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Current Opinion in Environmental Sustainability

Review

Growing through transformation pains: integrating emotional holding and processing into competence frameworks for sustainability transformations

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Current frameworks for sustainability competences give insufficient attention to competencies for holding and processing difficult emotions such as ecological grief and eco-anxiety. This is despite emotional distress caused by environmental crises becoming a rapidly growing field of investigation and the ability to cope with such emotions an increasingly apparent need within sustainability research, education, and practice communities. To effectively support the radical sustainability transformations required to avert (or adapt to) socioecological collapse, it is crucial that competences linked to emotional recognition, holding, processing, and integration be included in future frameworks. A synthesis framework of sustainability competences with a proposal for how to incorporate these additional emotional competences is presented, together with emphasis on how developing and implementing practices for cultivating such competences represents a significant growth edge for sustainability programmes, particularly within higher education.

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Current Opinion in Environmental Sustainability 2025, **74**:101525

This review comes from a themed issue on **The State of Knowledge on Social Transformations to Sustainability**

Edited by **Susi Moser, Sarah Moore** and **Lizzie Sayer**

For complete overview of the section, please refer to the article collection, "The State of Knowledge on Social Transformations to Sustainability"

Available online 22 March 2025

Received: 27 March 2024; Revised: 19 February 2025; Accepted: 24 February 2025

https://doi.org/10.1016/j.cosust.2025.101525

Introduction

Any hope of achieving sustainability is recognised as requiring radical reorganisation and transformation of social, political, economic and cultural systems [1–3]. Such an undertaking demands the cultivation of specific competences, that is, the knowledge, skills, and attitudes necessary to become effective agents of transformative change for sustainable futures [4–6]. In this context, we take sustainability to mean justly safeguarding the Earth's life-support system upon which the health and well-being of all current and future generations of humans and non-humans depends (adapted from Ref. [7]).

A number of frameworks for sustainability competences have been published in recent years, both by academic scholars [8,9] and international organisations such as the European Union [10] and the Inner Development Goals network [11]. Reviewing recent advances we note a significant level of alignment that enables a synthesis of key competences across the different frameworks. However, our review also reveals an important gap: none of the frameworks explicitly address the need to develop competences for constructively navigating emotional distress (i.e. anguish from the experience of difficult emotions, such as anxiety, fear, grief, despair, etc). This is despite emotional distress caused by current environmental crises and attendant risks of societal collapse (e.g. from climate instability, mass extinction, and anticipated cascading and compounding impacts) becoming a widely recognised phenomenon and rapidly growing field of investigation [12–14].

Although most available research has been conducted within western cultures, emotional distress linked to environmental crises has been documented in countries across the Global North and Global South (where legacies of colonialism extend the timeframes of distress) and is particularly prevalent amongst women and youth [15–17]. Competences to hold and process emotions, such as ecological grief and eco-anxiety, are only likely to amplify in importance as impacts from global environmental change become more acutely felt and social transformation ever more necessary. We suggest that to effectively support the deep and persistent work

required for radical sustainability transformations, competences linked to emotional recognition, holding, processing, and integration need to be included in future sustainability competence frameworks. Furthermore, developing and implementing appropriate techniques and methods for effectively cultivating these types of competences represents a significant growth edge for sustainability programmes, particularly within higher education institutes.

In this article, we review and synthesise recent developments in sustainability competence frameworks and highlight a gap related to handling ecological emotional distress based on an overview of the rapidly growing body of literature on ecological anxiety and grief. We then make a proposal for how to expand sustainability competence frameworks to explicitly include emotional recognition, holding and processing. We argue that these competences are vital for facing the risks of social and ecological collapse and enabling radical sustainability transformations. We conclude by highlighting that effectively developing these competences requires higher education institutes to evolve and embody new aims, pedagogies, and practices.

