



Emotions and transformative learning for sustainability: a systematic review

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Abstract

As multiple global sustainability crises are getting more severe and existential, a better understanding of how people undergo deep personal transformations related to sustainability is needed. In the educational debate on sustainability learning, transformative learning theories are widely used. To analyze specific phases of transformative learning, we derived five meta-phases from the literature (novel experience, reflection, social exchange, shift of action, shift of meaning). Although human emotions often arise during the confrontation with sustainability issues and are central to moral action, no substantial, theorized understanding of the role of emotions within sustainability-related transformative learning exists to date. We conducted a systematic review (following the PRISMA guidelines) and screened 355 publications to close this research gap. After applying the exclusion criteria, the in-depth analysis of 20 studies showed that sound theoretical references to theories of emotion and transformative learning are rare. The review shows clearly that diverse emotions permeate sustainability-related transformative learning processes. Among these are both negative emotions to novel learning experiences concerning sustainability (e.g., sadness, shame, disgust, guilt) as well as positive emotions in the context of social exchange (e.g., awe, gratitude, fun) and associated with newly formed actions (e.g., fulfillment, pride). Accordingly, to enable emotionally positive learning experiences, relationship and action orientation are particularly important within sustainability learning. The analyzed studies call for an educational practice where emotions can be experienced, expressed, and understood in a safe atmosphere. Future research in this area should use more stable theoretical foundations for emotions and transformative learning theory and apply methods that can capture deeper levels of subjective experience.

Keywords Transformative learning · Emotion · Sustainable development · Sustainability learning · Education for sustainable development (ESD) · Systematic review

Introduction

Sustainability is about providing a good life for all, today and in the future. However, humankind is far from realizing this vision (e.g., Alvaredo et al. 2018; IPBES 2019; IPCC 2022; Rockström et al. 2023) and major individual, and

collective efforts are needed to ensure human survival on Earth. This requires more insight into the transformational processes through which individuals, groups, and societies move toward sustainability. It has increasingly been argued that individuals' inner dimensions are deep leverage points for fostering societal transformation toward sustainability (Woiwode et al. 2021). But one particular facet of these inner dimensions has long been neglected in sustainability research: human emotions (Ives et al. 2020). This seems surprising since human beings are always in emotional states (LeBlanc et al. 2015), and emotions, even if they are unconscious, fundamentally influence moral judgment and behavior (Haidt 2001).

A growing body of research in the sustainability context shows that emotions also play a central role when experiencing unsustainability and taking action for sustainability (for a typology, see Landmann 2020). For example, exposure to

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sustainability crises can lead to strong emotional responses that may also affect mental health in the long term (Burke et al. 2018; Lund et al. 2018), even when people are not yet directly affected (Ogunbode et al. 2021). Among those negative emotions are frustration (Verlie 2019), sadness (Cunsolo and Ellis 2018), anxiety, and worry (Ojala et al. 2021), which arise when people are confronted with issues such as climate change, biodiversity loss, and social injustice. The hopelessness that sometimes accompanies these emotions can even prevent people from engaging for a sustainable future (Grund and Brock 2019). This may result in a negative feedback loop between accelerating sustainability crises and paralysis of action (Coffey et al. 2021). At the same time, negative emotions such as anger regarding injustices in global crises, like the climate crisis, can lead to motivate individuals for action (Agostini and van Zomeren 2021). Positive emotions—such as pride, awe, or hope—can also be felt by individuals when they get involved in collective environmental action (Landmann and Rohmann 2020). These diverse and frequently strong emotional responses are hardly surprising, since emotions are evolutionarily deeply anchored patterns of reaction to experiences that are significant for survival and indicate the extent to which basic needs are met (Panksepp 2010). Accordingly, sustainability-related emotions are an adaptive response to dangerous and unjust human activities.

Education is a central sector that must address the emotional experiences of individuals. Education is also seen as a deep leverage point for sustainability transformations (Holfelder 2019; Otto et al. 2020) and holds “the power to transcend paradigms” (Meadows 1999, p. 19). Here, we refer to education and learning not only in the sense of compulsory school (“formal”) education, but with a focus on broader and life-long education and learning-related processes within and beyond formal educational institutions.

One of the most prominent theories in research on sustainability learning is transformative learning (TL; Singer-Brodowski 2023). Interestingly, this theory has been criticized as having underestimated the role of emotions throughout the learning process for a long time (Ali and Tan 2022; Taylor 2001). In recent years, however, more and more research has described the vital role of emotions in (transformative) sustainability learning (e.g., Bryan 2020; Leichenko et al. 2022), pushing toward an “affective neuroscience of TL to address twenty-first century issues” (Ali and Tan 2022, p. 85). Still, there is a substantial need for systematic and actionable knowledge on the role of emotions in TL for sustainability (Boström et al. 2018).

