. I feel like I questioned my own beliefs about sustainability a lot, and that was scary and wonderful. It has been a wonderful 2 years, and *I am certain that I will carry all of these lessons forward through life.*[5]

The quote reinforces the discussion that preceded it, but it also demonstrates that a 30-credit program, approximately 2000 hours of interaction, study and reflection, merely initiates a process of transformative learning. In many ways, the program or creative piece is the easy bit, *remaining disrupted* much more onerous. MEd programs, like the one described here, contribute to transformative learning but it does not signal the fact that a program does more than provide the right enabling conditions and encouragement to catalyze future transformations toward the sustainability movement. Research concurs, transformative learning has been recognized as something that can be epochal or cumulative (Mezirow, 2009, p. 94; also see Sipos et al., 2008), and thus acknowledging this should be built into lesson plans with the understanding that learning outcomes and competencies and transformation may take years to emerge.

CONCLUDING REMARKS

"Visioning a healthier, fairer, more meaningful future for all of the planet's inhabitants involves learning to change by changing how we learn" (see text footnote 4, p. 13). This manuscript posits that transformative learning could be this new way of learning because it is process-driven and open ended; not prescriptive and without arbitrary endpoints. Transformative learning promotes critical, inquiry-based collaboration and creation with the question of what to transform into changing all the time. Here the classroom is examined, especially in the sense of linking the individual and collective in a long-term union of learning, which is defined in action.

Transformative learning could facilitate a shift toward multiplicity of ways of knowing not least allowing us to understand "ourselves and our self-locations; our relationships with other human beings and with the natural world; our understanding of relations of power in interlocking structures of class, race, and gender; our body awareness; our visions of alternative approaches to living; and our sense of the possibilities for social justice and peace and personal joy" (O'Sullivan, as cited in Walter, 2013, p. 28). Understanding many perspectives and their relationships to one another is important for sustainability since, increasingly, research into the natural world demonstrates that social (read human) systems are homo sapiens' "natural" setting to the planet's peril. It appears that we have humans have actively torn ourselves from the practices we'd undertake

[5]Several lessons were addressed from the first to second cohort. First, a cohort is more intense and collaborative than its coalition-like durations and purpose would suggest. Second, we assumed that participants "knew" sustainability. It turns out this it is still new and graduate programs, like ours, must be prepared to backfill on some content. Our final major lesson was that we needed to be more intentional about building in listening as an essential skill, especially as related to the nature of service and the need for research and other skills to be applied to the problem outlined.

if we really did consider nature our home. What is more, the social life of, for example, forests demonstrates that humans leave something to be desired in regards decidedly social gestures, like reciprocity. Maybe our somewhat desperate turn to Aboriginal peoples' worldviews reflects a dawning awareness of our current place vis-à-vis natural systems and the desire to change this trajectory.

The research considers some relevant pedagogical strategies and a few are noted here. Wang (2010), for example, uses the modality of *currere* to combine knowledge, life history and intellectual growth to sponsor self-transformation. Wang (2010, p. 276) writes of a 4-step method that combines these functions:

- Regressive step is about the free associative remembrance of the past.
- Progressive step is the meditative pondering of the future.
- Analytical step is about the analysis of what one uncovers above in relation to one's present biographic situation.
- Synthetical step is about pulling oneself toward a higher level of knowing and being.

This strategy is not in **Table 1** but it obviously conforms with critical reflection in order to leverage a decidedly more personal change. As Wang (2010, p. 282) states "A dynamic interplay between external time and internal time is key to initiating and sustaining the transformation of the present moment."

Firth and Robinson's (2016) previously mentioned research also advances a revised version of the 1970's consciousness-raising groups in the form of a collective transformational learning strategy. They isolate what they call grassroots knowledge production and suggest the term Kairos as transformative time. They write (2017, p. 354] that "Kairos is experienced as a time-lapse or a moment where everything is simultaneous... [It is] a series of small, but structurally transformative events within the lives of particular actors... A particular kind of personal Kairos is experienced within critical reflection in the form of the "click"– the moment at which subjective alignments are reconfigured on the basis of the group process. To return to **Table 1**, critical reflection can be advanced by the use of such pedagogies as diaries, self-evaluations, free writing, and peer assessments.

Today's complex problems require that we adopt novel way of thinking, feeling, acting, and relating to all other aspects of the world. It is posited here that transformative learning theory has the potential to create future change-makers that can bring about this large shift by encouraging awareness, reflection, empowerment, and action over time. We can disrupt habits that we have adopted from unsustainable dominant ideologies by them by striking out in novel ways (Rieckmann, 2012, p. 128). Transformative learning encourages people to develop habits and dispositions *for* sustainability rather than just learning *about* it creating a shift to ontological learning so that we may not only think, but act our way into a new future.

There are new challenges to transformative learning theory in relation to time. Distortions in the temporal dimensions of an EfS curriculum (i.e., the differences between virtual time and real time) have occurred and they may have lasting impacts. In the past, perhaps the biggest pedagogical concerns of transformational learning theorists involved the legitimacy of learning when doing outdoors activity (attending an off-campus classroom, climbing a cliff, hiking a trail, canoeing, etc.) versus the traditional classroom. That was before COVID-19 when these were the extreme settings for learning. However, for some recent graduates we must ask if one will undertake a lifetime of keeping the planet intact for future generations when a significant chunk of their classroom learning involved a screen. It is a worry that a new link to "capitalist time" (i.e., time as linear, progress, production, profit, success, productivity) has been forged in higher education. How can we include other ways of knowing (i.e., Indigenous worldviews of acting in relation to its impacts for seven generations) where time is not linear? How can we continue to emphasize gifting/giving in a monetary system? How can we emphasize time for self-care, self-improvement, reflection, connecting with community/ecosystem?

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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HYPOTHESIS AND THEORY
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How a New Learning Theory Can Benefit Transformative Learning Research: Empirical Hypotheses

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Transformative Learning research and practice has consistently stalled on three fundamental debates: (1) what transformative learning is, and how it's differentiated from other learning; (2) what the preconditions for transformative learning are; and (3) what transformative learning's predictable and relevant outcomes are. The following article attempts two main feats: (1) to provide a re-organization of transformative learning theory through the work of Vygotskian cultural-historical activity theory, and a newly synthesized meta-theory of learning and development generally, and (2) to use that re-organized model to articulate empirical research questions and hypotheses that are more amenable to observation and analysis than the typical time and cost intensive methods available to most researchers studying transformative learning today. The newly synthesized model draws on historical work in cognitive, social, educational, and clinical psychology, and clearly articulates the dialectical nature between the environment and experience, and what is meant by classical transformative learning concepts such as cognitive-rational frame of reference shifts, self/soul inner work, critical reflection, imaginative engagement, and everything in between.

Keywords: transformative learning, Vygotsky, ZPD, ICBCI, meta-theory, practical-critical

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INTRODUCTION

In the last four decades of transformative learning research, analytical-reductionist psychological science has proliferated characteristics and definitions of transformative learning without doing enough critical-dialectical theoretical work to resolve the inconsistencies between them (Cranton and Taylor, 2013; Howie and Bagnall, 2013). The following article is intended to make progress toward a resolution. Transformative Learning (TL), according to its most cited theorist, Jack Mezirow, is:

> The process by which we transform problematic frames of reference (mindsets, habits of mind, meaning perspectives) – sets of assumption and expectation – to make them more inclusive, discriminating, open, reflective and emotionally able to change. Such frames are better because they are more likely to generate beliefs and opinions that will prove more true or justified to guide action (Mezirow, 2008, p. 92).

In this context, frames of reference are composed of "habits of mind" and "points of view" (2008, p. 92). Habits of mind are defined as "broad, abstract, orienting, habitual ways of thinking, feeling, and acting, influenced by assumptions that constitute a set of codes" (2008, p. 92). Points

of view are defined as "the constellation of belief, memory, value judgment, attitude and feeling that shapes a particular interpretation" (2008, p. 92). An example provided by Mezirow of a habit of mind is ethnocentrism, a resulting point of view being the negative feelings, beliefs, judgments, and attitudes toward individuals or groups with different characteristics than our own (2008, p. 93). Finally, "problematic frames of reference" are those that result in a "disorienting dilemma" for the individual, where their current habits of mind and points of view are inadequate for overcoming some challenge through changing only a point of view or a habit of mind, and can only be resolved through changing the entire frame of reference, or the meaning-making relationships between the habits of mind and the points of view, or *how* habits of mind "result" in points of view (2008, p. 94).

Transformative learning then, is neatly described as occurring in the moment when a point of view transforms not only the habit of mind, but the entire frame of reference (habits of mind as well as resulting points of view and the relationships between them, p. 94; also defined as "structures of assumptions," 1997, p. 5). This deceptively simple illustration of TL has led to its application in diverse but not always easily relatable contexts and conditions (Nohl, 2015), and what exactly is meant by how points of view "result" from habits of mind (i.e., the frame-of-reference process) isn't very clear, and neither are its necessary and sufficient conditions (Dirkx et al., 2018). As a further confusion, frames of reference are alternatively described in Mezirow's later writings as composed by two dimensions (habits of mind and points of view, i.e., greater than the sum of these parts), as well as equated with one of these dimensions (habits of mind), often on the same page (2008, p. 92). Yet in his earlier writings, these concepts are clearly differentiated (1991, p. 5–6).

Not only has Mezirow's own thinking around TL evolved over time (Kitchenham, 2008), his original 10-step critical-dialectical theory (Mezirow, 2000) has been criticized for a lack of generalizability, and alternative models have proliferated within the gap (Taylor, 2007; Hoggan, 2016b). Both factors combined make theoretical differentiation (between TL and not-TL) and linkage (between various observations of TL) challenging. An example of the *ad hoc* proliferation: Taylor (1997) categorizes TL processes as psychocritical, psychodevelopmental, psychoanalytical, or social-emancipatory, which all require a disorienting dilemma but specifying various conditions that produce it and engaging different processes to resolve it. Then, Taylor (2008) adds neurobiological, cultural-spiritual, race-centric, and planetary to the typology, but it isn't clear how any of these new categories demonstrate consistent discriminant or convergent validity beyond loosely and incompletely described content validity (see Taylor, 2007, p. 10). Hoggan (2016b) further complicates this picture by categorizing TL outcomes without regard to the processes that may give rise to one category of outcomes instead of another.

An empirical issue resulting from this theoretical milieu: strategies for measuring TL or TL outcomes have relied on intensive qualitative data collection such as retrospective interviews (Taylor, 1994), focus groups (Hoggan, 2014), written content analysis (Boyer et al., 2006), video content analysis (Burden and Atkinson, 2008), and ethnography (Quinn and Sinclair, 2016), or on crude quantitative methods such as self-report scales (see Romano, 2017 for a review). These methods limit the scope and generalizability of TL research generally due to the time and cost implications of the qualitative strategies (Harder et al., 2021), or the lack of reliability found in self-reports. Further, methods have also tended to impose data collection instruments that probably instigate TL outcomes they hope to observe (e.g., Carrington and Selva, 2010, "reflection logs" p. 1; Harder et al., 2021 *WeValue InSitu;* see also Pernell-Arnold et al., 2012; Dirkx et al., 2018). These characteristics of TL research gate its theoretical advance and understanding by underemphasizing *a priori* hypotheses about what causes transformation in favor of arguing for the expansion of TL theory to include the researcher's domain of practice and/or methodology of choice. While it is important to find the conceptual and practical boundaries of TL, this is impossible to do without an anchored perspective, just as, somewhat ironically, the transformation from one perspective to another isn't possible without first one identified perspective and then a differentiated other perspective to transform to Mezirow (2003, p. 60). The purpose here is to show how previous TL meta-theory attempts have fallen short, and why, before explaining how a new theory of learning generally can boost TL research by providing such an anchor. To do so, I return to Mezirow's original conceptualization of TL, and show how its most mature evolution can be clarified and associated with evidence-based TL outcomes with this new theory. I then specify empirically testable hypotheses that afford broader, faster, and cheaper data collection methods for TL researchers.

What has been missing since the beginning are empirically testable hypotheses concerning:

(1) What is transformative learning, and how is it compared to other kinds of learning (Mezirow, 2000; Kitchenham, 2008; Sessa et al., 2011)?
(2) What are the preconditions for transformative learning to occur (Mezirow, 1978, 1991, 2003; Dirkx et al., 2018)?
(3) What are the predictable outcomes of transformative learning (Hoggan, 2016a,b; for relevant discussions, see Dirkx et al., 2006; Taylor and Cranton, 2012)?

These questions have been addressed in the literature by numerous authors examining qualitative data from their own perspectives with their own biases, resulting in disparate theories that pay minor lip service to one another without critically examining the gaps, overlaps, and confusions across them (Cranton and Taylor, 2013). This trend hampers theoretical development as the meanings of central terms like "perspective," "meaning," "frame of reference," and "habits of mind" are defined in conflict with previous definitions (Howie and Bagnall, 2013).

This article attempts to resolve these issues by applying a newly synthesized theory of learning and development to transformative learning, and then contrasting it with perceptual, adaptive, and generative learning (Goldstone, 1998; Sessa et al., 2011). First, a Vygotskian perspective on cultural-historical activity theory (Roth and Lee, 2007) is presented as the theoretical basis for this new theory of learning, known as

the Introduction-Conflict-Balance-Creation-Identity Theory of Learning and Development (ICBCI), which is then briefly outlined (see Friedman, 2021 for full details). Next, the stubborn challenges of TL research are reviewed in light of this new theory. Finally, ICBCI is used to state empirically testable hypotheses for TL theory as a theory-in-practice of learning-leading-development through human activity (Holzman, 2006; Roth and Lee, 2007).

VYGOTSKIAN CULTURAL-HISTORICAL ACTIVITY THEORY

As early as the 1930s, Russian psychologist Lev Vygotsky expressed frustration with educational psychology as employing "atomistic and functional modes of analysis. . .[that] treated psychological processes in isolation" (Vygotsky, 1986, p. 1). In the time since, numerous psychologists have taken up the charge to integrate psychological processes with one another with varying degrees of analytical-reductionism. While the various threads of this work go by many names, Vygotsky's colleagues and students developed what is known generally as cultural-historical activity theory (CHAT; Roth and Lee, 2007). Vygotsky's original emphasis on engaging critical-dialectical methods to discover the processes involved in human learning and development spurred his students, particularly Alexander Luria and A. N. Leont'ev, to develop his work further, culminating in what is today considered "third-generation CHAT" (Roth and Lee, 2007, p. 188). The roots of CHAT can be traced back to dialectical materialism (e.g., Marx, 1967), classical German philosophy (e.g., Hegel, 1991; Wittgenstein, 2010), and Vygotsky's (1978, 1986) writings. Vygotsky's work, considered the genesis of first-generation activity theory, emphasized activity, rather than the individual person, as the appropriate unit of psychological analysis (Newman and Holzman, 2013, p. 52), a revolutionary act amongst dominant Western constructivist theory (Loughlin, 1992, p. 791). In the second generation, students of Vygotsky incorporated societal, cultural, and historical dimensions into the dialectical materialist focus on activity (Roth and Lee, 2007, p. 189). And in its third generation, Leont'ev (1978) specifically argued for historically evolving object-practical activity as the fundamental unit and the explanatory principle for human learning and development (Langner, 1984).

Put simply, Vygotsky posited that psychological science was far more insightful and productive when viewing activity, rather than individuals, under definite conditions; his contemporaries and immediate students expanded these observations of definite local conditions, such as a teacher working with a student to learn language or mathematical operations, to global conditions, incorporating the cultural-historical dimensions of that activity, such as who was culturally welcome to learn math (e.g., largely wealthy men and boys) and by what historically embedded method (e.g., direct instruction). Finally, Vygotsky's intellectual descendants in Soviet Russia as well as Europe and the United States (e.g., Leont'ev, 1978; Cole, 1995) discovered the value and relevance of *cultural tools*, or objects and methods of practice under definite conditions. These tools develop and change through *praxis*, or the moments of real human activity that occur only once (Bakhtin, 1993), distinguished from *practice*, or the patterned form of action over time. For Vygotsky, what mattered was the activity engaged; for his students, the activity plus its contextualized expectations and norms; and for his descendants, that activity in normed context around stable tools also under development and change themselves, including but not limited to objects, theories, and spaces for and of activity. The development from first generation activity theory to present day CHAT is easily traced back to Vygotsky's work, and its reliance on Marxist dialectical materialism (applied to educational psychology). For this reason, CHAT is interchangeably referred to below as "Vygotskian" theory.