Methods

This article is the result of a critical review (i.e. summary and critical evaluation [18]) of contemporary sustainability competence frameworks in light of recent work on emotional distress linked to environmental crises. Firstly, we analysed and synthesised recent developments in sustainability competence frameworks with a primary focus on those that were (a) published after the classic United Nations Educational, Scientific and Cultural Organization (UNESCO) framework from 2017 and (b) generated through international collaboration and broad-based review. These selection criteria allowed us to review the most recent developments in the field with a solid grounding in the literature and a claim to international applicability. The intention was to identify similarities and differences and the extent to which a synthesis could be achieved for practical application in the development of educational programmes. Adopting an action research approach, we then worked to implement and reflect on the synthesis through design and teaching of a new postgraduate programme. Despite confidence that the programme was effectively working to build all identified competences, we were struck by the regularity of requests from students for help in handling the emotional distress that accompanied and was amplified by their learning. We noted a recurring pattern of similar student requests across various sustainability programmes, as well as resonance with struggles expressed by colleagues in global environmental change research and social movements. We therefore began to review research on emotional distress linked to environmental crises and ask to what extent contemporary sustainability competence frameworks were adequately accounting for this emergent issue. The literature set we considered on emotional distress began with academic reviews published in the last 5 years on eco-anxiety and ecological grief, followed by backward snowballing to identify and further explore central papers across different fields. Recent papers with a specific focus on the interface between sustainability competences, emotional distress, and higher education were used to inform conclusions.

Recent sustainability competence frameworks

A widely recognised and internationally adopted competence framework for sustainability comes from the UNESCO [19]. This framework describes a cross-cutting set of key competences for achieving the Sustainable Development Goals and includes *systems-thinking*, *critical thinking*, *strategic*, *collaboration*, *anticipatory*, *normative*, *self-awareness*, and *integrated problem-solving competences* [19].

In 2022, the European Union released: "GreenComp — a sustainability competence set to support European Green Deal objectives" [10]. Drawing on a literature review together with expert and stakeholder consultation, GreenComp specifies four interrelated competence areas, each with three specific competences. These include *embodying sustainability values* (valuing nature, supporting fairness, promoting nature); *embracing complexity in sustainability* (systems-thinking, critical-thinking, problem-framing); *envisioning sustainable futures* (futures literacy, adaptability, exploratory thinking); and *acting for sustainability* (political agency, collective action, individual initiative).

Both of these frameworks are supported and informed by more than a decade of scholarship within academia on key competences for sustainability, as well as implementation in hundreds of sustainability programmes around the world [8,9,20]. Over the years, these academic efforts have identified various interrelated and cross-cutting competences needed to address sustainability challenges through research and practice [21,22]. The most common set of sustainability competences advanced within academia have included: *systems-*, *futures-*, *values-*, *and strategic-thinking*, and cross-cutting *interpersonal and integrated problem-solving* competences [20,22,23]. A recent review by Brundiers et al. [8] also identified a closely related *implementation* competence.

All these recent frameworks include an explicit focus not only on the type of knowledge and skills that need to be fostered and facilitated but also on values, attitudes, and forms of self-development that need to be nurtured for responsible citizenship within social and ecological communities (such as respect and reciprocity). This

aspect, increasingly referred to as the 'inner dimensions' required for sustainability, has been gaining enhanced attention in recent years [24–27] and connects to earlier work on the need to address deeper leverage points to effectively advance system change for sustainability, including our values, goals, priorities, paradigms, and mental models [28–30]. Specific efforts to collate, elaborate and lift the profile of inner dimensions of sustainability have recently been advanced through the Inner Development Goals network. Using global surveys and broad consultative processes, this network crafted the Inner Development Goals framework [11] as a synthesis of the type of character traits and inner development needed for sustainability. This framework includes 5 general themes — b*eing* (relationship to self), t*hinking* (cognitive skills), r*elating* (caring for others and the world), c*ollaborating* (social skills) and a*cting* (driving change) — elaborated into a total of 23 different skills and qualities.

Synthesis of sustainability competence frameworks

Despite variation in terminology and clustering, the above described recent sustainability competence frameworks converge around the need for people to be able to work together to address complex, value-laden challenges in socioecological systems with vision, self-awareness, collaboration, and strategic intent. As the above literature explains, systems-thinking is required to understand and operate within complex systems with nonlinear dynamics and interdependent relationships underlying both the problems and solution options. Futures thinking is required to enhance anticipation of potential challenges and pathways forward through imagination and visioning that motivates inspired action. Values thinking is vital to appreciating the social and cultural conditions in play (including the different interests and values shaping institutions and human behaviours), which need to be engaged and negotiated to achieve sustainability. Strategic thinking is needed to navigate current and future opportunity landscapes and build adaptive plans toward desired goals. Integrated problem-solving and implementation competences serve to support the type of knowledge-weaving and adaptability required for operating within and shifting complex socioecological systems under dynamic circumstances. Intra- and inter-personal competences underlie the entire endeavour, enabling people to understand and reflexively monitor their own position and collaborate effectively towards impact under the challenging conditions of complexity, uncertainty, and value heterogeneity.