The authors of the present paper are aware of individual work that has explicitly or implicitly addressed emotions in transformative sustainability-related learning processes. For example, Ball (1999) showed how strong emotions were essential in several phases of transformative sustainability

learning. Other researchers also investigated the role of emotions in TL (though not sustainability oriented) based on the interconnectedness of cognition and emotion (e.g., Taylor 2001). However, no systematic knowledge on the role of emotions in transformative sustainability-related learning processes exists to date to guide researchers and practitioners.

To address this research gap, we report here on the results of a systematic review of empirical and theoretical papers, conducted in line with the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses; Page et al. 2021). Our review intends to systematize this emerging field and dives into the question of what role emotions play within transformative sustainability learning. It focuses on (1) theories applied for understanding emotions and TL, (2) connections between emotions and specific phases of TL, and (3) educational implications.

To enable us to allocate specific emotions to the respective phases of TL, we first summarize and compare core phases of TL described in three empirically based theories. We then define emotions and summarize first studies on emotions in transformative sustainability learning. After introducing the research questions and specifying the methodology of the systematic literature review, we present quantitative and qualitative results. Finally, we reflect on and discuss these results and describe avenues for future research in the conclusion.

Theoretical background

Transformative learning and sustainability

Sustainable transformations of human societies are of utmost importance in the background of the transgression of planetary boundaries and the danger of reaching global tipping points (Steffen et al. 2018). While the concrete understandings of sustainability, sustainable development, or even post-sustainability are the subject of ongoing debates, each with far-reaching implications (see e.g., Jickling and Sterling 2017; Kaul et al. 2022), we refer here to a concept of strong sustainability in which the integrity of ecological systems takes precedence over, e.g., economic interests (Ott et al. 2011). To achieve sustainability, transformative learning has become an important concept (e.g., Rodríguez Aboytes and Barth 2020) and is for example used in the UNESCO program ESD for 2030 (UNESCO 2021).

On the most abstract level, TL can be described as “processes that result in significant and irreversible changes in the way a person experiences, conceptualizes and interacts with the world” (Hoggan 2016, p. 71). For a learning process to be considered transformative, it has to be characterized

by (a) depth, describing a change that is significant and impactful, (b) breadth, describing learning outcomes manifest across several different contexts, and (c) stability, as the change needs to be permanent (Hoggan 2016).

Several authors have described phases of TL and their sequences in very different ways. In the following, we present and synthesize the empirically grounded work of three key theorists of TL who represent different relevant streams of theory (Mezirow is the founder of TL theory, Nohl links TL to discourses on *Bildung*, and Ball is, to our knowledge, the author of the first empirical study of TL in the context of sustainability). The result of our synthesis (see Table 1) provides the categories we use for our analysis.

Based on long-term analysis, Mezirow (2000) described an ideal–typical model of TL as an emancipatory process with 10 phases starting with a *disorienting dilemma* (Phase 1), followed by *self-examinations* (Phase 2), and *critical assessments of assumptions* (Phase 3). Other learners play a pivotal role in these phases of TL because the individual learners recognize that they are not alone with their endeavor of perspective transformation (Phase 4), they explore new options (Phase 5), plan new actions (Phase 6), cooperatively develop new skills (Phase 7), and try out new roles (Phase 8). In the later phases of TL processes, the learners deepen their self-confidence and competence (Phase 9) and reintegrate their new perspectives in their daily lives (Phase 10). For Mezirow, emotions occur especially at the beginning of a TL process in the second phase of “self-examination with feelings of fear, anger, guilt or shame” (Mezirow 2000, p. 22). In his later writings he additionally described the importance of “coping with anxiety over the consequences of taking action” (Dirkx et al. 2016, p. 124).

Based on narrative biographical interviews, Nohl (2015), in contrast to Mezirow’s assumption that a TL process starts with a disorienting dilemma, observed that the first phase is a *non-determining start* where “novelty, neither anticipated nor planned, breaks into life” (p. 39). After this *non-determining start*, most people’s TL process continues with *experimental and undirected inquiry* and *social testing and mirroring*. Only after that does a *shifting of relevance* take place, where the newly introduced practice gains a strong biographical meaning. “In a certain regard, this shifting relevance is functionally equivalent to the “disorienting dilemma” that Mezirow [...] places at the beginning of transformative learning” (Nohl 2015, p. 46). Nohl (2015) hardly refers to emotions, and when he does, the emotional states remain unspecified (e.g., “our interviewees recalled highly active and emotional experiences” p. 45).