Actions in Activity

More recently, researchers pursuing further theoretical advancement of these Vygotskian ideas have emphasized the important distinction between *activity* as opposed to *behavior* (Newman and Holzman, 2013, p. 46). Activity is defined by conscious awareness of, and contribution to, dialectical-critical learning and development, in a radically monistic sense, *in history*, rather than *for society* (p. 49). In other words, human *activity* changes the conditions that define it while being defined by them (i.e., a *tool-and-result*, p. 47), or capable of making tools to remake itself with, similar to a dye-maker machine in a machine shop, which can produce parts to repair or enhance the dye-maker, essentially constituting a machine that constructs itself (an imperfect analogy to neurobiological systems such as the human brain). This is fundamental human activity, where the products (cultural tools in Vygotskian theory) of that activity redefine the activity itself in their construction and use (p. 87).

A simple example of activity under definite conditions would be when a group of people agree on norms for creating norms in the group, such as deciding to use voting to make decisions on what tasks to prioritize in completing a project. Another: a classroom of students deciding to improve the ecosystem of a local creek to learn about scientific observation techniques (e.g., Roth and Lee, 2004). While subtler, this example highlights the *radical monism* (Newman and Holzman, 2013, p. 137) of Vygotskian theory: in praxis (i.e., the exact same moment that is never repeated), students are learning (acquiring) and developing (evolving) scientific cultural tools as their unique perspective participates in the activity, adopting some pieces wholesale (e.g., velocity is equal to distance over time) while also adapting provided tools (e.g., exchanging Styrofoam balls for oranges to counter the wind's confounding effect; Roth and Lee, 2007, p. 204), the nature of their own interactional stance (child/observer to student/actor), and the nature of interaction generally believed to be culturally appropriate (direct instruction in dialogue with project-based learning). The refusal to engage in dualistic thinking (subject/object, individual/collective, and learning/development) in Vygotskian theory forces the theorist to think dialectically, which is:

> Equivalent to saying that any part that one might heuristically isolate within a unit [of activity] *presupposes all other parts*; a unit can be analyzed in terms of its component parts, but none of these

> parts can be understood or theorized apart from the others that contribute to defining it (p. 196).

Roth and Lee's (2004) study is a radically monistic description of humans engaged in activity under definite conditions, as "they not only contribute to the ultimate reproduction of society, but also increase action possibilities for themselves" (p. 205), and what is meant below by "learning-and-development," in the sense that *activity* is the cause-and-effect, dialectically, of simultaneous individual and societal learning within praxis (a single moment that occurs only once).

Critically, for ICBCI (see below), Vygotskian theorists characterize various forms activity by the nature of their motives (Leont'ev, 1981), realized by adopting the general object or motive of the activity itself (Roth and Lee, 2007, p. 201). ICBCI clarifies this motive as the *purpose* of the activity, useful for anchoring critical-dialectical analysis of human activity under definite conditions (i.e., in pursuit of an implied or identified purpose; Friedman, 2021, p. 6–7). Thus, preliminarily for the discussion below, [one form of] activity is praxis that reciprocally defines, and is defined by, the purpose (or motive) for which it is conducted (Leont'ev, 1981; Newman and Holzman, 2013, p. 148), such as when children engage in imaginative play, and develop a world where each child's assertions and contributions through word and action both change the nature of their own understanding and the nature of the imagined world itself *in the same moment and with the same act* (p. 99; Vygotsky, 1978, p. 102–103). The theoretical advancement made by the ICBCI model is to extend and clarify how purpose (such as "imagine a world to play imagination in") is a dialectical unity with the norms, goals, and meaning of praxis as well (Friedman, 2021, p. 5–6; also see **Figure 1** and section "ICBCI: A Learning Theory on its Frontier" below). Before discussing ICBCI in more detail, it is necessary to clarify what is not activity, *behavior*.

Actions in Behavior

When human actions are not dialectical in praxis (e.g., not simultaneously defining and defined by their definite conditions), they are instrumental, in service of a particular purpose (i.e., function) and are being defined by their conditions, but not defining them, referred to here as *behavior* (Newman and Holzman, 2013, p. 46). Behavior (i.e., *a tool-for-result*), implies a constellation of actions in service of societal conditions, with no access or capacity to change those conditions themselves, like using a screwdriver and a screw (Roth and Lee, 2007, p. 201–202). A screwdriver can make use of a screw because conditions allow for that, but it cannot change the norms of the screw-screwdriver relationship itself. In fact, it can only entropically deteriorate in service of those norms, such as stripping the head of the screw. Behavior can only change conditions defined by the purpose of the tool itself. In this example, the tool secures one material to another with the use of the screw. Behavior, as the term is used here, is akin to what has also been called *operations* (p. 202). Leont'ev (1978) viewed them as emergent "in the objective-object conditions of [goal] achievement" (p. 65), such as turning the screw "left-loosey" or "right-tighty." Deciding to do so is, potentially, conscious and goal-directed (e.g., "I want to tighten/loosen"), but given the overt goal (e.g., "tighten that screw"), is relegated to subconscious instrumental action taken for granted and barely attended. Instead, the action is assumed and conditioned over time. Thus, behavior (as opposed to activity) is defined entirely by its conditions, and cannot change the conditions themselves (e.g., the direction of the screw's helix, or what screws are for). An example relevant to education: a teacher simply assigning basic workbook problems "to teach math" and students completing those problems "to learn math." Activity in this case may involve arithmetic word problems the students write for each other or going shopping on a budget with various calculation requirements (see Lave, 1988).

For the present discussion, this distinction between activity (tool-and-result) and behavior (tool-for-result) lays the theoretical foundation for Mezirow's (2008) transformation in the context of ICBCI. For transformative learning to occur, activity is necessary, as the tools applied in the learning context are necessarily changed by the actions (i.e., tool use) of those experiencing transformation. In Mezirow's (2008) terminology, this is a point of view changing not only a habit of mind, but an entire frame of reference, or the relationships between points of view and habits of mind. ICBCI helps clarify this notion by connecting learning tools (predicting, trying, doing, and reflecting, i.e., habits of mind) to the products of tool use (purpose, norms, goals, and meaning, i.e., points of view), and further, by describing exactly what the relationships between points of view and habits of mind are: *connections between purpose*, and norms, goals, and meanings (i.e., Introduction, Conflict, Balance, Creation, and Identity activity and behavior). To clarify the meaning of this statement, a general outline of the ICBCI model is necessary.

INTRODUCTION-CONFLICT-BALANCE-CREATION-IDENTITY: A LEARNING THEORY ON ITS FRONTIER

See **Figure 1** for a reduced presentation of the ICBCI model of learning-and-development. ICBCI is a meta-theory that synthesizes historical work from cognitive, social, educational, and clinical psychology (Friedman, 2021). It posits that "zones of proximal development" (ZPDs; Vygotsky, 1986, p. 208–209) define-and-are-defined-by five "spheres of activity" (or behavior): Introduction, Conflict, Balance, Creation, and Identity (the hyphens here denote activity-like reciprocity between the constructs, i.e., are in dialectical unity). These spheres of activity (or behavior) are qualified by four "balance tools": Purpose, Norms, Goals, and Meaning; and two "imbalance forces": Rigidity and Chaos, resulting in Balance (i.e., activity/integration) or imbalance (i.e., behavior/trauma), whose interaction defines-and-is-defined-by learning-and-development. Each of these constructs is briefly explained below, and full details of the model can be found elsewhere (e.g., Friedman, 2021).

These spheres, tools, and forces are always in dynamic interplay in human activity under definite conditions (e.g., during all forms of learning). In other words, the purpose, norms, goals, and meaning (i.e., conditions) of an activity (or behavior)

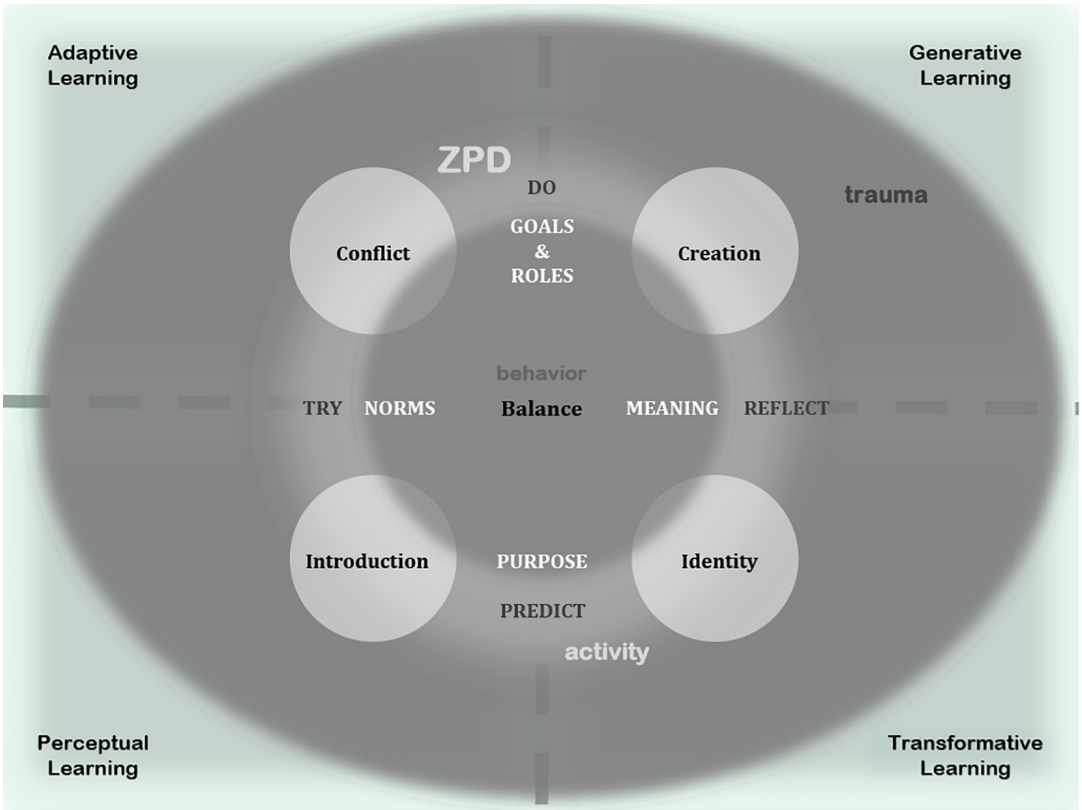

FIGURE 1 | Introduction-Conflict-Balance-Creation-Identity (ICBCI) model of transformative learning (TL). See full model details in Friedman (2021).

meet the rigidity| chaos present in the individual| group and the environment| purpose and produces either a ZPD (i.e., activity), behavior, or trauma. Note that here and below, the Sheffer stroke ("|") corresponds to the NAND operation in classical Boolean logic to denote the dialectical nature of these categories (Roth and Lee, 2007, p. 197). The terms on either side of the stroke *presuppose the other* and are understood as mutually exclusive terms of the same entity that together explain what neither alone does. While the rigidity| chaos unity isn't discussed at length in this paper, all that matters for the present discussion is that it explains the natural and unknowable forces of change that we, in praxis, affect, and affect us. The rigidity| chaos unity thus explains the infinite milieu of conditions in history humans contend against in their own processes of learning-and-development.

Under conditions ZPDs emerge, learning-and-development is perceptual, adaptive, generative, and/or transformative, depending on the spheres of activity that are defining-and-being-defined-by the ZPD (see **Figure 1**). Under conditions that ZPDs do not emerge, learning takes the form of conditioning, which is to say that the individual| group engages in behavior primed and enforced by the conditions that they have no power to change; they simply execute expectations, perfectly or imperfectly, without conscious access to the conditions' development, or their own. Before describing how this theoretical shift can aid TL research in section "Theoretical and Real Obstacles to Current TL Theory," the main constructs of the model relevant to the present discussion are briefly described.

Spheres of Activity or Behavior

Introduction-Conflict-Balance-Creation-Identity posits five modes of activity (or behavior; depicted as spheres in **Figure 1**) extended from the integration of classical group dynamics theory (Tuckman and Jensen, 1977) and the Kolb Experiential Learning Cycle (Kolb, 2014; for details of this integration, see Friedman, 2021). Each mode is defined by the interaction between two spectra: (a) perception-action, and (b) internal-external. The distinction between perception and action is related to common sense notions of observing or sensing and acting or doing, respectively. The distinction between internal and external is related to whether perception and/or action is directed to the outside world or inner milieu of the individual| group.

Thus, external perception describes the "Introduction" mode, wherein individual| groups observe and get a sense of their environment| purpose. Following clockwise around **Figure 1**, internal action describes "Conflict" wherein individual| groups act on the internal milieu of themselves, essentially to organize and resolve apparent contradiction or tension. "Creation" is described as "external action," the mode individual| groups engage while acting on their environment| purpose. Internal perception describes "Identity," or the mode wherein individual| groups observe and get a sense of their own being within the

environment| purpose. Finally, "Balance" describes the mode of any unity between (i.e., co-occurrence of) Introduction, Conflict, Creation, and/or Identity. Further, the model borrows Vygotskian theorists' discovery of activity as defining-and-defined-by learning-and-development and extend the discovery of this unity (and it's disunity, behavior) to activity as defining-and-defined-by the five modes (as each is a form of learning; see **Figure 1**), while behavior is simply defined by them (see above, Newman and Holzman, 2013, p. 46). The actions that support (i.e., create the potential for) activity, and thus learning-and-development, are called "balance tools" [note their places on the border between the Balance sphere and ZPDs (i.e., activity) in **Figure 1**].

Balance Tools

The balance tools – Purpose, Norms, Goals, and Meaning – are derived from the integration of the five spheres in **Figure 1** with the Kolb Experiential Learning Cycle actions: Predict (also referred to as Think; i.e., abstract conceptualization), Try (i.e., active experimentation), Do (i.e., concrete experience), and Reflect (i.e., reflective observation; Kolb, 2014), and serve as supports between the spheres (i.e., the more developed the balance tools, the more capable the activity or behavior). By taking the Vygotskian view of *activity* rather than *the individual* as the proper unit of psychological analysis (see Roth and Lee, 2007, Figure 4, p. 198; Newman and Holzman, 2013, p. 52), ICBCI recasts actions individual| groups engage in as tools (tools-for-results and tools-and-results depending on the definite conditions) that human activity (and behavior) requires to function. Sometimes these tools are explicit and conscious (i.e., articulated, acknowledged, and intentional), such as when the purpose of the learning activity, the methods engaged in pursuing that purpose, the goals (i.e., objectives) those methods aim to achieve, and the meaning of the resulting experience for that purpose are articulated. Other times they are implicit and subconscious (i.e., assumed, taken-for-granted, unknown potentially to both teachers and students), as is their negotiation. An example of activity at the conscious level are project-based learning environments where actions (and their environment| purpose) are co-constructed by both teacher and student. The unconscious level is common in apprenticeships where shifting balance tools may not be articulated or recorded but are nonetheless evolving through reciprocal activity between the apprentice and the expert. This evolution does not occur in behavior, where the tools are inaccessible to definition by the learner. Note here that these tools (purpose, norms, goals, and meaning) are also postulated to be the "definite conditions," and thus, while they *can* each define-and-be-defined-by one another, they do not need to be in praxis, and this is the distinction between activity and behavior, one of the crucial points of the argument presented here.

Given the focus of this article on transformative learning, the balance tools (i.e., conditions) most important for the present discussion are Meaning and Purpose. Or, as Vygotskian theorists consider it – the unity – human-activity-as-meaning-making-as-learning-and-development (Newman and Holzman, 2013, p. 198–199). ICBCI furthers this Vygotskian discovery by clarifying the unity's definite conditions and in so doing defines TL phenomena: when Meaning (i.e., the reflective observation of experience such as an appraisal, judgment, or metaphor) is engaged in as *activity* (i.e., meaning is made in such a way as to transform meaning-making, i.e., reflection), and *that activity* transforms Purpose (i.e., the conceptual abstraction of experience into a model or prediction) under those [transforming] definite conditions which further, is engaged in as an activity itself (i.e., transforms concept-building activity, i.e., thinking/predicting). Thus, the Vygotskian discovery of meaning-making-as-learning-and-development is, in ICBCI's theory of TL, further elucidated as meaning-making-transforming-purpose-as-learning-and-development (see also Immordino-Yang et al., 2019 for a discussion of this phenomenon from educational neuroscience). It is that meaning-making activity that transforms purpose of human activity under definite conditions (i.e., the balance tools, including purpose) that ICBCI identifies as transformative learning, in a radically monistic account. This is only a slight clarification of Mezirow's (2003) point of view (i.e., meaning) that transforms a frame of reference (i.e., purpose), but, as shown below, a crucially important one.