Sustainability competences are often presented as lists of items that appear independent or disconnected, which fails to highlight how they are actually interrelated, need to be integrated to be effective in practice, and often develop in a relational manner [4,20,23]. In synthesising recent frameworks, it was therefore important to find a mode of presentation that enabled clustering related concepts and communicating their operation as an integrated whole. Previous work drawing together different pedagogical approaches across sustainability education and transformative learning used the head/heart/hands model as an organising principle [8,31], which we found compellingly integrative and worth building upon. Although other organic metaphors have been put forward (e.g. the tree of key sustainability competences presented in Ref. [4]), we deemed the body metaphor as more directly accessible. We therefore offer a synthesis of contemporary sustainability competences within a head/heart/hands framework (see Table 1).

Within the synthesis of recent frameworks that we offer, 'head' competences cover categories of analysis and

Table 1

Synthesis of sustainability competences within a head, heart, hands framework. This synthesis is based on a critical review of recent sustainability competence frameworks, with a focus on those published within the last 15 years and generated through international collaboration and broad-based review. This included Rieckmann 2018 [6], Brundiers et al., 2021 [8], Redman and Wiek 2021 [9], Joint Research Centre 2022 [10], Inner Development Goals 2021 [11], UNESCO 2019 [19], Wiek et al., 2015 [20], Lang et al., 2012 [21], Wiek & Lang 2016 [22], Wiek et al., 2011 [23]. While this table presents a synthesis of converging competences from across all these different frameworks, specific competences described are outlined in the section *Recent sustainability competence frameworks*.**

Head	**Analysis**	**Imagination**
	Systems Thinking & Critical Thinking	Exploratory Thinking & Futures Thinking
Example keywords	*complexity, uncertainty, perspective, inter- and trans-disciplinarity…*	*curiosity, experimentation, creativity, innovation, anticipation, visioning…*
Heart	**Values**	**Presence**
	Understanding & Embodying Sustainability-Aligned Values	Self-Awareness and Self-Development
Example keywords	*interconnection, empathy, equity, justice, responsibility, reciprocity…*	*authenticity, integrity, reflexivity, perseverance, learning mindset…*
Hands	**Action**	**Implementation**
	Individual, Collective & Political Actions	Collaboration & Inter-personal Relations
Example keywords	*strategic thinking, integrated problem solving, mobilisation, agency…*	*diversity, inclusivity, inter-cultural awareness, trust, negotiation…*

imagination, including *systems thinking and critical thinking* as well as *exploratory thinking and futures thinking*. The 'heart' competences link to cultivating supportive values and qualities of presence, including *understanding and embodying sustainability-aligned values* and actively working to build *self-awareness and self-development*. The 'hands' competences relate to action and implementation, including *individual*, *collective*, *and political actions* and *collaboration and interpersonal relations*, which are necessarily developed through interaction.

In addition to the integrative and dynamic nature of the body metaphor, we find emphasising head, heart, and hands usefully counters long held ideals that science should be value-free or not purposely engaged in shaping the world [32,33]. Although a simplification, we believe organising the competences in this way provides an overview that is rich, representative, and easily relatable for people both familiar with the field and importantly, those new and trying to orient in how to design and deliver education programmes that empower sustainability transformations. We would emphasise though that the use of different body parts is offered as a heuristic and should not be interpreted to mean that these competences are attributable to or solely identified with specific parts (e.g. head competences as solely cognitive or heart competences solely affective). The body operates as a dynamic integrated whole with knowledge, skills, and attitudes emerging through the parts working in relationship with one another and so too do the competences.