Also, on the basis of qualitative interviews, Ball (1999) described five phases of sustainability-related TL. The most defining characteristic of the first phase, described as *leaving the familiar and entering a state of disequilibrium*, was “the

intensity of emotion accompanying it” (p. 259). In the second phase, *responses to the disequilibrium: making meaning*, “people often seemed to move directly from one way of being and behaving to another” (p. 261). Accordingly, in contrast to Mezirow, Ball did not find conscious reflection to be as important for the learning process. On the contrary, he describes meaning making as a non-rational and emotional process. Furthermore, in the third phase, *building commitment and personal responsibility*, “the role of passion, of intense emotion, is central” (p. 264). Also in the fourth phase, the *action phase*, “participants had strong feelings about what they should, wanted to, and planned to do” (p. 265). The fifth phase, *renewal*, is similar to Mezirow’s last phase: a newly found stability in which the renewed self is simply referred to as “the way I am” (p. 266). Ball (1999) sums up that “it was perhaps the clearest learning from this study—the degree to which emotions, and strong ones, accompanied transformation” (p. 268). It should be noted again that Ball (1999) is the only researcher who specifically focused on sustainability learning. Accordingly, the strong differences in the phases he found in his empirical material may be due to the particular content focus.

Although Mezirow (2000), Nohl (2015), and Ball (1999) provide a different order for their empirically reconstructed phases and build their work on various theoretical traditions, on a meta-level, we see overlapping elements in all three models (see Table 1). A comparison of the different perspectives shows that at the beginning of a TL process, learners usually face a *novel experience* (all other phases vary in terms of their temporal situatedness in the different theories). The *novel experience* either challenges previously held assumptions and leads to an irritation, or it is not perceived as meaningful at first but leads to exploration. The *reflection* phase is marked by conscious or unconscious exploration of learners’ previous assumptions or new experiences. Within the phase of *social exchange*, others provide resonance through exchanging ideas and feelings, reassuring learners by offering commonalities or providing feedback. New actions and habits are pivotal within the phase that we call *shift of action*. This includes trying out and establishing new roles and behaviors as well as developing new skills and competencies. The *shift of meaning* phase is a core result of TL. Here, in comparison with the old state of being, a fundamental shift in how learners experience and conceptualize themselves and/or the world emerges. Especially, Ball (1999) found a high relevance of emotions within all phases of TL. However, this insight does not seem to have been analytically explored so far (e.g., Weinberg et al. 2020). One reason for this could be the complexity of defining and researching emotions in the context of education.

Table 1 Overview of key phases of transformative learning

Key phase	Mezirow (2000)	Nohl (2015)	Ball (1999)	Description
Novel experience	Phase 1: a disorienting dilemma	(1) The non-determining start “... novelty, neither anticipated nor planned, breaks into life” (p. 39)	1. Leaving the familiar and entering a state of disequilibrium	The learner has a novel experience, which either: (a) disrupts previous assumptions, is therefore disorienting, and leads the learner into a disequilibrium or (b) is seemingly insignificant at first but leads to exploration
Reflection	Phase 2: a self-examination with feelings of guilt or shame Phase 3: a critical assessment of epistemic, sociocultural, or psychic assumptions	(3) Phase of social testing and mirroring Learners “exposed their new practices to the appraisal of other people and had the opportunity to reflect on them in light of the reactions of their interaction partners” (p. 41)	2. Responses to the disequilibrium: making meaning “In some cases, this phase seemed to be skipped entirely” (p. 261) “If these reflective activities actually took place (...) they seemed to happen inconspicuously (...), perhaps even subconsciously, and in the context of everyday activities” (p. 261)	The learner consciously, subconsciously or intuitively (a) examines previous assumptions and/or (b) reflects about the new experience
Social exchange	Phase 4: recognition that one’s discontent and the process of transformation are shared and that others have negotiated a similar change	(3) Phase of social testing and mirroring Learners “exposed their new practices to the appraisal of other people and had the opportunity to reflect on them in light of the reactions of their interaction partners” (p. 41)	3. Building commitment and personal responsibility Learners “reported that they drew ongoing support from a variety of sources, but perhaps kindred others provided the most reinforcement” (p. 264)	Learners experience themselves in a social environment that provides resonance through: (a) exchanging ideas and feelings/discourse (b) connection by commonality (c) social mirroring and feedback concerning the transforming self
Shift of action	Phase 5: exploration of options for new roles, relationships, and actions Phase 6: planning of a course of action Phase 7: acquisition of knowledge and skills for implementing one’s plans Phase 8: provisional trying of new roles	(2) Phase of experimental and undirected inquiry The learners “explore the novel practices” (p. 41) “These inquiries may be embedded in collective or individual practices, and instances exist of social learning (adapting to a group’s behavior) or of learning with artifacts” (p. 41)	4. Integrating through acting anew “Data from this study support the notion that action is necessary to confirm the transformation” (p. 265) “action served both to establish the new identity and commitment (...) and to make it more likely that those behaviors would occur again” (p. 265)	Learners try out new behaviors and roles. These new actions serve as exploration and establishment of new routines and entail the development of new skills