To preview, since human activity under definite conditions describes reciprocity between human actions and the conditions that define them, and those conditions are balance tools, and one of those balance tools is Purpose, and Purpose most powerfully influences the other three tools (Norms, Goals, and Meaning; see Leont'ev, 1981; Friedman, 2021), ICBCI shows how TL, in making Meaning that transforms Purpose that transforms Norms, Goals, and Meaning can lead to radical and irreversible change in individual| groups within their [transformed] environment| purpose: it transforms points of view (constellations of purpose, norms, goals, and meaning), habits of mind (predicting, trying, goal-setting, reflecting processes) and frames of reference (quality and capacity of Introduction, Conflict, Balance, Creation, and Identity activity and behavior). In other words, it is a radically monistic account of TL. The goal of the following section is to suggest that the most intractable issues of TL research and practice can be at least chipped away at if not alleviated by making exactly this relationship (meaning-making-transforming-purpose-transforming-conditions) clear, and amenable to observation, without the need for mountains of time and data to do so.

THEORETICAL AND REAL OBSTACLES TO CURRENT TRANSFORMATIVE LEARNING THEORY

Despite 30 years of work, theoretical progress on TL has stalled in the same places (Cranton and Taylor, 2013; Howie and Bagnall, 2013; Dirkx et al., 2018): what *exactly* is being transformed, what are the predictable consequences of this transformation, and how is this transformation an example of learning [processes] (i.e., how is transformative learning related to other, non-transformative, forms of learning)? The following section attempts to show how these obstacles can be resolved by a Vygotskian perspective of education and the

role of educational psychology. It is not the author's view that researchers today are unaware of Vygotskian cultural-historical activity theory, but rather that this work and Vygotsky's life-as-lived are often misinterpreted to fit a dominant, institutionalized concept of the bounds of psychology and its appropriate unit of analysis (the individual, or in less Westernized traditions, the collective). The following is an attempt to return to Vygotsky's discovery of human-activity-as-meaning-making-as-learning-and-development to show how ICBCI makes TL processes and outcomes observable across sets of conditions (i.e., Purpose, Norms, Goals, and Meaning). First, a brief review of the history of learning research is presented, before describing how ICBCI, in following Vygotskian cultural-historical activity theory, articulates TL's necessary and sufficient conditions as re-organizing [revolutionary] activity.

Before Vygotsky's and his contemporaries' work from the early 20th century was widespread in the West in the 1970s and 1980s, "learning," was first conceived by James et al. (1890), Thorndike (1927), and another Russian psychologist, Pavlov (1957; later championed most strongly by the American, Skinner, 1965), as innumerable stored Locke (1847) representations of stimulus-response (S-R) links, and all that mattered was how many times the S-R link had been "occasioned." Later, thanks publicly to Chomsky (1959), and privately to numerous passionate researchers (e.g., Newell and Simon, 1972; Neisser, 2014, among many others), the quality, rather than solely the quantity, of information processing was discovered as a factor in determining learning processes and outcomes. Only very recently in the West, biopsychosocial approaches to educational psychology and cognitive neuroscience (those that consider the biophysiological and social environment of learning in the process of research and practice) have strongly argued with tantalizing neural and behavioral evidence that while the information processing approach was certainly an improvement over behaviorism's S-R links, it still lacks much in the way of explaining learning phenomena, and is improved in this capacity by accounting for the motor, emotional, and social (i.e., the nature of the group and individual relationships present) contexts of the learning environment, and the surrounding socio-cultural-historical environment (i.e., the dominant culture(s) present; see Bandura, 1997 for a classical argument; Barsalou, 2008; Barrett, 2017, and Immordino-Yang et al., 2019 for modern perspectives).

During all this time, Vygotsky and his contemporaries published their work and passed away, largely ignored by the West. Also, during this time, Mezirow (1978) began his research program to investigate a particularly important sort of learning that seems to transform the very people who experience it, rather than simply provide another tool in their toolbelt (i.e., the learning experience re-organizes the entire structure of what they already know, rather than learning a new tool to simply apply or extend the structure already known). It is relevant to consider what Mezirow would have thought or what direction his work would have taken if Vygotsky's work was more well known in his time, but more pertinent to the present goal is how Mezirow's work can be understood in terms of the radical monism championed by Vygotskian scholars. In other words, Mezirow's classic 10 steps of TL (and learning more generally by Mezirow's descendants and colleagues) will be described as a dynamic emergent process in ICBCI, before describing the concrete predictable consequences of TL according to ICBCI. First, a broad overview of learning as conceived of by TL researchers generally is presented in dialect with Vygotskian ideas.

What Is Learning?

Though the actual attention to non-transformative learning by Mezirow waxed and waned over his career, it was clear to him that TL was a separable kind of learning from other kinds of learning (Mezirow, 2000). Particularly, TL according to Mezirow is a form of Habermas's (1984) "communicative learning" as compared to "instrumental" (learning to manipulate or control the environment or other people to enhance performance), "impressionistic" (learning to enhance one's impression on others), or "normative" (learning oriented to common values and a normative sense of entitlement to expect certain behavior) learning (Mezirow, 1997). "Communicative learning," or learning to understand the meaning of what is being communicated, is exactly what Vygotskian theorists had in mind when describing the unity of imitation-as-revolutionary-activity-as-learning-and-development, when they described how children imitate adults (and peers) in performing the activity they observe in others – and this is crucial – *only the activity*, and *not the behavior* (Bloom et al., 1974; Newman and Holzman, 2013, p. 56). In other words, Mezirow (and Habermas) are pointing at the tip of the Vygotskian iceberg: that learning to understand meaning is necessarily communicative, necessarily *an activity between* rather than *of*, individuals.

For Vygotskian cultural-historical activity theory, instrumental, impressionistic, and normative learning are not learning-leading-development, or revolutionary *activity*, but rather, *behavior*, or development leading learning, also, just plain "acting" (Newman and Holzman, 2013, p. 176; i.e., *operations,* Roth and Lee, 2007, p. 202). Behavior, and acting out behaviors, despite any learning's newness to a given individual| group, won't enable them to maintain that behavior outside the present conditions, unless those conditions are recreated *for* that individual| group. Vygotskian scholars contrast this kind of learning with the revolutionary activity of learning-leading-development, where individuals can transfer that activity to new sets of conditions (within limits, see Lave, 1988; Bransford and Schwartz, 1999; and Immordino-Yang et al., 2019 for discussions).

For Mezirow, TL occurs when a new "point of view" (as the result of cumulative progression toward that point, or sudden situational experience of it) changes not just a present habit of mind but the over-arching and determining frame of reference (1991), and this is contrasted with non-transformative forms of learning where the new points of view don't change anything (i.e., a new point of view), or change only a habit of mind or other points of view (i.e., both new meaning schemes), rather than the entire frame of reference (i.e., a new meaning perspective, 1991, p. 93–94; also described as content, process, and premise reflection, respectively, p. 107–108). For example, in the ethnocentric example earlier, a new point of view (e.g.,

"that person of a different ethnicity is more intelligent than I thought") experienced within an old habit of mind (e.g., "persons of different ethnicities are less intelligent") may lead a learner to adopt a only a new habit of mind (e.g., "my ethnicity's peoples are more intelligent for other reasons than ethnicity, like our culture"), or a new frame of reference (e.g., "all individuals exist on the same scale of intelligence regardless of origin"). Only the latter is an example of TL (related: Bateson's (1972), "Learning III" p. 293).

This is what makes TL irreversible for Mezirow: the shift in the frame of reference *as a result of* the new point of view, because the new frame of reference transfers to new and old points of view (e.g., "many people I thought inferior before are actually not"). For Vygotskian theory, this (tool-and-result activity: points of view defining-and-defined-by frames of reference) is what makes activity learning-and-development, or adapting to history, and behavior simply acting, or adapting to society (i.e., the adoption of a point of view, or a habit of mind, without understanding *why*, or *how*, i.e., without having access to the conditions; Newman and Holzman, 2013, p. 187–188). In this sense, behavior can be thought of as the expression of a point-of-view or the expansion or application of a current habit of mind. Activity, on the other hand, is either the adoption of a new habit of mind (when norming, goal-setting, and meaning-making processes are accessible and changed in accessing them) or a new frame of reference (when meaning-making-as-activity defines-and-is-defined-by purpose which then transforms habits of mind: norming, goal-setting, and meaning-making processes) resulting in reorganized points of view (constellations of norms, goals, meaning, and purpose).

For both TL and CHAT research programs, there is something unique about dynamic and reciprocal activity between humans and their conditions, and ICBCI attempts to articulate this uniqueness by clarifying what a "point of view" and "frame of reference" are (meaning and purpose, respectively), how they prime transformative experiences (meaning-making-transforms-purpose), and the product that is transformed (meaning-making-transforming-purpose-transforming-conditions). In the case of a TL experience relative to ethnocentrism, an old purpose (e.g., "maintain assumption of natural superiority over other humans") is transformed through a meaning-making process (see above) to a new one (e.g., "recognize common humanity regardless of ethnicity"), which then proliferates through new norms, goals, and meanings (i.e., conditions and points of view), and norming, goal-setting, meaning-making, and purpose-identifying processes (i.e., balance tools, or habits of mind). A final briefing note on learning perspectives in TL theory of learning generally will help interpret this claim (and **Figure 1**) before elaborating on transformative learning in ICBCI terms.

TL researchers since Mezirow have embarked on diverse directions to define learning, and transformative learning as a special case thereof (for a relevant dialogue on divisions within TL research itself, see Dirkx et al., 2006). Probably the most well-known taxonomy of this work within the TL literature (besides the Mezirow/Habermas taxonomy above) is described in detail by Sessa et al. (2011), who, working in a team learning space, define TL as:

> Re-shaping or altering the team's purpose, goals, structure, or processes. . .and requires experiencing disorientation and then reorientation for an entirely new direction for growth. . .produc[ing] a new team, structure, strategy, goals, and identity (p. 149).

Sessa et al. (2011) anchor this definition of TL by comparing Transformative Learning to Adaptive Learning ("reacting almost automatically to stimuli to make changes in process and outcome as a coping mechanism") and Generative Learning ("proactively and intentionally applying new skills, knowledge, behaviors, and interaction patterns to improve. . .performance") processes (2011, p. 149). Focusing on activity here as the appropriate unit of analysis rather than the individual vs. group distinction, this tool-and-result aspect of TL, and the tool-for-result character of adaptive and generative learning, clearly emerges. This suggests that for Sessa et al. (2011), adaptive and generative learning are forms of behavior [according to Newman and Holzman (2013)], and transformative learning is a form of activity (as defined by CHAT; Roth and Lee, 2007). ICBCI disagrees.

Relying on Vygotskian cultural-historical activity theory, ICBCI defines learning as *increasing capacity to act on a specified purpose under definite conditions*. Note the use of "act" here, rather than activity or behavior. The increased capacity is independent of any definite future reciprocity between actions and conditions. Some learning increases capacity for activity, some for behavior, and some for both. Some learning is learning-leading-development, and some learning is development-leading-learning. A key insight that follows this formulation is how all types of learning can be activity (tool-and-result) or behavior (tool-for-result), including TL (see above, and **Figure 1**).

To be clear, the transformative learning process that Mezirow (1991) describes is, to ICBCI, transformative learning-and-development (i.e., activity, or more specifically: meaning-making-transforming-purpose-transforming-conditions), but this is not the only kind of TL, because sometimes individual| groups "act out" TL, and are thus able to recreate the consequences of that TL experience in *those conditions*, but not in others (Newman and Holzman, 2013, p. 176). Their transformed frame-of-reference, in the case of Identity as behavior, is relevant to *only* that environment| purpose it was transformed in, and not others (e.g., being able to take a humanistic meaning perspective, or purpose, with a group of colleagues after an anti-racist workshop but reverting to egotistic perspectives with family). Remember, for ICBCI, conditions and balance tools are essentially the same, what matters is if they're accessible to individual| groups' actions. If they are, *activity* results; if not, *behavior*. The theoretical existence of TL activity doesn't preclude that of TL behavior [the "acting out," or unaware pretending of transformation, in Newman and Holzman's (2013) language, p. 176]. TL behavior is meaning-making-that-transforms-purpose (but isn't transformed, or to use Vygotskian language, reorganized, by it). In other words, the environment| purpose is transformed, but the individual| group's capacity for Identity, is not. This is also akin to Mezirow's (1991) point of view that changes a habit of mind (in this case, how

purpose is identified, or "process reflection," p. 107–108), but not the frame of reference (how identified purpose establishes conditions, or "premise reflection," p. 108). Before describing this difference in detail, it will be helpful to review the TL literature's response to the second stable obstacle: what is transformed.

What Is Transformed?

As mentioned above, for Mezirow (2008), problematic frames of reference are what's transformed. Also referred to as meaning perspectives, and defined as the "structures of culture and language through which we construe meaning by attributing coherence and significance to our experience," these frames of reference are transformed when those structures encounter a "disorienting dilemma," instigating a practical-critical process of reflection, identification, communication, and integration of changes in perception and action that culminate in a novel point of view from which an entirely re-organized frame of reference propagates (p. 92). This cohering and signifying structure of experience, for human activity, is Purpose, or more specifically, tool-and-result activity-as-identifying-purpose-transforming-conditions. The relationships between and among the individual's points of view are themselves reorganized to reflect a new meaning perspective (i.e., frame of reference). For ICBCI, Purpose constructs (i.e., is) the frame of reference, and is also the primary condition for the activity [or behavior] engaged in, framing every other condition (Norms, Goals, and Meaning). This *formation of perspective* (i.e., Purpose) for human activity sets the stage for transformative experiences, serving as the landmark for meaning-making activity to transform, in so doing transforming every other condition for the individual| group. Purpose has a special place in ICBCI, and in human activity (Leont'ev, 1981; Friedman, 2021).

No matter the typology of the transformation itself (or the typology of its outcomes), it can be described by ICBCI. Taylor (1997, 2008) identifies eight types of TL processes (see section "Introduction"). ICBCI can anchor every kind under the umbrella of a relevant and articulated Purpose of human activity under definition conditions without the need for eight categories overlapping to different extents with one another. To simultaneously echo and update Taylor (2008), the exciting part of the diversity offered by the Purpose concept emulates the diversity of human learning-and-development, and thus helps us get that much clearer on the more fundamental question of what *exactly* develops – the capacity for [revolutionary] activity (itself enabling behavior) within the reach of present definite conditions – and how that development occurs: activity-as-meaning-making-transforming-purpose. When conditions (Purpose, Norms, Goals, and Meaning) are such that individual| groups can change their conditions through their actions (i.e., engage in activity) and one of those actions is a meaning-making process that transforms their purpose in that environment| purpose (transforming the rest of their conditions), we can say that TL, as Mezirow (2008) described, occurs.

The infinite number of purposes that may be identified (and their context-bound necessity) provides scope and structure to TL research by enabling taxonomic efforts to focus on the nature of the change itself, rather than its antecedents and consequences. Thus far, the codification effort of TL has proliferated in walled gardens within the taxonomy all claiming a unique kind of transformation (e.g., psychocritical, cultural-spiritual, race-centric, etc.), for which the list of necessary and sufficient conditions for a "disorienting dilemma," "critical reflection," or "imaginative engagement" to occur has rarely simplified, and far more often compounded on itself in the effort to answer critics and broaden the umbrella TL theory covers (e.g., Taylor, 2008; Hoggan, 2016b).

In contrast to these efforts to categorize disparate content, ICBCI focuses on the dynamic and continuous process of emergent transformational activity (or behavior), making clear what exactly is transformed: Purpose (and as a result: balance tools, as well as the capacity of their interactions, Introduction, Conflict, Balance, Creation, and Identity); how it is transformed: tool-and-result meaning-making-transforming-purpose; and what enables, or instigates this *activity*: a set of conditions (i.e., purpose, norms, goals, and meaning) that *don't have the capacity to fulfill the current Purpose*. This can be mapped onto the model and compared to other forms of learning-and-development (i.e., activity, not behavior), that are not transformative (see **Figure 1**): *perceptual activity* transforms the Norming process through trying new norms (based on present purpose); *adaptive activity* transforms the Goal-setting process through setting new goals (based on present norms and purpose); *generative activity* transforms the Meaning-making process through making new meaning (based on set goals, norms, and purpose); and finally, transformative *activity* transforms the purpose-identification process through identifying new purpose (based on made meaning, in pursuit of a goal, through norms, hinged on purpose), that, due to the environment| purpose unity (i.e., the conditions-defining nature of purpose), transforms perceptual, adaptive, and generative *activity*, or the relationships between norms, goals, meanings, and their formation processes. In this way, ICBCI's definition of learning can be further elucidated as taking the shape of *either* (a) learning-and-development, or transferable learning (to new sets of definite conditions) when engaged as *activity*; or as (b) development-leading-learning, or non-transferable learning when engaged as *behavior*. This is a very Vygotskian idea: that the development we are in search of in the process of education is that which can be carried around, and this is only made possible when the learning individual| group has access to reshaping (through activity) the conditions of their environment| purpose, or what Vygotsky described as the ZPD (Vygotsky, 1978). See **Table 1** for examples of activity and behavior for each kind of learning.