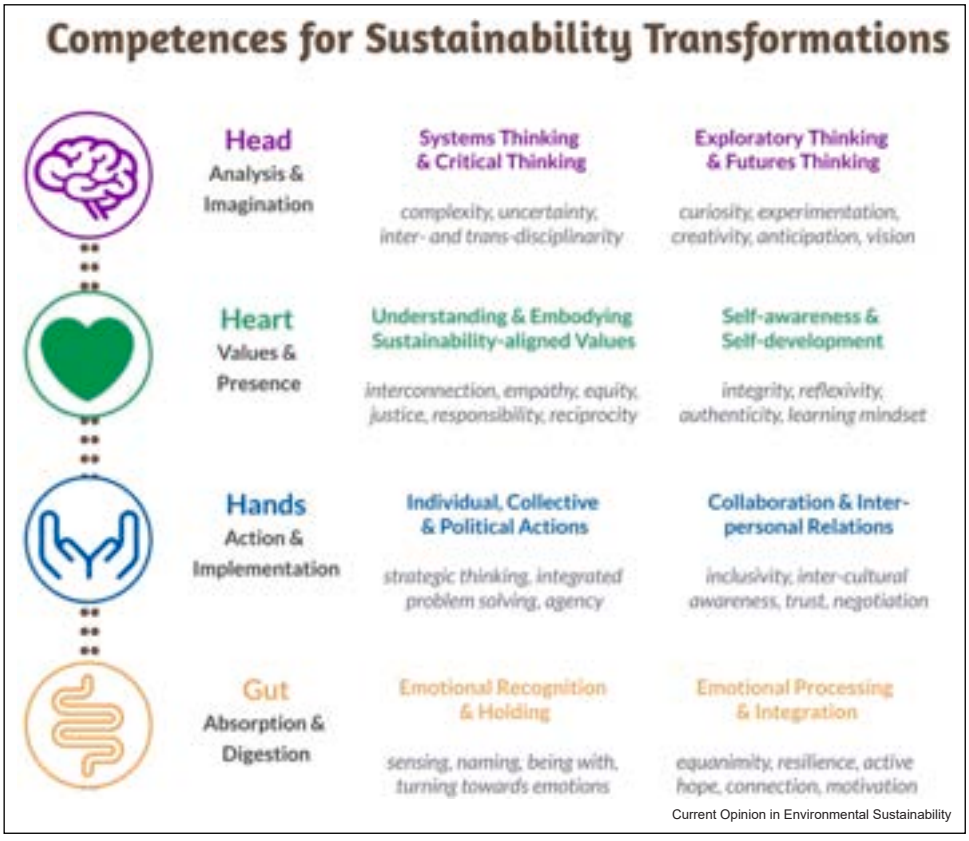
Expanding sustainability competence frameworks to address emotional distress

While extensive convergence across sustainability competence frameworks enables the above synthesis, additional competences are now emerging as vital for sustainability transformations. These are competencies for recognising, holding, processing, and integrating the challenging emotions that arise when learning about the weight and scale of the sustainability polycrisis and working against incumbent structures and power dynamics in efforts to advance transformative change. Such competences have become necessary to be effective agents of social change for sustainability in today's world, as well as for addressing longer historical struggles such as colonialism and consequent social inequalities that are inextricable drivers of global environmental change. None of the recent frameworks reviewed directly acknowledge the rising tide of emotional distress in response to environmental crises or drivers nor do they sufficiently discuss the importance of navigating this emotional distress for effecting deep social change. While there is some reference in existing frameworks to skills like empathy and attitudes such as optimism, there is a general failure to explicitly address the implications of eco-anxiety and grief for the competence of sustainability change agents. Competences for managing emotional distress are, however, clearly emerging as essential for handling the emotional toll of facing the very real risks of societal and ecological collapse and for girding oneself to perform the challenging work required over an extended period to generate the type of deep transformative systems change required. Yet, the knowledge, skills, and attitudes necessary to scaffold this type of emotional work, both in ourselves and in others, are not yet captured in current sustainability competence frameworks.

Mounting evidence demonstrates that enhanced information on and experiences with the sustainability polycrisis (or components thereof) gives rise to significant negative emotions and can affect mental wellbeing of both adults and youth [12,13]. A sharp rise in academic scholarship on the emotional turmoil and distress connected to current and expected future environmental changes and losses includes work on solastalgia [34–36] and anticipatory solastalgia [37], climate anxiety [15,38–40], eco-anxiety [14,41–46], and ecological grief [13,47–50]. The ability to cope with the emotional distress generated by the sustainability polycrisis and the type of existential threats it represents is also emerging as a necessary competence through strong bottom-up calls for help. These calls come from students of sustainability programmes within higher education; researchers working with sustainability science or transformations; and people working to communicate and act on the latest scientific findings. Without generating appropriate ways of working with and through challenging 'eco-emotions', people of all walks of engagement with sustainability transformations can experience mental and physical health impacts and reduced motivation for action [16,51]. The competence to recognise, hold, process, and integrate difficult emotions is clearly becoming necessary for maintaining hope, motivation, and work towards transformation in the face of ongoing resistance from powerful actors and accelerating loss and suffering.

To capture these types of emotional competences and make them more explicit, visible, and directly incorporated within sustainability programmes, we propose that 'gut' competences be added to the head, heart, hands synthesis from existing frameworks. We describe these gut competences as capacities for *emotional recognition and holding* (referring to the ability to understand, name, turn towards, and be with negative emotions that arise in ourselves and others) and *emotional processing and integration* (referring to an ability to interrogate social and political dimensions of these emotions and to cultivate equanimity, resilience, and active hope in ways that allow us to remain connected and motivated to act for social, political, and systems change; see Figure 1). We emphasise that this interpretation of competences linked to

Figure 1



Competences for sustainability transformations represented within a head, heart, hands model and expanded to include gut competences (supporting the absorption and digestion of intense and difficult emotions), which are essential for facing the realities of global environmental change and maintaining active engagement in the challenging work of shifting incumbent systems, structures, and power dynamics under accelerating and compounding crises. The left-most column of text provides overview descriptions of the focal areas for each competence set, while the centre and right-hand columns articulate the competences in more detail, with example keywords provided to help illustrate meaning and important aspects. The dynamic and integrated nature of the competences is indicated by bidirectional dotted flow linking the body parts.

ecological emotions is not just about individual resilience and responsibility. Importantly, managing and integrating emotions happens in relationships, as part of collectives, and through the ongoing work of deep systems and structural change [52,53].

We propose these as 'gut' competences for various reasons. Firstly, calling them gut competences connects to the importance of healthy *absorption and digestion* of information on and experiences with sustainability crises. This includes abilities to process inputs in ways that allow one to extract the nourishment available (e.g. for fuelling pro-environmental behaviours) while transforming and/or releasing the rest. Bringing the gut into the body of existing sustainability competences holds potential for enabling sustainability practitioners to not ignore, shy away from, or be held back by challenging emotions. The competence invites people to absorb and digest these emotions independently and in relationship. Using the metaphor of the gut also helps emphasise the interplay between cognitive and affective aspects in these competences because not only do many people 'feel' emotions in their gut, the gut is also increasingly called the 'second brain' with recent research documenting the importance of the bidirectional gut-brain axis of communication [54].

We argue that gut competences are not only essential for facing the realities and impacts of an accelerating sustainability polycrisis with its attendant social and ecological unravellings but also for maintaining engagement in the challenging collaborative work required for radical social transformation. The fundamental transformation of social, political, economic, and cultural systems necessary for sustainable futures will inevitably involve distress. Progress towards sustainability has been painfully slow to date and pathways towards transformation require all, but especially those who sit in privilege and benefit from the status quo, be willing and able to face into discomfort and process distress. This is not only

distress concerning our own role in the problems and the instability that comes with change but also the emotional and moral distress that comes from confronting existing power dynamics, witnessing the inaction of governments, and acknowledging the challenges of shifting existing systems and structures [15,55]. Gut competences are therefore essential not only for frontline communities and those managing trauma from crisis impacts [56,57] but also those engaging in the work to enact and accelerate change. Given that this work requires collective action and emotional distress arises through our relational existence and engagement in the world, gut competences are not just skills or traits for individuals to develop as they can be significantly strengthened through social dynamics and embedded within cultural ways of being.