What makes TL truly unique in the pantheon of learning phenomena tends to be its emphasis on *its* changes changing everything else. Again, ICBCI models exactly this, as it is only through transforming Purpose, through transformative activity that one "re-Introduces" their "entire self" (purpose in this set of definite conditions) to a new set of definite conditions from a new meaning perspective, or purpose. Further, for the purposes of TL research, that newly transformed purpose can be anchored to a set of meanings before, after, and within any particular meaning-making process, the changes in those meanings can be

TABLE 1 | Examples of activity vs. behavior for various learning types.

Learning type	Definite conditions	Activity	Behavior
Perceptual	Purpose and norms	A wandering adventurer attending to the smells of flora and fauna, given a guidebook with only images and descriptions of texture	A wandering adventurer attending to the textures of the flora and fauna and comparing them with the guidebook's descriptions and images
Adaptive	Norms and goals	A group deciding to follow their own chosen leader's instructions, rather than the leader assigned by a teacher or supervisor	A group following the assigned or implicitly elevated leader's instructions as closely as possible, despite personal grievances
Generative	Goals and meaning	A grade school teacher assigning a free choice research project to help students study for the end of year standardized test	A grade school teacher creating as many questions as similar to the standardized test questions as possible to help their students study
Transformative	Meaning and purpose	A policeman, upon seeing a young person using substances on the street deciding, for the first time, and thereafter, to take them to the local safe injection site instead of the police station	A policeman, upon seeing a young person using substances, tries to get to know them and their struggle while taking them to the police station

Learning types are not mutually exclusive.

identified, and any resulting changes in activity or behavior under new conditions (i.e., new norms, goals, meaning, and purpose), integrated and observed to build a theory of what potentiates TL experiences. Finally, the complexity of any given environment| purpose: its depth, breadth, and coherent integration (or rigidity| chaos) can be interrogated with systematic clarity compared to the transformed environment| purpose. Before an illustration of this potential, the TL predictions ICBCI makes beg elaboration.

What Are the Predictable Consequences of Transformation?

The final stubborn stumbling block to TL theory and practice that ICBCI can help resolve are the predictable consequences (i.e., evidence) of transformative learning. Here, the challenge is collecting practical and observable data from TL phenomena. Because it hasn't been clear what the antecedents to transformation are systematically (other than "disorienting dilemma"), data is typically sampled from settings considered dramatic enough to make TL likely (e.g., breast cancer survivors, Hoggan, 2014; outdoor adventure education, Meerts-Brandsma et al., 2020; developing cultural competency as members of historical majorities, Taylor, 1994; and the women's liberation movement, Mezirow, 1978), rather than observing TL under definite conditions where TL is theoretically potentiated for some actions, but not all actions, and the hypotheses determining which are tested empirically.

In other words, in TL's fragmented theoretical landscape, researchers can study who transforms *when they do transform*, why *they* transformed, and what the consequences of *their* transformation are, but they cannot study who *doesn't* transform, or what actions or conditions prime transformation vs. don't, because the experimental contexts engaged assume that transformation is inevitable for at least someone under those conditions (and researchers focus on *them*). The limitations of these contexts restrict researchers' ability to understand the boundaries of what TL is and what it isn't (Nohl, 2015). TL research today can't study why certain actions don't lead to transformation unless one or more of Mezirow's 10 steps didn't occur, or the active frame of reference wasn't "problematic," but these are vague and insufficient negative definitions (Apte's (2009) dialectical model is an interesting practical-critical exception that hasn't been noticed much by TL researchers). Further, the theoretical models available for collecting systematic data on a TL experience (i.e., transformative activity and its consequents) remain sparse, and require an intensive amount of qualitative data collection and analysis to draw conclusions (see Harder et al., 2021 for a relevant discussion and attempted technological solution resulting in similar limitations). These limitations in scope and efficiency can be overcome if conducting TL research based on ICBCI.

Regardless of the setting observed, TL outcomes are often categorized in terms of their depth, breadth, and stability (e.g., Hoggan, 2016b). ICBCI further clarifies "stability" as "integration" (differentiation *and* linkage; Siegel, 2001), or increasingly greater capacity of modes of activity (i.e., ICBCI; Friedman, 2021). Every TL experience, according to ICBCI, leads to a sweeping activity period where meaning-making-transforms-purpose, and that *made meaning* propagates through *transforming purpose* which then re-organizes norms, goals, and meanings related to that environment| purpose. This is what ICBCI means by a transformed re-introduction to definite conditions. Those definite conditions are defined by the identified purpose. The introduction (or any other) mode can be either of activity or behavior. In both cases, the perceptual learning (or any mode of learning) and the formation of norms (or any balance tool) are based on, or related to, the environment| purpose. Engaging in activity (rather than behavior) in any form of learning extends the environment| purpose to which that learning will transfer. However, it is only when the introduction mode (or any mode) is engaged in *as activity,* as the direct result of the Identity mode *as activity,* that there is evidence of TL (i.e., if perceptual, adaptive, and generative activity transforms as a result of meaning-making-transforming-purpose). If perceptual, adaptive, and generative activity (and behavior) is a spontaneous propagation of that meaning-making-transforming-purpose process, there is evidence of TL. When there *is* evidence of TL, ICBCI predicts that, in Siegel's (2010) language, the [transformed] definite conditions (purpose, norms, goals, meanings) will be more flexible, adaptive, coherent,

energized, and stable across and within the environment| purpose (p. 69–71). In essence, their capacity for [revolutionary] activity (as opposed to [societally expected] behavior), will be greater, and challenges that used to be more difficult are now less, achievements that were impossible before will now be possible. Wondrously, this claim of course, is an empirically testable one, because we can anchor on each environment| purpose and test each individual| group within it.

Thus, the 30 year-old questions: what are the consequences of transformation, and how do they differ from consequences of non-transformation, can finally be answered. The consequences of transformation are contained in the dialectical unity: Meaning-making| Purpose| Norms| Goals| Meaning (i.e., a meaning-making process that transforms purpose results in a new purpose, or meaning perspective, that requires transformations of Norms, Goals, and Meanings, *and their formative processes,* to align with the transformed Purpose). This means that no matter the content of the outcomes (e.g., Hoggan, 2016b, p. 70), they can be described in terms of Purpose, and its transformation under definite conditions (of norms, goals, and meaning). This focus on Purpose allows individual| groups (be they researchers or learners) to identify specific changes relevant to history (i.e., their activity), rather than society (i.e., their behavior; acting out what is expected). Additionally, each purpose can be seen both as what is transformed: from the previously identified purpose to the newly identified one; and the outcomes of that transformation: new purpose propagated through new norms, goals, and meanings, *as well as* new norming, goal-setting, and meaning-making processes. An identical formulation of the consequences of TL: "triple-loop" learning (Peschl, 2007), or that which re-organizes itself, is re-organized by, and reorganizes its container in the process of its performance. The consequences of non-transformative learning-and-development (i.e., perceptual, adaptive, and generative activity): "double-loop" learning (Argyris, 1977), or that which re-organizes itself in the process of its performance. These are the predictable consequences and key pieces of evidence TL theory has been searching for: new meanings re-organizing purpose, which then re-organizes norming, goal-setting, and meaning-making processes to align with the historical direction of activity for each individual| group experiencing TL.

DISCUSSION

Thus far, this theoretical proposal has suggested that TL theory has faced the same obstacles since Mezirow's formulation of the topic: a lack of clarity on what exactly learning is, what transformative learning specifically transforms, and what the predictable consequences of these transformations are. These obstacles have kept TL research largely in a qualitative case-study space, only tentatively inching forward into experimental and generalizable methods until a stringent criterion for dramatic enough change gadflies researchers and hampers further progress (Cranton and Taylor, 2013).

Introduction-Conflict-Balance-Creation-Identity offers the following resolutions: (1) learning conceived of in Vygotskian terms as tool-and-result activity, or tool-for-result behavior. While the latter is still learning, it isn't capable of re-organizing its conditions, only being defined by them, and thus can't be transformative activity (or transferable to new sets of conditions), though might be "acting out" transformative behavior (in which case we would expect meaning to shape purpose, but not purpose to re-shape meaning, losing any holistic transformation, or "breaking the loop"); (2) TL as transforming purpose through meaning-making processes that are also transformed through transforming that purpose of activity under definite conditions. It is the unity, meaning-making-transforming-purpose that is itself transformed during TL activity. Finally, (3) the predictable consequences of transformation are (so far discovered) transformed Norming, Goal Setting, and Meaning-making *activity* (tool-and-result change, and their ICBCI interactions) related to Purpose-identifying activity for the environment| purpose. Given these tool-and-result methods for investigating TL, researchers can be more efficiently equipped to observe necessary and sufficient conditions for TL *for every*

TABLE 2 | ICBCI empirical transformative learning (TL) questions and hypotheses.

Research question		Hypotheses
(1)	Under what conditions does activity emerge? How do these conditions differ when emerging from behavior vs. activity?	(a) Activity emerges when reorganizing purpose, norms, goals, and/or meaning, as opposed to other things
		(b) Activity emerges from behavior by reorganizing at least one balance tool
		(c) Activity emerges from activity by reorganizing at least two balance tools
(2)	How does activity change as a result of TL experiences [of activity-as-meaning-making-transforms-purpose-transforms-norms-goals-meaning]?	(a) Activity occurs more often under similar (but reorganized) conditions as a result of TL experiences
		(b) Activity under similar conditions is more complex in depth, breadth, and integration after TL experiences under definite conditions
(3)	Within groups, how does "meaning-making-transforms-purpose" vary by role in the group?	(a) TL will occur earlier, more readily, and it will change more meanings for individuals central to the activity of the group as compared to individuals less involved in the group activity [and behavior]
(4)	What are the differences between TL outcomes that transfer across environment|purposes individual|groups engage in and TL outcomes that don't?	(a) Transferable TL outcomes result when individual|groups are able to reorganize meaning-making processes that transform their environment|purpose, whereas non-transferable TL outcomes do not have access to reorganize these processes

purpose under definite conditions. An example of what this could look like follows before presenting final thoughts and empirically testable hypotheses based on ICBCI for TL.

An Illustration of Transformative Learning According to Introduction-Conflict-Balance-Creation-Identity

Outdoor adventure education (OAE) is known for its TL potential so much so that a large part of the field's research and practice is focused on TL theory and outcomes (e.g., Meerts-Brandsma et al., 2020). Briefly, OAE typically involves a stable group of learners spending a significant amount of time together engaged in challenge-based problem solving (usually, but not always, outdoors in nature). The significance of each element of these conditions can't be easily overstated. The group primes dialogue, the environmental challenge primes practical-critical activity, and the significant time together, reflection and conceptualization. Typical TL examples in these environments are when individuals see themselves as more capable and competent as a result of overcoming an obstacle they thought impossible for them to overcome (usually following a challenge they saw themselves as incapable to accept, but then, through activity, through imitation-learning-leading-development in a ZPD, they realize they are actually quite capable; Newman and Holzman, 2013, p. 176). And this new point of view, that they are more capable than they realized, propagates through their frame of reference (who they are as a person, what they as a person are capable of) and habits of mind (responding "oh, I can do this" to a tall tower to climb or long hike instead of "get me out of here") across contexts, or sets of definite conditions (i.e., feeling capable of public speaking as a result of completing a long hike, not because long hikes make you good at public speaking, but because the frame of reference, individual competence judgment, has re-organized to prime confidence in the face of challenge rather than insecurity). While basic, this is, in a general sense, the archetypical TL trajectory in Mezirow's (2008) language.

Introduction-Conflict-Balance-Creation-Identity can help define what is observed in this example and what can be predicted about similar purposes under definite conditions. The "disorienting dilemma" can be further clarified in terms of Norms (e.g., as the normative belief: "I am incapable of doing things that scare me") that didn't support the capacity of articulated Goals (e.g., "I am going to climb this tower") that instigated Meaning-making activity that transformed Purpose (e.g., "If I can climb this tower, I was wrong about being incapable, I wonder what else I thought myself incapable of that I might actually be quite able to do. . ."). In this case, Purpose has shifted from, for example, "I am here to climb towers", to "I am here to increase my self-confidence, in climbing towers as well as doing many other things." Each of these four conditions can be identified prior to and in the moment of disorientation, what ICBCI refers to as imbalance, to interrogate the dynamic interrelationships that prime TL *for every purpose* (in our current example, what is stated above, or perhaps "to increase feelings of competence in the face of challenges"). Importantly, this shift in purpose is *only possible* in activity, as in behavior, these conditions cannot be accessed or negotiated, and likely take the form of "to climb a tower as a group" (Newman and Holzman, 2013, p. 194–195).

Introduction-Conflict-Balance-Creation-Identity can also further clarify the shift in meaning perspective by anchoring on the pre-transformational meanings and interrogating meanings post-transformation, or during TL activity, to better explain the mechanisms of TL (i.e., Norms-Goals-Meanings in conflict with Purpose under conditions of activity, which is to say Purpose-Norms-Goals-Meaning constellations that are accessible to the learner). This allows researchers and educators to peer inside the black box of "shifts in meaning perspective." In this case, pre-dilemma meanings had to do with maintaining norms related to the purpose of competence that interpret the environment as threatening, overwhelming, and beyond the competence of the individual| group. Since the hypothetical post-transformation norms are observed as "interpret challenging environment| purposes as welcoming and tantalizing," the TL activity itself, the during-imbalance meanings can be interrogated for change processes with clarity. For example, imagine that in the moment of struggle, the individual| group [potentially] undergoing transformation is probed for their current meaning of the environment| purpose; this is surely more reliable and less expensive than extensive retrospective interviews.

Purpose, and its transformation – in this case, first to increase competence by going on an OAE trip, and then, to feel competent in the face of challenge – is what helps anchor TL theory, research, and practice according to ICBCI. What norms were meaningfully related to the imbalanced purpose, and what norms are now meaningfully related to the balanced purpose? What goals? What meanings? Was there Norming, Goal Setting, and Meaning-making *activity* preliminary to Purpose-identifying *activity*, or only norming, goal setting, and meaning-making behavior? These are empirically testable hypotheses. As the articulated purpose changes, and as activity supplants behavior, hypotheses can also be articulated as to the direction of that purposeful change, and the effect of its direction and magnitude on consequent Norming, Goal-setting, Meaning-making, and Purpose-identifying activity processes. These empirical hypotheses can then help potentiate activity that reorganize TL (and ICBCI) theory itself to understand the lifespan of TL, activity under definite conditions that create capacity for TL, and the resulting impact on the lives-as-lived individual| groups who experience TL. Nothing is more important in a world with so much integral change to make so quickly.

Conclusion

Vygotsky and his descendants' discovery that all [revolutionary] learning-and-development is a dialectical unity (meaning-making-as-learning-and-development) necessarily embedded in history (human activity under definite conditions) helps us clarify, through a synthetic meta-theory of learning, ICBCI, and the organization of classical features of TL, and further clarifies *exactly* what they are: disorienting dilemmas

are threads of Norming, Goal-setting, and Meaning-making activity (or behavior) incapable of fulfilling articulated (or implicit) Purpose (i.e., are imbalanced), instigating Purpose-identification activity, or tool-and-result meaning-making-transforming-purpose. Dialogue, imaginative engagement, and critical reflection are more integrated Norming, Goal-setting, and Meaning-making activity propagating from Purpose-identification activity, and *not* behavior; and transformed frames of reference are more capable and complex, which is to say deeper, broader, and more integrated meaning perspectives, or Purpose under definite conditions. A final example from development: consider a baby's environment| purpose to understand utterances shifting to the application of utterances in communication. It is an open question whether this is identical to TL in the adult context (i.e., that transforming purpose is instigated by meaning-making activity) or whether it is simply behavior. ICBCI-based experiments can help sort this out by pursuing methods to probe the concept of "meaning-making" itself, and how the activity of it develops.