These gut competences therefore go beyond a competence in self-awareness or self-development as articulated in existing frameworks. Self-awareness focuses on questions of interrogating who we are — our values, desires, stressors, and strengths. Self-awareness, however, does not address the need to turn towards, hold space for, and effectively process difficult emotions in ways that support constructive and socially engaged responses. Healthy feedback between emotional recognition and emotional processing demands more than just awareness. In navigating sustainability transformations, there is also a need to effectively engage not only with our own intense emotional challenges but also those of our peers, collaborators, and students, as well as the communities we serve through our sustainability research, teaching, and collective action. Viewed in this light, emotional 'absorption and digestion' can be both supported through collective actions and help to sustain social movements [58,59]. Thus, while self-awareness and the learning mindsets of self-development are certainly necessary sustainability competences, they are insufficient to the challenge of supporting ourselves and our communities through the emotional demands of navigating sustainability transformations in times of accelerating crises.

Without the type of gut competences we outline, human responses to emotional distress from the sustainability polycrisis may be maladaptive, for example, leading to eco-paralysis [60] and environmental inaction and withdrawal. Eco-emotional distress has been documented as inversely related to mental health and mental well-being, and it is clear that it can lead to feelings of overwhelm, powerlessness, and hopelessness [17,61]. Constructively engaged, however, responses to emotional distress can also be adaptive and lead to more active political engagement and pro-environmental behaviours [42,62,63]. In some cases, increased exposure to information about current sustainability crises has been positively correlated with pro-environmental behaviour [17,42,64]. This is because there is potential for distressing emotions to act as motivational forces [13,65] (c.f., [48,66] on ecological grief as the start of a healthy response). The competence to process and integrate emotional distress with enough skill to subsequently choose an adaptive response is therefore crucial for sustainability transformations. Without this competence, feelings of helplessness and hopelessness can lead to overwhelm, depression, withdrawal, and inaction — the antithesis of what is required. Recent research has also noted that the prevalence of adaptive responses to ecological emotions varies across cultures [17]. This highlights how social and cultural conditions affect both the experience and expression of emotional distress and responses to it [67] — interplays worthy of additional attention if we are to effectively tailor and build sustainability competences across cultures.

A range of strategies have been identified as relevant and necessary for processing and integrating distressing eco-emotions. Moser [49], writing on the question of 'to retreat or not' (in reference, e.g., to front line communities) has noted the importance of 'conscious psychological processing…and communicative reframing', when facing the extraordinary challenges of global climate change (p. 276). Writing on medical professionals' experience with climate change activism, Lindemer [68] noted the importance of connecting with peers and networks engaged in similar work to negotiate the 'potential conflicts and costs of engaging' (p.775). Pihkala [14], in a review of responses to eco-anxiety and ecological grief, noted the importance of action, taking distance (including self-care), and emotional engagement (including grieving) as a trio of strategies for living with distressing eco-emotions.

While action is clearly necessary to advance sustainability transformations, acting in a sustained manner benefits from a belief that one's behaviour will be meaningful [13]. This sense of self-efficacy is linked to behaviour change in cognitive theory and has been studied, for example, relative to recycling behaviour [69]. However, the complexity, scale, and time frames involved in the sustainability polycrisis complicate an individual's ability to accurately perceive self-efficacy and thus interfere with how people might process their emotional responses and sustain motivation for engaging in sustainability transformations. Incumbent structures significantly restrict possibilities for individual actions and necessary changes may span several generations but it is inaccurate to say that one's self-efficacy is low if the results of effort to mitigate ecological loss today are not immediately perceptible. Furthermore, even if one experiences emotional rewards and a sense of self-efficacy sufficient to motivate pro-environmental action, no action taken by any single individual will resolve a polycrisis or create the kind of deep system-wide changes needed. Indeed, it has been suggested that eco-anxiety

stands in contrast to other types of anxiety precisely because of the recognition that resolution requires collective action [52]. Further research into how people process perceptions of self-efficacy in work on sustainability transformations would be valuable for better understanding how to manage eco-anxiety in ways that sustain actions and ongoing political engagement.

Cultivating competences through education and practice

Given sustainability competences will increasingly be called upon to face existential threats and steward radical transformations, the question arises: how best to support the cultivation of these competences? Particularly when it comes to emotional holding and processing, higher education institutes will need to better support the maturation of sustainable societies by advancing not just education, but human and social development more broadly [70] (c.f. the distinction between *utdannelse* and *dannelse* in Norwegian). This will require growing offerings related to so-called inner transformative work, including absorbing and digesting the distressing emotions.