Future Directions

With ICBCI and its tool-and-result methods covering the entire TL trajectory, TL researchers and practitioners can now readily articulate sets of concrete empirical hypotheses. Some examples are summarized in **Table 2**, many are in the preceding text. It is the hope that this clarification of TL theory and concepts will enable researchers to interrogate deeper relationships between activity and behavior, between perceptual, adaptive, generative, and transformative learning, and most importantly, between activity and exactly what develops as humans digest experience. Additionally, some classic lines in the sand for TL researchers such as whether TL is a qualitative or quantitative phenomenon, an individual or group process, or has social or individual sources of disorientation can be wiped away by recognizing activity, rather than an individual, as the appropriate unit of analysis, and can specify the conditions of that activity (i.e., Purpose, Norms, Goals, and Meanings) in terms of both its qualitative and quantitative characteristics, its differences when observed in individuals, groups, entire cultures, or some individuals in groups or cultures but not others, and how these levels interact. For example, an open empirical question is whether transformational learning on behalf of a leader primes transformational learning across the culture that they lead (Friedman, 2021). This shift in the unit of analysis is itself revolutionary activity in the service of psychology-in-history's Purpose-identification: to describe and predict human activity under definite conditions, rather than to describe and objectify a human, as humans are not objects, in their transformation or otherwise, and don't behave well or act naturally when studied or interacted with as such. Recognizing activity as the appropriate unit of analysis opens the door to agency on behalf of those studied in the context of transformation, for which agency is crucial according to Vygotskian theory. The purpose above has been to show how recognizing agency as such can move TL beyond the stumbling blocks currently on its treadmill. In Vygotsky's words, "the method is simultaneously prerequisite and product, the tool and the result of the study" (1978, p. 65), and it's time transformative learning research methods engage in transformative activity themselves, rather than simply attempting its description. Cultural-historical activity theory, and ICBCI as a revolutionary progression of it, provide one such option for doing so.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Transformation toward sustainability in Finnish teacher education policy: Promises and shortcomings

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While the state of the world is becoming ever more unsustainable, transformation and transformative learning have become increasingly relevant and raised attention in various sustainability education discourses. This is obvious in both policy and research. As teacher educators, we have studied how this sustainability and transformative education trend is visible in education policy. We have first read international policy and research on sustainability education and transformation. In a more thorough study, our focus has been on two recent and fundamental policy documents outlining the Finnish teacher education. Our results show that even if several UNESCO policies documents for years have called for a transformation toward sustainability through education, the Finnish teacher education policy has not yet fully acknowledged sustainability issues and teachers' transformative agency in addressing them, but emphasize other aims. Therefore, it is mainly up to the individual teacher educators and the leaders of their faculties to decide on how to prepare student teachers not only to deal with changes in general, but to particularly bring about changes towards sustainability.

KEYWORDS

transformation toward sustainability, transformative learning, sustainability education, sustainable future, 21st century skills, teacher education policy, teacher education, Finnish education

Introduction

Transformation can be understood as a change at the personal, social, and planetary levels. When it comes to education, transformation can simply refer to education as a tool for change, but it can also imply transforming education itself to make it a better change initiator. The latter is a broad undertaking, which concerns all levels of education and starts from policy. Undeniably, the environmental crisis with an obviously changing climate and a widespread pandemic calls for a transformation in the ways many people live, think and act. To reply to this call, the transformation must take place in both personal lives and as collective activities acknowledging unsustainability and striving

toward a just and equal society, as well as creating viable ecological conditions. The focus must be on every part of society now and in the future. Specific local interests must not hurt interests of other regions. In addition, education as a social phenomenon requires a transformation that considers contemporary sustainability discourses. For years, UNESCO has promoted education, and especially 'Education for Sustainable Development' (ESD), as a transformation power to improve the world order and shape a better world (UNESCO, 2021).

It is easy to become overwhelmed by these words, but they are political rhetoric, and need to be read critically. In the overall sustainability and transformative discourse, multiple narratives appear in which the views on what sustainable is, and what transformation is and what it aims at, differ. One narrative is advocated by the *Club of Rome* (Meadows et al., 1972) and supports a radical transition to a more resource-efficient economy, or what the authors call a change 'from growth to equilibrium'. However, they are both hopeful and skeptic:

> ". . . any deliberate attempt to reach a rational and enduring state of equilibrium by planned measures, rather than by chance or catastrophe, must ultimately be founded on a basic change of values and goals at individual, national, and world levels. This change is perhaps already in the air, however, faintly. But our tradition, education, current activities, and interests will make the transformation embattled and slow" (Meadows et al., 1972, p. 195).

This quotation shows that education is not an easy path to sustainability. In addition, the growth of the sustainability discourse has stirred criticism. While the sustainability concept has become universal, its critics have increased in numbers. The arguments used are that the notion is 'too boring' to attract attention, 'too vague' to offer guidance, and 'too late' to meet the large contemporary problems (Dernbach and Cheever, 2015). Nonetheless, Dernbach and Cheever (p. 286) mean that it is too late to discuss the relevance of the sustainability concept, since "understanding of sustainability is not one of many trains that are parked in the station waiting for passengers; the train left the station more than two decades ago." Instead, the relevant question is *how*. Some environmentalists and researchers claim that transitions to more equality and nature acknowledging politics are not enough if the operating model for society remains hierarchical (e.g., Finley, 2019). However, there are positive experiences of involving grassroots innovations (Belda-Miquel et al., 2020), and youth climate movements are gaining strength. Young people from the entire world have started to blame adults for their indolence and the political processes for being too slow (e.g., Zummo et al., 2020). They have collectively started to take a stand and are acting to change the world order (e.g., Bhashyam, 2021), and many are inspired by the young Swedish climate activist and, thus, struck by the so-called 'Greta Thunberg effect' (Sabherwal et al., 2021) and her 'global transformational leadership' (Nässén and Rambaree, 2021) and 'extraordinary agency' (Stoecklin, 2021).

Undeniably, it is time for change, even if *how* must be discussed. In this change process, education has an important role. Bell (2016) stresses the necessity to prepare for the future by viewing 21st century education through a sustainability lens. He emphasizes that conventional teaching needs to become transformative to encourage a more sustainable life on the planet. This is also in line with Cohen et al. (2002) who point out the need for a changed education system to secure a sustainable future, and that this demands a changed teacher education, which in many countries is part of higher education (see also Shephard et al., 2015). However, "is higher education capable of promoting learning for change?", and "can transformative learning nurture spaces for innovation in education for sustainable development?" Balsiger et al. (2017, p. 357) ask (see also Moore, 2005). Nevertheless, Weinberg et al. (2020) argue that education is a critical element in a global transformation toward sustainability and is urgently needed to stabilize socio-ecological systems worldwide. Yet, education is also identified as a problem causing more harm than good when it comes to sustainability (Hopkins and McKeown, 2005; UNESCO, 2005; Balsiger et al., 2017). To change education into a solution "requires a deeper critique and a broader vision for the future" (UNESCO, 2005, p. 59).

At a personal level, transformation through education includes developing new understanding and habits, and adapting a critical attitude. Such a change happens in transformative learning, and concerns altering the frames of reference through critical reflections of both habits of minds and points of views (Mezirow, 1990, 1991; Ananiadoui and Claro, 2009). Therefore, addressing the quest for educational change is all but easy if it does not concern worldviews (Shephard et al., 2015), and involve teacher education (Wolff et al., 2017). As Zilliacus and Wolff (2021) argue, there is a pressing need at all educational levels to support a profound worldview change as a response to the environmental and climate emergency. This position not only calls for a transformative change at individual and societal levels in schools and other educational institutions, it also calls for teacher education to revisit the notion of transformative learning (see also Varpanen et al., 2022). Yet, even if sustainability education, education for sustainable development (ESD), global citizenship education (GCED), and issues like human rights, peace and inter-cultural understanding are visible in teacher education, they are often only included in optional courses (Bourn et al., 2017; Cockerell, 2020). Civil society organizations and policymakers outside education are those who have had a major influence on the practices of ESD and GCED within teacher education, not only educational policy makers (Bourn et al., 2017). In addition, the practical implementation has been in focus in teacher education, while deep theoretical perspectives

and values are neglected, according to Evans et al. (2017). Therefore, the need for reflexivity and critique is pressing (Evans et al., 2017), given that the aim is to enable in-depth understanding.

A recent UNESCO study including data from ten countries shows that ESD is mostly implemented as scientific knowledge, which is not enough to promote transformation (UNESCO, 2020). For that reason, the UNESCO report states that education must start to transform itself. Sustainability in teacher education is an emerging area and it is still theoretically weak (Evans et al., 2017). Teacher education must start transforming itself and develop methods based on both theoretical and empirical research.

Undeniably, it is urgent to not only examine the theory and practice of sustainability and transformative learning *per se*, but also to study and discuss how these targets are included in teacher education leadership and policy. Both international and national educational policies address sustainability and transformation, but there are also many other aims that are striving in other directions. Internationally, the *2030 Agenda for Sustainable Development* with its 17 goals (SDGs) and 169 sub goals is the most important sustainability education policy document. The role of sustainability is increasing in many countries, and besides other policies, the curricula at various levels are important control documents. Yet, even if some voices express that Agenda 2030 is not radical enough (see Wolff, 2020), its message is still far from being a central interest in all educational policy, and it may even be absent in teacher education policy. The policy is a strong rhetorical performance in which many issues, especially ideas related to a specific worldview, are beyond debate and discussion (Levin, 1998; Edwards et al., 2013; Zilliacus and Wolff, 2021). According to Levin (1998), educational policy development is not a story of mutual learning, but more like epidemics (outbreaks of disease) that spread from country to country.

> "Politicians, policy advisors and members of 'think tanks' migrate around the globe spreading certain messages" (Edwards et al., 2013, p. 169).

In that situation, sustainability education easily draws the shortest straw. Teachers play an important role in any educational reform in general (e.g., de Vocht and Laherto, 2017), and particularly in the sustainability transformation process. Therefore, the authors of this article, as lecturers and researchers with a diverse subject background have undertaken this study. Our interest is how the policy of a specific system of teacher education, namely the Finnish education of teachers (early childhood educators, primary, subject, and vocational teachers) has integrated sustainability and transformation toward sustainability in its strategies. By this choice, we want to present an example of the situation from the view of a country with a high performance and renowned academic teacher education. A few earlier studies have focused on Finnish teacher education study programs (Hofman, 2012; Cockerell, 2020), the student teachers' change agency (Koskela and Kärkkäinen, 2021), student teacher preconceptions (Furu et al., 2018), obstacles for implementing sustainability in teacher education (Wolff et al., 2017), and curricula and educational policy in general (Jónsson et al., 2021). This study uses new lenses, and wants to shed light on the situation focusing on teacher education policy. More precisely, the aim of our study is to examine how the quest for sustainability and transformation in international educational policy by UNESCO is manifested in Finnish teacher education policy.

Policy request on transformation through education

Since the beginning of the 1970s, international sustainability policy has emphasized the role of education. Respectively, education policy has tried to include sustainability. Conferences have taken place and a myriad of policy documents on various levels have been published with sustainability and education as targets. In addition, many international guidelines on sustainability education refer to transformation and transformative learning. A few of them focus on teacher education. Yet, there are also other strong economic and political ambitions concerning education.

International general guidelines

In 1987, the report, *Our Common Future,* the *World Commission on Environment and Development* (WCED, also called the Brundtland Report) pointed out sustainable development as a political aim for all segments of society, not the least for education (World Commission on Environment and Development [WCED], 1987). The aim of this report is global, envisioning a better future for all humans and calling for new values and norms at all levels of society. However, the report does not diminish the technological and economic progress. In *Caring for the Earth* published by IUCN (International Union for Conservation of Nature), UNEP (United Nations Environment Programme), and the WWF (World Wildlife Fund) 1991, the concept sustainable development is "improving the quality of human life while living within the carrying capacity of supporting ecosystems" (International Union for Conservation of Nature [IUCN]/United Nations Environment Programme [UNEP]/World Wildlife Fund [WWF], 1991, p. 4). In collaboration with many other organizations, like the IUCN, and the WWF, UNESCO (United Nations Educational, Scientific and Cultural Organization) have been active in developing education in relation to the sustainability challenges (Wolff, 2011). Today UNESCO publishes most of

the international policy documents that relate transformation to sustainability and sustainability education. Other education policy documents may relate transformation to other aims. Among several UNESCO publications stressing transformative learning, one is *Education for Sustainable Development: A Roadmap* (UNESCO, 2020). Other important documents are *A Decade of Progress on Education for Sustainable Development*: *Reflections from the UNESCO Chairs Programme* (UNESCO, 2017), *UNESCO Global Action Programme on Education for Sustainable Development* (UNESCO, 2017), and *UNESCO Teaching and Learning Transformative Engagement* (UNESCO, 2019).

Between 2005 and 2014, the *UN Decade of Education for Sustainable Development* especially emphasized the role of education in the sustainability process (UNESCO, 2017). The aim was that the member states should implement sustainability education through the so-called *Global Action Programme on ESD* (GAP). Educational ministers and educational institutions were invited to create knowledge jointly and to broaden education for sustainable development.

A few years after the decade, the UNESCO roadmap (UNESCO, 2020) stresses education for sustainable development (ESD) as an integral element of the *Sustainable Development Goals* (SDGs, see United Nations [UN], 2015a,b), and simultaneously a 'key enabler' of all the other goals. This document sees education at all its levels as central to the implementation of the SDGs and addresses as the major actors in the sustainability process, education policy makers at institutional, local, national, regional, and global levels. Once again, the especially important target is the national ministries of education. Among the main targets, the document also underscores university leaders, and requests interdisciplinary, transdisciplinary, and whole-institution approaches. In addition, the roadmap announces that every 4 years, the United Nations (UN) member states must report how they have implemented SDG 4.7.1 (global citizen education and ESD national education policies, curricula, teacher education and student assessment) (UNESCO, 2020). This means that the country of our study, Finland, is obligated to show steady progress in the teacher education sustainability policy.

Education policy documents other than those published by UNESCO stress change to aims other than sustainability, such as documents that first and foremost emphasize economic development. For a long time, education has had a major role in improving national economic welfare (Levin, 1998), and various concepts have been used to emphasize this aim. Noticeably, many international policy documents stress competence for the twenty-first century (e.g., Organisation for Economic Co-operation and Development [OECD], 2005; Ananiadoui and Claro, 2009; European Commission [EC], 2021).

In the United States of the 1980s, the '21st century skills' concept was coined to address the various abilities required by the business community, such as interpersonal and problem-solving skills rather than traditional subject knowledge (Griffin and Care, 2014). Accordingly, the so-called '21st century skills' were initiated by market-oriented thinking, and the societal and economic changes caused by globalization. Economic organizations, like OECD (Organisation for European Economic Co-operation), are the main drivers behind this development (Ananiadoui and Claro, 2009).

The slightly indistinct set of 21st century skills has been embraced as being crucial in educational systems in many countries (Ananiadoui and Claro, 2009; Bellanca and Brandt, 2010). The sets have had an impact on educational policy, practice and research, not least in relation to higher education (Tight, 2021). During the last few decades, the 21st century skills thinking has accelerated due to the rapid development of information and communication technology (World Economic Forum [WEF], 2015). Therefore, these skills will facilitate the future workforce in keeping up with an increasingly digital and globalized competitive arena (e.g., Howard, 2018). At national and regional levels, the European Union and North America have emphasized and promoted the 21st century skills for teacher education and higher education (Coalition of Urban Serving Universities [AUSU], and Association of Public and Land-grant Universities [APLU], 2019; European Commission [EC], 2021). For instance, the *Joint Research Centre* (JRC) of the *European Commission's Science and Knowledge Service* focuses on '21st century skills,' 'innovating and modernizing education and training,' and 'open education' to address the *Learning and Skills for the Digital Era* (European Commission [EC], 2021). The JRC's Learning and Skills projects also cover multiple levels in the EU region, such as individual learners and educational professionals (micro), educational organizations (meso), and societies (macro) (European Commission [EC], 2021).

However, new thoughts have steadily emerged in the 21st century discourse, and the conceptualization changes. Thus, many similar concepts exist, and they are often used as synonyms, for example 'future skills,' 'generic skills,' 'key competencies,' 'core skills,' 'transversal skills,' 'transferable skills,' 'soft skills,' and several others (see, e.g., Martin, 2018; Viinikka et al., 2019; Tight, 2021). The concept that extensively is used in Finnish higher education in 2022 is 'generic skills' (see, e.g., Jääskelä et al., 2018; Ursin et al., 2021). The 21st century skills are listed in many ways, and this is only one of them: (1) *Ways of thinking*: creativity and innovation, critical thinking, problem solving, and decision making, learning to learn, and metacognition; (2) *Ways of working*: communication, collaboration (teamwork). (3) *Tools for working*: information literacy, ICT literacy. (4) *Living in the world*: citizenship (local and global), life and career, personal and social responsibility (incl. cultural awareness and competence skills) (Binkley et al., 2012). There have also been attempts to list and name the skills so that they all start with the letter 'C' (the 7 Cs) (see Tight, 2021), which shows the influential position of

the English language and English-speaking countries in this discourse.