Transformative learning theory [71,72] has long highlighted the importance of inner transformation for achieving social transformation. Yet, sustainability education's engagement with this body of pedagogical work remains in an early stage of development [73]. A recent review of parameters for developing cutting-edge undergraduate expertise in transdisciplinary problem solving, for example, made no references to emotional resilience [74]. Advanced graduate training programmes funded by the U.S. National Science Foundation to support integrative sustainability research also make no mention of the emotional challenges of doing and being in sustainability [75]. Although work to address eco-anxiety and related emotional issues linked to the sustainability polycrisis is rapidly expanding within psychology [76] and there have recently been some exploratory efforts broaching how to approach such issues within higher education (e.g. [24,77,78]), there remains a pressing need to consider how to effectively engage and develop emotional dimensions when teaching sustainability [79]. There is also a need to better understand why sustainability researchers and educators often shy away from speaking frankly about the scale and significance of the sustainability polycrisis and its existential risks [80]. This includes attending to the impact this avoidance has on sustainability students and society and the importance of emotional competences for 'deep adaptation' work on relinquishment, restoration, and reconciliation (see, e.g. [80]).

The development of gut competences through teaching and learning within higher education institutes would specifically benefit from enhanced engagement with pedagogies designed to develop appropriately responsive strategies, as well as enhanced engagement with practitioners working for transformative change. Embracing pedagogies that emphasise the importance of transformative, transgressive, and/or critical-emancipatory forms of teaching and learning [24,31,81–87] offer particularly promising starting points for integrating emotional competences in higher education. Here, the openly archived work of the T-Learning project and its transformative learning network offer a rich vein for further exploration (see https://transgressivelearning.org/). Contemplative practices also have much to offer [26,78,88,89], as do the valuable approaches used within environmental social movements (e.g. [90,91]).

Emotional holding and processing will be increasingly vital skills not only for processing eco-anxiety and ecological grief but also in contexts of social disruption [92] and for remedying profound social and environmental injustices and traumas [57]. Consequently, sustainability education would benefit from further linking to communities of practice experienced in holding space for personal and collective emotional experience and group emotional processing. Tabor et al. [93], for example, identified the potential for healing colonial trauma through collective art-making processes, while Menakem [94] has pointed to the value of body-centred approaches for processing the experience of racism. Beyond interdisciplinary exchange [95], there is therefore much to be gained from facilitating enhanced knowledge exchange among sustainability academics and practitioners in these and other communities to develop best practices for cultivating gut competences within higher education.

Conclusion

Grappling with distressing emotions is an essential competence for facing up to the scale of the sustainability polycrisis and sustaining the efforts necessary to heal, regenerate, and transform our world. Although emotional distress arising in response to the sustainability polycrisis is receiving increasing attention, recent sustainability competence frameworks do not yet place sufficient emphasis on the need to build capacity to navigate emotional challenges. To effectively maintain sustained motivation and engagement in the work of radical transformative change now required, it is thus crucial that competence frameworks for sustainability transformation explicitly include emotional recognition and holding, as well as emotional processing and integration.

Alongside the need for continued attention on head (analysis and imagination), heart (values and presence), and hands (action and implementation) competences,

working to develop appropriate strategies and practices to cultivate gut competence (emotional absorption and digestion) represents an exciting growth edge for research and education focused on sustainability transformations. Here, much is to be gained from exchanges and collaboration between sustainability scholars and practitioners, as well as across sustainability and justice fields. Recognising the importance of emotional competences and leaning into the challenge of developing appropriate ways to cultivate them will better position sustainability frameworks and educational programmes to support the dynamic interplay between the deep inner and outer transformations now necessary.

Funding Sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data Availability

No data were used for the research described in the article.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to thank three anonymous reviewers for their critical and constructive comments on the manuscript, as well as participants at the 2023 Transformations Conference for fruitful discussions and inspiring interactions. Deep appreciation is also extended to Associate Professor Filip Maric for helping to shape early versions of the head, heart, hands synthesis, as well as to Associate Professor Bruce Goldstein and Dr. Susanne Moser for constructive feedback on an early draft.