In relation to sustainability, the '21st century skills' synonym 'key competencies' (also referred to as 'key competences,' even if the English word competence does not have any plural form) is common both in European research and policy, also in higher education contexts (see Wals, 2014; Novo and Murga-Menoyo, 2015; González-Salamanca et al., 2020; Jaakkola et al., 2022). In addition, the words competence and competency are often mixed, even if they do not mean the same thing (Salman et al., 2020; Arifin, 2021; Jaakkola et al., 2022). The quest for 21st century skills are mixed with the sustainability attempt, and transformative learning (see e.g., European Commission [EC], and Joint Research Centre [JRC], 2022), of which the two first are political concepts and the third theoretical.

The *European Commission* has worked with the EU member states to support and reinforce what the Commission calls 'key competences [*sic*] and basic skills for all' as a part of its Lifelong Learning policy (European Commission [EC], 2018). These "key competences include knowledge, skills, and attitudes needed by all for personal fulfillment and development, employability, social inclusion, and active citizenship." A noteworthy approach is the European Commission's 'science for policy report' *GreenComp: The European Sustainability Competence Framework* (European Commission [EC], and Joint Research Centre [JRC], 2022). In this report the authors aim at developing a 'European sustainability competence framework' as policy actions set to promote sustainability learning in the European Union. GreenComp distinguishes sustainability competences [*sic*] that will "help learners develop knowledge, skills and attitudes that promote ways to think, plan and act" (Abstract, n.p.). However, transformative learning is also shallowly included as an approach in this framework. This shows how concepts and theories are freely mixed, when behavioristic aims are intertwined with critical transformative objectives, and the faith in skills and competence. According to Arifin (2021), competency is a set of knowledge, skills, abilities, attitudes, and behaviors, whereas competence is the ability to meet specific performance criteria. Yet, there are many other interpretations.

As Kuusisaari et al. (2021) note, the inclusion of 21st century competencies and skills in national curricula might be considered, on the one hand, as a political way to manage and control human capital through education. On the other hand, these competencies might generate necessary future skills. It is much up to how the competencies are interpreted, implemented and what the policy of the context is. Is it overall aiming at sustainability? (see also Burns, 2018). It is also a distinction between if transformation toward sustainability is addressed as a norm or as an open-ended continuous discourse (see Wolff et al., 2020).

In the book *Deeper Learning: Beyond the 21st Century Skills,* the editors Bellanca and Boss (2015) want to take a further step and stress the *depth* of education. Even if the many authors of the book do not agree about what deep learning is, Chow states in the preface that all authors believe that students must be prepared to meet a radically different world with environmental and social problems. Still Chow (2015, p. 11) sees as the principal challenge of contemporary education and the aim of the entire book "how to achieve excellence and how to do it equitably, rapidly and at scale." In the OECD document *Teaching as a Knowledge Profession: Studying Pedagogical Knowledge Across Education Systems* (Ulferts, 2021), "teaching is the mother of all professions," and the document emphasizes that teachers need deep knowledge to meet transformative challenges, such as COVID-19. Yet, sustainability is not an issue in the document.

There are also many critical voices to the 21st century skill discussion. Howard (2018) is critical to the 21st century skills, as well as to the later '21st century learning,' and overall, to the ideas of deep learning and new pedagogies for the 21st century. As an alternative, he emphasizes deep transformation, and education aims associated with living systems and life values. He means that an emphasis on 21st century skills is "sustaining a view of education that is contrary to the flourishing of life" Smith (2020, p. 159). Dishon and Gilead (2021) request a greater focus on normative questions:

> "[w]ithout grounding education in precise and substantive values, an education that aims solely at developing skills fails to fulfill the aims it was intended to achieve – adaptability to a complex and constantly changing world" (p. 409).

Dishon and Gilead (2021) call for a stronger emphasis on what has taken place in the past when discussing the future. They also want to view the future as something that education can have an influence on. According to Howard (2018), the current situation raises the *why* question of education. He finds this question much more crucial than to aim at an instrumental transformation, which may refer to addressing a series of educational goals such as 21st century skills, economic returns of higher education, national or regional competitiveness, and anthropocentric preoccupation on solving the core sustainability issues. People with merely cultural and social skills might not be prepared to build a sustainable future, not even if they are able to interact and think critically. Such skills are essential, as are learning to learn, and expression skills. Yet, Sterling (2011) claims that although 'learning to learn' is an important educational practice, it does not necessarily address context criticism or reflexive learning. Consequently, how the 21st century skills are implemented, definitively depends on the values of the educational institutions (Wolff et al., 2020). The basic values, and the basic aim of education need to be reflected on and deliberated. Questions like what the meaning of education is, what future society the current generations are aiming for, what education future teachers will need, and what the transformation is for, become most relevant.

Teacher education as policy target

A technical UNESCO paper focusing on especially teacher education is *Guidelines and Recommendations for Reorienting Teacher Education to Address Sustainability* (Hopkins and McKeown, 2005). This document is a result of the collaboration between 30 teacher education institutions between 2000 and 2005. The network made efforts to highlight sustainability within teacher education curricula, programs, policy, and practices to make teacher education adequate to what is needed for the environmental, social and economic aims of the institutions' communities, regions and nations. Many members of this network constantly stressed the need to act and to deeply change teacher education and one member even called for a total transformation of teacher education. (Finland did not participate in this work).

Another document called *A Decade of Progress on Education for Sustainable Development* (UNESCO, 2017) highlights as its main targets: educational and sustainability policy that integrates national and international guidelines, a holistic transformation of learning environments, capacity building among educators and trainers, mobilization of youth, and local networking. Transformation is visible, but the document *Teaching and Learning Transformative Engagement* (UNESCO, 2019) has a stronger transformative profile. Instead of elaborating with the theoretical transformative learning concept, the document uses 'transformative engagement' and thus succeeds in dodging a deeper theoretical discourse. In places, the rhetoric is clearly normative, such as when stressing what knowledge, skills and competencies education institutions should promote, and through what platforms, as well as what an effective education is in that regard. The publication identifies a possible transformation at two levels for how to promote youth engagement and various approaches to social, economic and political interaction. A teaching and learning approach can center on a personal transformation, such as identification of gaps between beliefs and reality, internalization, and empathy-based actions. For social and political interaction, the teaching and learning approach can promote duty-based, justice-driven, and liberatory youth engagement that takes place across digital platforms and civil society platforms in formal or informal settings. Finally, according to the agenda put forward by the *5th UNESCO Forum on Transformative Education for Sustainable Development, Global Citizenship, Health and Well-being* UNESCO (2021), "transformative education involves the teaching and learning geared to motivate and empower learners to take informed decisions and actions at the individual, community and global levels" (p. 2).

Finnish teacher education as an example

Finland is a country with a reputation for offering 'miracle' education (e.g., Niemi et al., 2012). However, as Schatz et al. (2017) note, although the Finnish education 'brand' has gained international attention by performing well in the PISA assessments (the OECD's Programme for International Student Assessment) 2000–2009, recently ranking has been less outstanding for Finnish learners (e.g., Schleicher, 2019, p. 11). Furthermore, although Finnish society stress both research and policy concerning sustainable development, the average annual carbon footprint per capita is high due to the amount of energy and food (esp. dairy) consumption, and a high mobility (Akenji et al., 2021). However, as a member of the United Nations, and signatory to many agreements on sustainability, the Finnish educational system including teacher education needs to participate in the transformation towards sustainability through education (UNESCO, 2020). Finland has been active in this field in many arenas.

While UNESCO provides an international education agenda that largely targets global issues (e.g., climate change and sustainable development goals), member countries often support and work together to address these issues through national education policies. Finland has both produced several of its own environmental and sustainability education strategies and has participated in collaboration on policy development with other countries. Therefore, Finland has collaborated within the Baltic region (with the eight other countries surrounding the Baltic Sea: Denmark, Estonia, Germany, Latvia, Lithuania, Poland, Russia, and Sweden. In addition, there has been collaboration at the Nordic level (with the four other Nordic countries: Denmark, Iceland, Norway, and Sweden), and Finland has been active as a member of UNESCO (see, e.g., Jónsson et al., 2021). In general, these policies underscore teacher education as an important target. Environmental education was stressed as a task for all the society in a national UNESCO strategy on environmental education in 1992 and as an obligatory issue in Finnish teacher education (Suomen UNESCO-toimikunta, 1992). Yet, this has not been realized 30 years later, but there are still many obstacles that hinder a thorough implementation of transformation towards sustainability in Finnish teacher education (Wolff et al., 2017; Cockerell, 2020; Jónsson et al., 2021; Koskela and Kärkkäinen, 2021).

All Finnish teacher education takes place in higher education institutions. Early childhood educators have a bachelor's degree (180 ECTS), while primary, lower secondary and upper secondary school teachers have a master's degree (300 ECTS). Vocational teacher education is based either on a bachelor's or a master's degree. Only the universities

offer master's degree teacher education, and the teaching must be research based. One central obstacle is the academic freedom, for better or worse, at the universities in Finland. Wolff et al. (2017) found the following reasons for neglecting sustainability in Finnish teacher education. First, sustainability conflicts with overall trends in society and politics since Finland is a rich country with mass consumption as a lifestyle. Second, as it is university based, Finnish teacher education must conform to the *Bologna Declaration* and thus the aim is to make student teachers more competitive in the world educational market (see European Higher Education Area [EHEA], 1999; Diogo, 2016). Third, sustainability is complex and interdisciplinary, but based on a long tradition, university education is divided into disciplines and has split curricula that complicate the implementation of sustainability topics. Fourth, sustainability is difficult to understand because it strongly relates to ecological literacy. To understand the environmental problems in all their complexity and thus relate to both social and ecological factors a basic ecological understanding is needed. Fifth, sustainability is a value dependent topic entwining nature and social dilemmas, which actualize even extremely difficult normative questions. According to Wolff et al. (2017), the Finnish universities must acknowledge and overcome these hindrances to become forerunners in the sustainability education process.

However, student teachers no longer stand aside and wait for sustainability education. Among the aims of the *Teacher Student Union of Finland* (SOOL, n.d.) in 2019 was to have sustainable development integrated into Finnish teacher education, and, thus, the teachers' roles as sustainable lifestyle models is underscored (Jónsson et al., 2021). In 2019, SOOL challenged the Finnish teacher education universities and polytechnics (vocational teacher education) to include climate change and sustainability education in their study programs (SOOL, 2019).

In the context of this article, Finland is a member of the *UNESCO Executive Board* (2017–2021), which is one of the UNESCO decision-making bodies. The current priorities of UNESCO focus on the implementation of the *2030 Agenda for Sustainable Development* (United Nations [UN], 2015b; UNESCO, 2020), which focuses on (i) the education 2030 process, (ii) science for sustainable development, (iii) cultural diversity and inter-cultural dialog, (iv) access to information and freedom of expression. Since Finnish teacher education takes place in higher education institutions, Finland's higher education policy simultaneously aims at developing higher education institutions into internationally competitive entities, in which each institution also responds flexibly to regional needs (Diogo, 2016; Ministry of Education and Culture, 2021, n.p.). Moreover, the *Ministry of Education and Culture* specifies five target areas and strategic objectives, of which three are related to the UNESCO current priorities in the following areas:

> "The activities of universities and universities of applied sciences promote Finnish competitiveness, well-being, education and learning as well as sustainable development."

> "The higher education institutions exercise foresight and help regenerate society, culture and working life and make sure the required highly educate workforce is available."

> "The objective is to establish a higher education system that is of a higher standard and more international as well as more influential and effective than at present." (Ministry of Education and Culture, 2021, n.p.)

In addition, the other two higher education policy objectives are oriented toward the international level. For instance, the aim of the higher education policy is to establish a more international, influential and effective higher education system than at present, and international and attractive learning and research environments (Ministry of Education and Culture, 2021). Overall, these objectives on higher education policy are intertwined with teacher education. Finland's aim is to safeguard the openness of research and science, make full use of the opportunities offered by digitalization, and "improve the quality of education by revamping education content, teaching methods, learning environments and the competence of teachers, as well as to increase cooperation" (Ministry of Education and Culture, 2021, n.p.). Although 'quality of education' is not elaborated and specified, the above target areas and strategic objectives may suggest instrumental transformation as a response to social change and global problems.

The Finnish *National Core Curriculum for Basic Education 2014* (Finnish National Board of Education, 2016) conveys the metaphor of social reconstruction, with the curriculum being a means to a better world (Mäkinen and Kuijala, 2017). According to Zilliacus and Wolff (2021), this principle constitutes an ethical commitment to transformative ideals that aim for normativity. Instead, the teacher needs to shape reflective spaces to encourage the learners to consider a wide range of viewpoints, rather than to choose ready-made options. This raises a critical educational issue about whether a certain worldview, sustainable or not, sets the ground for sustainable education (Zilliacus and Wolff, 2021). In addition, it leads to the question about what the vaguely yet widely used transformative learning concept may encompass, as policy in general lacks theoretical bases and concept descriptions. In contrast to the skills and competence concepts we have presented above, the *Transformative Learning Theory* is based on a foundation of great number of philosophical, psychological and educational theories. Built on the first transformative theory basis several researchers have spent years developing a learning approach suitable for adult learners (Wolff, 2022). Below we will give an account on transformative learning by drawing on the

development of the transformative learning theory, critiques and current interpretations.

Multiple perspectives on transformative learning

While transformative learning has become ubiquitous in sustainability education literature and policy documents, at the same time it has become problematic due to multiple interpretations of the term in both research papers and policy documents. Therefore, consensus is lacking concerning what constitutes transformation and how transformative learning relates to sustainability education and teacher education. In addition, the interpretation of the transformative learning concept is often vague. Since transformative learning especially is interpreted and used shallowly in relation to sustainability education (Rodriguez Aboytes and Barth, 2020), we will now discuss what transformative learning implies. However, in a short article like this, the description cannot be very deep.

The transformative learning theory

Transformative learning was initially created as a response to the needs of teaching and learning as a meaning making process that could make a change, and the theory was created explicitly for adult learning situations. Several practitioners and theorists have discussed transformative learning drawing from the field of education and the social sciences. Transformative learning is a blend of basic educational theories, and therefore the emergent perspectives are multiple. For a start, Mezirow's seminal work on transformative learning draws from Habermas' *Theory of Communicative Action*, from Freire's idea about critical consciousness as well as from many other thinkers (e.g., Mezirow, 1991).

Jack Mezirow started to develop transformative learning arguing against what he regarded as being a learning approach that was too instrumental. According to Mezirow (1991), transformative learning defines the process by which the individual learns to critically and reflectively reason about meaning and values instead of passively adapting to values set by others. Thus, transformative learning is about meaning making, and in addition, about coherently interpreting experiences. In this way, the adult learner considers former assumptions and repressions and starts to reflect critically on presumptions used for arriving at 'truth,' and even change perspective and solve problems in alternative ways (perspective transformation, in Mezirow's, 1978, terms). In education, value-laden topics and intense experimental activities can trigger critical reflection and promote change as a consequence (Taylor, 2009). An aim of transformative learning is that presuppositions like social norms, language codes and ideologies become detectable and open for change (Mezirow, 1991).

In a social learning situation both the learners' prior experiences and actual joint activities encourage critical reflection, empathy and dialog. The reflections occur at three levels, as a reflection on content, on process, and on premises (Mezirow, 1990, 1991; Taylor, 2009). The last of these three (reflection on premises), is the foundation, as it might include questioning fundamental worldviews. Reaching such a reflection level might be strongly emotional and penetrate deeply hidden traumatic experiences. In addition, it is time consuming. However, transformative learning takes time; it is allowed to do so (Taylor, 2009).

Although Mezirow's work offers solid ground and integrates transformative learning into the field of adult learning, it has met criticism for being a proponent of mainly western values and understandings of transformation (Cranton and Taylor, 2012; O'Sullivan, 2012; Gilpin-Jackson, 2014). For instance, unlike Freire's pedagogy that aims to address the needs of the oppressed, Mezirow's work has been scrutinized for its individualistic character that sets it apart from collective action. In addition, Mezirow's approach is a linear, rationalized version of transformative learning that has been criticized for disregarding issues of, for instance, inequalities about gender, class and race (e.g., Irving and English, 2011). This creates a gap in adult learning and raises the question about who the adults are that the transformative learning should aim at and for what purposes.

Although Mezirow and Taylor focus on the intra-personal and inter-personal levels of transformative learning, Lange's (2019) conceptualization takes a different direction, toward a more systemic approach to transformative learning. Lange identifies three change levels of transformation in sustainability education. The first level is a change in the individuals' thoughts through critical reflection that often takes place in dialog with other learners. This 'micro level change' is in accordance with Mezirow's' view of transformative learning (e.g., Mezirow, 1990) and Immanuel Kant's appeal for people to think for themselves (see Kant, 1784). Lange calls the second level 'meso level change' and describes it as a change beyond the individual including an understanding of the human role in the world in a larger perspective. This level is challenging since it may awaken emotional pain. However, it is triggered by alternative methods, like art-based activities. It is also the level that is the most important from a sustainability view. This level "requires incorporating a cosmic horizon, drawing from older wisdoms, celebrating life systems of the Earth, interspecies awareness, and helping learners see their presence within a much larger historical process of geological evolution, human cultural development, and scientific-technological development" (Lange, 2019, p. 6).

The third level on Lange's list follows Paulo Freire's notion of critical consciousness (see Freire, 2021). At this

level the transformation involves structural changes on economic, technological, political, and even ideological grounds. Transformative learning is then a process in which the learners develop awareness of far-reaching power structures and develop agency to transform society, even if the context is a familiar environment (Lange, 2019). According to Lange, the current unsustainable situation demands deep ontological and epistemological changes. Other scholars have also developed transformative learning approaches that focus on social change and ideological critique (Mezirow, 2009; Taylor, 2009).

To summarize, the levels Lange (2019) presents progress from a critical personal perspective to a joint planetary responsibility. Nevertheless, the distinct levels interact and multi-faceted considerations on transformation can be promoted simultaneously. This may sound promising, but transformative learning is no quick fix. It is a demanding learning and teaching approach that it is all but easy to implement in various educational settings (Taylor, 2009), especially higher education (Lange, 2019). Even if the intentions are set high, the implementation may fail. Unfortunately, this circumstance is often forgotten or hidden in sustainability education discourses, not the least in policy and research. Nevertheless, there is a clear request for a wide range of deep transformative learning approaches.

Current interpretations of transformative learning

A planetary view of transformative learning takes in the totality of life's context beyond the individual and addresses fundamental issues in the field of education on a larger scale (O'Sullivan, 1999; Taylor, 2009). Casebeer and Mann (2017, p. 234) argue that a planetary view of transformative learning addresses human experience beyond the individual, and therefore, a planetary view offers a holistic conceptualization of transformative learning. Such a view "seeks to reorganize the entire system, not only in the context of education and society, but also in the wider context of politics, industry, and the environment." This view recognizes the interconnectedness between the Universe, the planet, the natural environment, human communities, and a personal world. It is most significant to recognize the individual not just as a social-political prospect but also from an ecological and planetary view. As O'Sullivan (2003, pp. 326–327) notes, transformative learning means that the fundamental task of education is to create a sustainable planet environment for interdependent life forms, rather than emphasizing a global competitive market.

Current new materialist thinking brings also these multiple strands together in discourses that adopt a multi-disciplinary approach. For instance, Burns' (2018) consideration on transformation as a relational process is in alignment with the need stressed by new materialist thinkers (e.g., Barad, 2007; Geerts and Carstens, 2019; Oinas, 2021) for education grounded upon a relational ontology. A relational ontological orientation seeks ethical responses to bodily entanglements and material assemblages and is based on the principle that these are co-constituted in relation to multiple others, human and more-than-human. Under this lens, Lehtonen (2021) also argues for a relational ontological orientation to sustainability education (relational sustainability). In this sense, transformative sustainability is also relational, aiming to interconnect different standpoints (e.g., cultural, social, and ecological) of sustainability (see Wolff, 2022). Therefore, the stake is not only to find out how to make such interconnection possible. In addition, it is about how the process of interconnecting sustainability can become a transformative experience. The ontological orientations and underlying assumptions in policy documents set the overall goals and aims for teacher education.

Considering these arguments along with the need for transformation that the environmental and other crises dictate, we now aim to investigate current conceptualizations and practices of transformative learning in a particular national sustainability education policy. Through this example from Finland, we hope to make visible the route from international sustainability policy to national, and how sustainability and transformation are dealt with in national educational policy.

Materials and methods

The aim of our study was to examine how the quest for sustainability and transformation in international educational policy by UNESCO is manifested in Finnish teacher education policy. As argued in the previous sections, teachers play a crucial role in any educational reform, and national level policies on teacher education are an important yet under-researched factor. Therefore, we address the needs through two research questions:

(1) How is sustainability represented in Finnish policy on teacher education?
(2) How does the Finnish policy on teacher education reflect the call for transformation toward sustainability?

To respond to the research questions, we chose to analyze two high-level policy documents that set guidelines and evaluate Finnish teacher education at the national level. While the Finnish educational system, including teacher education, is relatively decentralized, these two documents are the most influential nationwide policy documents on teacher education at the time of writing this article, and they provide a general outlook on the Finnish approach and aim for reforming teacher education at all educational levels.

The first document is called *Guidelines for the Development of Teacher Education: Ideas and Suggestions for the Teacher Education Forum*, and is published by the *Teacher Education Forum*, which was established by the Finnish *Ministry of Education and Culture* (MEC) in January 2016. The objective of the Forum is to respond to needs caused by the changing system and settings of education in Finland by reforming the structures, goals and procedures of teacher education. The document is referred to as "MEC" in our analysis. The document indicates that there is as an "urgent" need to develop teacher training and educate teachers to meet the forthcoming social challenges. The document states that these future challenges and a rapidly changing society require teachers with transversal and innovative skills for renewal (Ministry of Education and Culture, 2016, p. 6). Common in policy texts, the rhetoric being used in this document is at a general level and the objectives are not spelled out in detail. However, the document includes priorities that are regarded important, such as digitalization, internationalization, cultural diversity, special education, and school leadership (Ministry of Education and Culture, 2016, pp. 7–8).

The second document in our study is called *Becoming the Most Competent Teachers of the World: Evaluation of the Teacher Education Forum in 2016–2018* published by the *Finnish Education Evaluation Centre* (Niemi et al., 2018). This document evaluates the reform of teacher training in Finland (i.e., the objectives of the MEC document). The body under evaluation is the *Teacher Education Forum,* and in the report, external evaluators analyze the Forum's work. Thus, it comments on the guidelines and the work reported in MEC and makes recommendations for the ongoing reform of teacher education. In our study, we refer to this latter report as "FINEEC". Both documents, MEC and FINEEC, are written in Finnish, with some parts translated into English by the publishers (abstracts and recommendations). When citing the documents, we used our own English translations in passages where translations were not provided by the publishers.

We applied document analysis as the method (Bowen, 2009). According to Bowen (2009), this method involves data that can be examined and interpreted to elicit meaning, gain understanding, and develop empirical knowledge. These educational policy documents contain text (words) that have been written without a researcher's intervention (e.g., Bowen, 2009). We carried out the document analysis (Bowen, 2009) using a qualitative content analysis (see also, Vivitsou, 2019). The category formation of the thematic analysis (Saldana, 2009) was primarily an inductive bottom-up process, but still influenced by the theoretical considerations discussed in the previous sections (e.g., Patton, 1990).

First, we examined both documents to recognize passages that discuss or relate to the notions of sustainability. Second, we examined both documents to identify aspects related to transformative learning as discussed in previous sections, and to study how the notions of sustainability in the documents reflect and demand an inclusion of transformative learning approaches in teacher education. We grouped the passages into categories, each representing a theme emerging from the documents (cf. Patton, 1990; Saldana, 2009).

Two of the researchers carried out the qualitative content analysis independently. After that, they compared and discussed the findings and interpretations with each other. In the third stage, all authors negotiated the interpretations until a consensus was reached. Based on the results, we discuss the need for teacher education to address the request of individual and societal transformation necessitated by the *Sustainable Development Goals* (see Section "Introduction").

Results

In this section we present the results of our analysis of the two policy documents, MEC and FINEEC. First, in Section "Sustainability as a topic in the policy documents," we present how sustainability is addressed as a topic in the documents. In Section "Paths to transformative education in the policy documents," we present our findings on how the documents reflect the aspects of transformative learning.

Sustainability as a topic in the policy documents

When describing the broad, contemporary changes and challenges which affect schools, teachers, and teacher education, *Ministry of Education and Culture* (2016, p. 8) lists "flexibility of learning environments, digitalization, internationalization, cultural diversity, diverse learners, learning at work, multi-professional teams, and personalization of learning." However, the upheaval in the broader societal surrounding of schools, caused by sustainability challenges are not addressed. Internationally, such issues are central in recent views of the contemporary challenges of education discussed above. In the Section "Current status and challenges" (Ministry of Education and Culture, 2016, pp. 12–14), the Finnish guidelines repeat the same above-mentioned challenges. In addition, the Finnish guidelines also include the descending and diverging achievement levels of pupils and students, wellbeing of the young, transferring phases between primary, secondary and vocational/higher education, interplay with families and work life, and the scarcity of professional development and networking opportunities for teachers. The same issues and trends are addressed when setting the aims for "creative and communal teachership" (Ministry of Education and Culture, 2016, pp. 16–19), where human interaction, communality and research-based practice are highlighted as the key stones of the profession.

In the recommendations, the guidelines document mentions the word 'sustainable' (in Finnish 'kestävä') only three times:

when discussing the role of teachers in liberal adult education to provide "sustainable well-being of citizens" (Ministry of Education and Culture, 2016, p. 17). When it comes to environmental sustainability, the only mention is in the "ideas and examples" section: "Ethical issues, value competence and the ability to act in a responsible and sustainable way in global environments are to be strengthened in the content of teacher education" (Ministry of Education and Culture, 2016, p. 21). According to the evaluation report (Niemi et al., 2018, p. 56), the "ideas and examples" collected in MEC are ideas that were brought forward by working committee members in the events organized by the Forum. However, the document also states that to integrate the process (that tended to scatter in all directions), the working committee decided to leave these ideas outside the actual development program. Yet, in relation to change, the MEC document raises the question: "Is something sustainable if it connects all teachers across ages, levels of education and subject boundaries?" (Ministry of Education and Culture, 2016, p. 9). (In MEC, the concepts 'sustainable development' ('kestävä kehitys') and 'sustainability' ('kestävyys') are lacking).

Despite the scarcity of notions of sustainability, the guidelines for teacher education state that the future teachers should be able to "integrate societal, global and ethical issues into their teaching" and "foresee changes" (Ministry of Education and Culture, 2016, pp. 16–19). Nevertheless, the document does not explicitly state what "social, global and ethical issues" mean (p. 17), but presumably, the text refers to global challenges in societies, such as equality and sustainability. Furthermore, the guidelines suggest that teachers should practice "active local and global agency" (p. 15). Thus, the document identifies societal and global challenges but does not explicitly declare which themes they refer to.

The absence of an analysis of global and societal changes in the teacher education reform program was noticed in the evaluation by the *Finnish Education Evaluation Centre*. The FINEEC document points out that the online brainstorming sessions, in which the teacher education development process was planned, did not highlight climate change and other global issues as challenges of the future for teacher education:

> "The vision work highlighted the general generic skills that will be required of teachers in the future, such as learning to learn and interaction and collaboration skills. On the contrary, global challenges related to changes in people's living conditions, work and economy, climate change, increased inequality and radicalization, technological changes and artificial intelligence (see, e.g., UN Agenda 2030) did not emerge as future challenges in teacher education." (Niemi et al., 2018, p. 48)

With reference to this shortcoming, FINEEC argues that the program should have incorporated a consideration of global long-term issues such as sustainable development and climate change:

> "The time horizon of the development program is relatively short, dating back to about the 2020s. It would have been useful to include in the development program process an assessment of long-term global drivers of change that will have a strong impact on the educational structures, the curricula, and the teachers' work. These include the equality of future education, radical changes in the labor arena, the challenges posed by representative democracy, sustainable development and climate change, artificial intelligence and robotization, and the increasing demands for media literacy (see, for example, World Bank, 2018)." (Niemi et al., 2018, p. 62)

Paths to transformative education in the policy documents

The MEC guidelines document mentions the constantly changing societal context of the educational sector, the need to keep up to phase with the change, and the quest for teachers who generate new ideas:

> "We live in a world in which only change is certain. Competence and education (Bildung – in original *sivistys*) is more important than ever for Finland and for the world. The challenges of the future and the rapid changes in society require teachers with comprehensive and creative skills." (Ministry of Education and Culture, 2016, p. 6)

The guidelines for teacher education list a number of skills teachers need to deal with this continuous change. Collaboration and creativity are seen as key factors in teachers' professional development:

> "Teachers' abilities and opportunities to work together, to network, to continuously develop personal skills are the keys to change." (Ministry of Education and Culture, 2016, p. 6)

> "Future teaching is based on a wide range of pedagogical and content skills, co-working, self-development, in addition to creativity and entrepreneurship." (Ministry of Education and Culture, 2016, p. 15)

> "Learning environments and methods are collaboratively reformed through experimentation and innovation." (Ministry of Education and Culture, 2016, p. 7)

> On the same note, "the skills of future teachers" (Ministry of Education and Culture, 2016, p. 17) include "change competence" (*muutososaaminen*), "the competence to change one's own action," "self-efficacy and agency," and "the competence to diffuse new educational innovations (e.g., digital skills)."

Furthermore, MEC considers the ability to keep up with change to be crucial in fostering the quality of the Finnish education system and teacher education in international comparison:

> "The present material outlines the goals and measures that help Finnish teacher education to remain strong, attractive and internationally valued, developing toward a new creative teaching profession." (Ministry of Education and Culture, 2016, p. 9)

> "Many countries want to develop education systems that are forward-looking and support learning in the best possible way. The biggest challenge has often been that the education sector is not very good at renewing itself and innovating new solutions to deal with its own problems. Creating a long-lasting change is difficult. Achieving a genuine and lasting change is a complex and multidimensional process for the education system." (Ministry of Education and Culture, 2016, p. 10)

When evaluating the teacher education guidelines set by MEC, the FINEEC document also stresses the management of change and calls for a national structure to support the ongoing change at all levels of the educational system.

> "Its [the national structure's] mission would be to ensure that the ongoing changes is teachers' basic, induction and continuing training are carried out at all levels of the education system; at macro level (structures, resources, and legislation), institutional level (teacher education institutions and education providers and schools), and at micro level (the personal development and competence of teachers and students)." (Niemi et al., 2018, p. 8)

However, the approach to change and renewal seems to be mostly *responsive* in the documents, and to refer to learning environments and pedagogies – not a wider value-based change related to the purposes and aims of education. For teachers, change appears frequently as something to anticipate and respond to, instead of something to bring about. MEC calls for the education sector to embrace and facilitate change, but the direction of the change is not outlined. While the guidelines document poses questions such as "How will people learn in the future and what kind of training and skills will be needed?" and "How will the change affect teacher education?" (Ministry of Education and Culture, 2016, p. 9), it does not aim to answer these questions in terms of the content of the change but solely focuses on managing the change itself – in a collaborative fashion:

> "Teachers [. . .] are able to think and act creatively in the changing operational environment and in national and international networks." (Ministry of Education and Culture, 2016, p. 18)

> "Teachers [. . .] are able to change their own actions and circumstances, and lead toward change and in change processes." (Ministry of Education and Culture, 2016, p. 18)

> "Teachers [. . .] foresee changes and are enterprising." (Ministry of Education and Culture, 2016, p. 18)

> "Teaching is an interpersonal profession that requires enthusiasm, ability to encounter change, and an innovative approach." (Ministry of Education and Culture, 2016, p. 15)

> "Teachers and leaders of early childhood education and educational institutions work together to reform the operating environments and the culture of education and teaching. In a culture that supports renewal, teachers need diverse skills." (Ministry of Education and Culture, 2016, p. 7)

In the evaluation report, the FINEEC points out the restricted vision of teachers' agency as presented in the aims of the development program:

> "In the vision written in the context of the Forum, teachers are seen as transversal pedagogical and societal actors. On the contrary, the aims of the development program see the future teacher mostly as a pedagogical expert." (Niemi et al., 2018, p. 63)

When evaluating the program, FINEEC presents five recommendations (Niemi et al., 2018, p. 4) for continuing the reform of teacher education. These recommendations deal with facilitating change though structural measures, evaluation and collaboration. For instance, structural problems hindering in-service teacher training in Finland should be solved to support renewal. While FINEEC criticizes MEC for not considering the global issues (Niemi et al., 2018, p. 62) and directing the reform on that basis, in its recommendations FINEEC does not seize the opportunity to give suggestions related to the purposes and objectives of the reform. This choice may be due to the nature of the assignment that the *Finnish Education Evaluation Centre* received from the *Ministry of Education and Culture*. The assignment was to "evaluate the course of action, the concept that has been chosen to reform teacher education" (Niemi et al., 2018, p. 14). This may explain why FINEEC confined its recommendations to consider the process of the reform rather than its purposes and objectives. The directives or the purpose of the reform seems to be given by the *Ministry of Education and Culture* in its outlook on contemporary and future challenges,

and the MEC neither explicitly discusses sustainability issues as a challenge, nor makes a call for transformative learning. Both the Forum and FINEEC seem to have followed the assignment quite narrowly and did not decide to add transformative aspects.