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Papers of particular interest, published within the period of review, have been highlighted as:

- • of special interest
- •• of outstanding interest

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A large number of higher education institutions offer sustainability programs. Yet, there is a high degree of variability and limited consensus on a specific key competence framework for sustainability. This study used a Delphi study of 14 experts in sustainability education to attempt to arrive at consensus on key competence frameworks, including highlighting areas of differentiation and overlap. A refined set of sustainability competencies are offered and related to basic academic competence (e.g. communication, critical thinking etc.) and topical knowledge (e.g. environmental sciences, humanities, etc.). Five key and two cross-cutting key competencies are presented as a result of the study: systems thinking, futures thinking, values thinking, strategic thinking, implementation (key competencies); integrated problem-solving and interpersonal (cross-cutting).

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The increasing prominence of global change impacts is foregrounding human experiences with and the mental health impacts of complex eco-emotions. This article summarizes literature on these challenging eco-emotions (worry, anxiety, and grief) and discusses how experiencing these emotions connects to motivation to engage in proenvironmental behavior. In self-report studies of subjective well-being, worry, anxiety, and grief are sometimes associated with lower well-being; sometimes with greater sense of meaning. People especially vulnerable to global change impacts and extremes report experiencing challenging eco-emotions more acutely. The article notes the importance of constructing coping strategies that fully account for different aspects of worry, anxiety, and grief, for example, meaning-focused coping; addressing stressors in tangible ways; and in participatory community-based activities.

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Coping, adaptation, and transformation are three frameworks for studying and helping people address eco-anxiety and ecological grief. This article aims to clarify a new model of how people encounter and experience eco-anxiety and ecological grief. The language of perceiving or awakening, experiencing, coping, adjusting, changing, or transforming is used with an understanding of these as phases that generally occur chronologically. The article makes the point that action, emotional engagement, and self-care are becoming crucial components of 'living

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There is a growing recognition that outwardly focused technological and scientific approaches to sustainability transformation need to be complemented with more humanistic, inwardly focused approaches. This includes aspects of human consciousness, values, worldviews, and mindsets. This article explores inner transformation as a deep leverage point (after Meadows 1999) for sustainability transitions. Inner transformation is explored through leveraging changes in intent (e.g. mindset); design (e.g. social structures); processes (e.g. interactions); and relationship to the material (e.g. stocks and flows). Each of these leverage points are further considered from the orientation of individual action and collective action. The article concludes with a word of caution about the constraints of traditional research and education structures hampering inner transformations for sustainability.

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There is increasing understanding of the mental health impacts of global climate change. The subtypes of emotional distress related to environmental crises, however, are less clear. This study conducted semi-structured interviews to better understand peoples' experience of eco-anxiety, eco-guilt, and eco-grief. The investigation revealed numerous subtypes related to each distressing eco-emotion, with aspects such as helplessness and frustration (eco-anxiety); guilt for one's existence (eco-guilt); and anticipated future losses (eco-grief). The article synthesizes six coping mechanisms ranging from direct action to social.

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Human activity driven by economic growth has radically altered Earth's climate. Impacts range from the acute, associated with extreme weather events — likely to increase in intensity and duration; to the accumulated, associated with childhood exposure to resource scarcity as well as the socially and environmentally determined marginalization and displacement of large populations; to the vicarious of anticipated environmental loss and ecological grief. The article describes how each of these acute and accumulated conditions qualify as traumatic events according to DSM-5 criterion A. Protective factors for resilience include prosocial adaptation and posttraumatic growth. Current initiatives in public health and policy are explored to address mental health traumas of climate change.

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Transformative sustainability education (TSE) is pedagogy seeking to advance ecological, spiritual, and cognitive dimensions in education. Drawing on experiences in the Portland State University Leadership for Sustainability Education program, the authors seek to theorize and explain TSE and present examples of contemplative pedagogies that support TSE. An ontology of relationality, unlearning, healing and reconnecting is viewed as vital in TSE, in contrast to Cartesian, modernist worldviews and their destructive ecological and cultural consequences. Contemplative pedagogues are described as encouraging experience with opening awareness to suites of internal and external experiences to develop self-awareness, mindfulness, and emotional regulation. The article presents a tree of contemplative practices ranging from silence to storytelling.

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