Discussion

The aim of this study was to examine how the quest for sustainability and transformation in international educational policy by UNESCO is manifested in Finnish teacher education policy. To reach this aim and answer the two research questions regarding sustainability and transformation, we examined two recent national policy documents on teacher education, here referred to as MEC and FINEEC. We allocate the discussion on the findings in this section.

Sustainability

Our first research question was how sustainability is represented in Finnish policy on teacher education. At a first reading, it is obvious that sustainability does not hold a key position in the two documents we have examined. Nevertheless, these policy documents introduced a broad view on the need to change society and teacher education.

The MEC document emphasizes that the future teachers need a range of skills and lists several skills as important for a professional teacher. In general, teacher education must prepare the students for the challenges of the teacher profession by promoting broad basic skills, creative professionalism, and a willingness to develop both personally and in collaboration. At the general level, the document describes teachers as active agents both locally and globally in a world with great challenges and a fast-changing society, but does not contextualize this in relation to sustainability.

The FINEEC document points out that education needs to address urgent societal challenges when aiming to tackle climate change. Thus, this policy document takes at least one step toward a planetary vision of transformative learning, even if it does not stress ecological and planetary perspectives in depth (cf., O'Sullivan, 2003; Taylor, 2008; Casebeer and Mann, 2017). The Finnish national teacher education policy guidelines seem to remain rather ambiguous and do not clearly present any distinct objectives with regard to goals of sustainability education. For instance, the policy mentions climate change, but does not deal with the issue and its educational implications in depth. On the one hand, this may be due to the timing of the policy guidelines that were prepared and published between 2015 and 2020 (e.g., Niemi et al., 2018; Ministry of Education and Culture, 2021), at a time when climate awareness was increasing, but not so much discussed. On the other hand, this ambiguity may suggest attentiveness instead of a clear position in relation to climate change and other sustainability issues in teacher education. Later policy, like the objectives of Ministry of Education and Culture (2021) are more in line with the UNESCO current priorities, such as sustainable development. In addition, the Finnish educational policy agendas are aligned with UNESCO's educational policy with a planetary view on sustainability. However, the general higher education policy objectives of the Ministry of Education and Culture (2021) also prioritize international competitiveness and regional needs over planetary and ecological concerns.

Transformation

Our second research question was how the Finnish policy on teacher education reflects the call for transformation toward sustainability. To understand the national Finnish policy, it should be noted that a key feature of the Finnish educational system is the independent, expert role of teachers. They not only implement the curriculum, but also interpret it and contribute to its development at the local level, since each municipality develops its own curriculum based on the national standards (Finnish National Board of Education, 2016). In line with this national context, the guidelines document (Ministry of Education and Culture, 2016) states "What is important is the local and global agency and participation of the learner, teacher, and the leader of the unit or school" (Ministry of Education and Culture, 2016, p. 15). Therefore, it is not surprising that the aims outlined for teacher education (Ministry of Education and Culture, 2016) include developing teachers who are competent in forming the curricula, implementing innovations, and initiating, guiding, and leading creative processes. In addition, the future teachers need skills to use, combine and develop new learning environments, implement digital tools, and jointly develop the schools' learning environments.

In the general tone of the guidelines, teachers' agency seems limited to primarily dealing with changes instead of making them happen, to implement rather than create reforms, and to develop rather than to participate in a transformation (see also, Varpanen et al., 2022). When discussing the roles of teachers and students as actors in the educational sector, the documents do not particularly denote the transformative function of education. Yet, they do not manifest a solely utilitarian function either. The 'learner' concept indicates all children and adults as joint learners and developers on various educational levels. This is in line with Balsiger et al. (2017), who emphasized that sustainability education calls for a role shift, making teachers facilitators of both students as joint co-learners, but also the teachers and students as mutual co-learners.

However, there are some aims in the MEC document that can be seen as presenting teachers as not only reproducing but also reforming the society. For example, the aims for future teachers involve being "societally and culturally active and competent" and "bold in developing and experimenting" (Ministry of Education and Culture, 2016, p. 18). Yet, as argued before, and as FINEEC points out too, the development program presents teachers mostly as experts in teaching, and thereby

the take on teachers' agency appears limited. The documents do not state in what area the teachers should be bold and experiment. In terms of pedagogical approaches, the guidelines for teacher education call for teaching and learning that are student-centered, research-based, collective and innovative. These approaches are referred to consistently throughout the documents, both in the MEC guidelines and in the FINEEC evaluation report.

Summing up, even if the documents highlight the teachers' agency, in terms of promoting change through action, they do not push forward action-based methods. MEC mentions that future teachers should be "societally and culturally active and competent" (p. 18), but this is not expanded on elsewhere in the documents and there is no consideration of promoting students' own activism. Hence, the teacher education documents might insufficiently 'promote and prepare learners to regenerate the society, the culture and the labor market,' or to 'promote wellbeing and sustainability development'; which are objectives laid out in Finland's higher education policy (Ministry of Education and Culture, 2021).

Critical reflections on the results

In many decades, UNESCO has called for sustainability education, and recently the organization has called for transformation, and transformative learning. Simultaneously, other strong international policy influencers like the OECD and the EU have highlighted other more instrumental aims consisting of long lists of necessary skills and competencies for the future world inhabitants including teachers. Finland has also participated in and distributed material in the skill and competence genre, of which MEC and FINEEC are examples. Therefore, objectives other than sustainability seem to have had a stronger impact on the teacher education policy. Accordingly, the basic aim of Finnish teacher education is something else than a sustainable planet.

The title of the FINEEC policy document is *Becoming the Most Competent Teachers of the World: Evaluation of the Teacher Education Forum in 2016–2018*, but the rationale for having a country with the world's most competent teachers is not mentioned. The title may suggest that teacher education in Finland adheres to the Finnish higher education policy objectives (e.g., international competitive entity) rather than to UNESCO's current priorities (e.g., sustainable education or transformative engagement). The superlative ideal of teacher education and teaching vocation conflicts with the critical and relational aspects of transformative learning. The policy document inadequately explains the rationale and implications on being 'the most competent teachers of the world.' Hence, it raises several existential questions. Why should Finland have the world's most competent teachers? What roles do the world's most competent teachers play in Finnish society and globally? What is the basis of comparison between countries to determine the extent of teachers' competence? This aim seems to oppose an idea of justice, global equality, and social sustainability.

Furthermore, the notions of equality and sustainability are used in a de-contextualized way, without any reference to the causes of the phenomena (e.g., inequalities and unsustainability) and how these are reflected on the Finnish society (e.g., how do migration and climate change relate to each other? What are the influences of migration because of climatic change on the Finnish society, Europe, and the world? How has change in the population in Finland influenced education and teacher education? What radical changes in the curricula are needed? These questions open further discussion about issues related to values, competence and action). They are concepts and practices presented in the Finnish regional and international policy documents addressing sustainability education, transformative learning and teaching, including higher education.

The policy texts are conceptually incoherent especially regarding the ontological orientations underlying the documents and the directions in which they are pointing. For instance, the fact that "value" is seen as "competence," and inserted into the adjective-noun phrase "value competence" indicates that this is a skill that can be developed as part of a series of courses or training. However, rather than a competence, it is critical consciousness and empathy that are required, if the aim is to educate teachers able to "act professionally, ethically and value-consciously" (Ministry of Education and Culture, 2016, p. 18). Acting professionally requires an understanding of the historical, political and economic processes across local, regional and global boundaries that lead to environmental and climate crises. It also requires an understanding of how knowledge is constructed; what and whose knowledge is legitimized in the Global North *vis-à-vis* Global South. Without these conditions, value is treated in a moralistic manner rather than as an ethical matter. Similar considerations apply to other newly coined skills, for example the so-called 'climate competence.'

A key reason for the scarcity of transformative aspects in the documents we have analyzed, is that the tone in both is quite value neutral. Such neutrality may be typical for policy documents but problematic when envisioning any kind of reform. The vision for Finnish teacher education, as stated in the national guidelines document, is based on two values (Ministry of Education and Culture, 2016, p. 15): *equality* and *communality*. One of the transversal competencies of future teachers is "value competence," that is to "act professionally, ethically and value-consciously" (Ministry of Education and Culture, 2016, p. 18). Yet, the document does not expand on the meaning of value-consciousness or justify its recommendations for teacher education in a value-based way. The scarcity of explicit value considerations in the documents does not support a transformative approach. In addition, several key values typically associated with sustainability, such as responsibility, solidarity or respect for nature, are not stated in the documents. Nevertheless, they could be read behind the lines in the vague rhetoric.

Both documents call for educational reforms as mutual processes. MEC focuses on the objective of bringing together the stakeholders in teacher education at national and local levels, and FINEEC considers this network-like approach to be the central strength of the reform of teacher education. FINEEC is also complimentary that the development program aims to enable teachers to take responsibility and participate in leadership processes. Such an interactional and de-centralized approach, promoting the significance of partnerships and the sense of community, probably contributes to the agency of teacher educators at various levels. In addition, teachers' mutual networking is supported in the development program. However, one FINEEC criticism is that the program gives relatively little guidance for future teachers on how to develop their work at the local (school or municipality) level.

Reflections on the research procedure

In this article we presented a literature study based on international education policy mainly from UNESCO, but also other agencies, covering research from the fields of sustainability education, transformative learning and teacher education. The empirical sections included an examination of two education policy documents on teacher education from Finland. We could have used many other documents and research studies, but tried to focus on a few of those that we found to be the most relevant in terms of national policy guidelines at the time of study. We could also have reflected more deeply on what the documents tell about issues other than sustainability and transformation, but we did not recognize this as our task.

The authors' backgrounds and fields of research draw from the social sciences, the humanities and the natural sciences. Therefore, our standpoints on transformative learning and sustainability vary as well. However, despite our various positioning, our thoughts converged in that teacher education needs a profound transformation. Yet, a transformational leap to practices with a deep understanding of sustainability requires an ontological shift in teacher education. In turn, this would require revisiting the definitions of what human life is and how to relate to the rest of the world. Based on these considerations, we first decided to discuss and analyze the ontological basis of transformative learning in relation to sustainability in teacher education policy in Finland. Yet, the text in the documents had very little to say about sustainability and deep transformations. As our analysis has shown, the narrative approach in policy documents is strategic rather than ontological and scientific. This has had an impact on the conceptual basis of this paper and has shifted the weight toward the body of literature that primarily focuses on skills-related studies and research. Further studies on teacher education in relation to sustainability and transformation at a more theoretical level are needed.

Conclusion

While we were compiling the final revision of this paper in May 2022, the Finnish Ministry of Education and Culture published a brief document (8 pp.) outlining a renewed development program for teacher Education for 2022–2026 (Ministry of Education and Culture, 2022). This document lists and briefly elaborates on four objectives that repeat the arguments in the more extensive guidelines document that we analyzed in this paper: teacher education should be anticipatory, research-based, continuous and collaborative, and it should promote leadership competence. However, we notice that this new document addresses sustainability issues more than the earlier MEC document. When listing "the great challenges emerging from society," Ministry of Education and Culture (2022, p. 6) now begins by "issues related to climate change" and "strengthening participation and active citizenship." The document also acknowledges that teachers' expertise should entail studying, solving and adapting to "wicked problems" (Ministry of Education and Culture, p. 3). According to this policy document, it might sound like Finnish teacher education should respond to the challenges caused by the sustainability crises. Despite a few promising sentences, we argue that the view of teachers' agency of this new policy document is still limited, and that the shortcomings apparent in earlier guidelines apply to this new document, too. Similarly, our arguments on the lack of transformative approaches and visions for value-based changes apply to the new document.

The conclusion of our study is that Finnish teacher education policy does not live up to UNESCO's quest for transformative sustainability education. Even if the message from the latest document from 2022 is more promising than the earlier documents, in the contemporary world situation it is still a shortcoming. It is obvious that neither this nor the two main documents in our study have taken UNESCO's call for the transformation toward sustainability seriously. When choosing between the transformation toward the economic aims of the OECD and the sustainability aims of UNESCO, Finland has chosen predominantly to prepare teachers (and consequently, students) to serve the global economy before learning to create sustainable global conditions. In some way, the two documents in our study are examples of typical Finnish consensus seeking approaches. Even if there might be conflicting thoughts about what is important in future teacher education, the document texts try to sketch a complete picture of excellent teacher education. In that situation, sustainability is easily sidetracked by other political and economic aims. Undoubtedly, the educational policy makers in charge of these documents tend to avoid "controversial" value related concepts like sustainability and instead refer to more general terms such as "social and ethical questions." This raises questions about who the authors and committees behind these documents are, what

their guiding principles were, and whose voices are conveyed and whose silenced.

The power of the policy is not self-evident. As Levin (1998, p. 134) states: "the road from ideological belief to political commitment to formal policy to actual practice is rarely a straight one." Consequently, whatever is written in a policy, the result can vary a lot. This means that the Finnish higher education institutions offering teacher education may implement sustainability in their own way, in any case. Thus, how teachers in Finland are prepared for implementing the core curricula in schools, and how they emphasize sustainability, is much up to the leaders of the teacher education institutions and to the teacher educators (Wolff et al., 2017). Transformative learning is one way, but it requires effort, time and research; it cannot be rushed and performed shallowly. Yet, according to Balsiger et al. (2017), capability and knowledge for sustainability transformation of higher education are widely lacking. Therefore, the training of teacher educators in sustainability education is the first step. However, the UNESCO's following up (see Section "International general guidelines"; UNESCO, 2020) might hopefully have an influence and start a discussion leading to actions for change in many countries. Finally, a relevant question that arises when discussing the issue of sustainability and transformation in connection to teacher education is whether research (theoretical and empirical studies) on teaching and learning *or* politics and economic objectives are to lead the transition toward a more sustainable future by means of education.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

L-AW, AL, SC, MV, and MA contributed to the conception and design of the study and discussed all the sections together. L-AW, SC, and MV were responsible for Sections "Introduction" and "Policy Request on Transformation Through Education." SC, MV, MA, and L-AW were responsible for Section "Multiple Perspectives on Transformative Learning." AL and MA performed the content analysis and wrote Sections "Results" and "Discussion." SC wrote the first draft of the manuscript. AL, L-AW, SC, and MV wrote the discussion. L-AW was responsible for the entity and structure. All authors are responsible for that all aspects of the work are critically, accurately and appropriately investigated and resolved. They have all contributed to manuscript revision and read and approved the submitted version.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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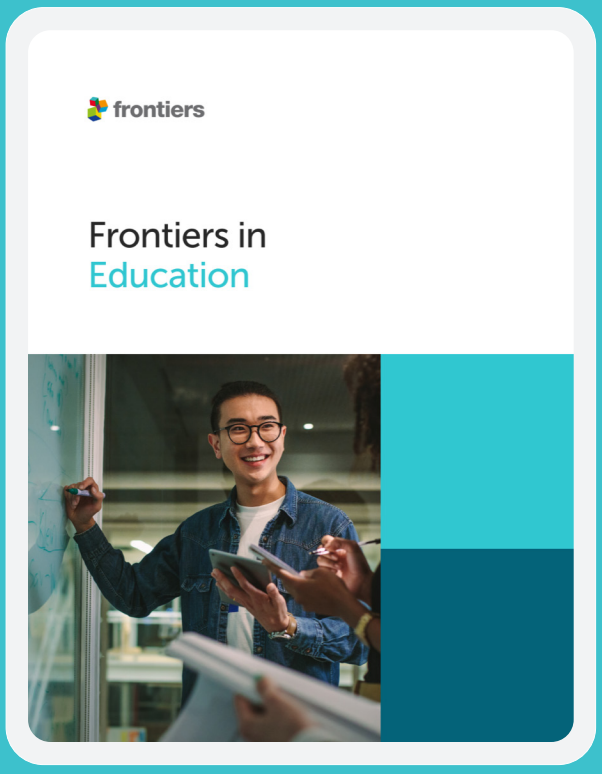

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