Table 1 (continued)

Key phase	Mezirow (2000)	Nohl (2015)	Ball (1999)	Description
Shift of meaning	Phase 9: building of competence and self-confidence in new roles and relationships Phase 10: a reintegration into one's life on the basis of conditions dictated by one's perspective	(4) Phase of shifting relevance “That the newly introduced practice turned from a marginal into a focused experience, that is, its relevance shifted, was indispensable for the transformative learning processes” (p. 43) “the crisis (...) stopped (...) other habits and social relations (...) and shifted the relevance to the newly introduced practice” (p. 44)	2. Responses to the disequilibrium: making meaning “In the current study, this break-out was accompanied by the shedding of old frames and a sense of unlimited new possibilities, visions and horizons” (p. 261) “Participants used terms connoting a sudden release, expansion, an awareness of much more than they had realized—more experience, more meaning, more interpretations and perspectives, more opportunities and possibilities, simply more world” (p. 261)	A shift of meaning is by definition the core element of transformative learning Learners undergo a fundamental shift in how they experience (bodily, sensory, emotionally, motivationally), and conceptualize the world (see Hoggan 2016)

What is an emotion?

“Everyone knows what an emotion is, until asked to give a definition” (Fehr and Russell 1984, p. 464). This definitional ambiguity is equally evident in the sources that address emotions in TL: most do not refer to any specific emotion theory (Ball 1999; Mälkki 2011; Scott 1997; Sterling 2010), some use neurobiological perspectives (Dirkx 2001; Mälkki 2019; Taylor 2001), one builds upon psychoanalysis (Dirkx 2006). Only Ali and Tan (2022) refer to both biological and more recent constructivist approaches and contrast them. We support an understanding of emotions as “both biologically grounded and culturally shaped” (Kuppens et al. 2006, p. 491). Such an integrative approach does justice to the complex multi-level properties of human emotions (Kappas 2002), which are based on innate primary emotional systems, influenced by lifelong learning processes (e.g., conditioning), and molded by thinking and metacognition (Panksepp 2007).

Despite the differences between paradigms in the various discourses, there is broad consensus concerning several aspects of human emotion. First, emotions are elicited by specific (external or internal) events (Scherer 2005). We react to the events depending on their “relevance and consequences for our needs, plans, and values” (Scherer and Moors 2019, p. 721). Furthermore, the emotional reaction consists of multiple components: based on a rapid evaluation process, called appraisal, reactions on different subsystems of the organism are elicited (Scherer 2005). Those include a change of subjective feeling, thinking, physiological activation, motor expression, and action tendency (Sander 2013; Scherer 2005). Accordingly, emotions determine the entire experience and action of a person and “index occurrences of value” (Dolan 2002, p. 1191).

Besides these general attributes, there are mainly two perspectives on how to describe emotions. On the one hand, emotions can be seen as *dimensional*, varying with regard to valence (positive vs. negative) and arousal (low vs. high) (Scherer 2005). The confrontation with climate change, for example, can lead to an emotional state subjectively experienced as negative and accompanied by a high degree of arousal. On the other hand, emotions can be viewed as *discrete* (ibid.). From this point of view, several basic emotions like anger, fear, sadness, and joy exist, while each emotion is characterized by a unique reaction pattern of the different components mentioned above (subjective feeling, thinking, physiological activation, etc.; see Tracy and Randles 2011 for an overview). In this understanding, climate anxiety would be an expression of the basic emotion of fear, coinciding among others with the activation of the sympathetic nervous system (e.g., heart rate increase) and behavioral schemes of fight, flight, or freeze. We acknowledge

the “importance of both dimensional and discrete models of emotion” (Harmon-Jones et al. 2017, p. 1), since both views hold true at different levels of our neurophysiology (Panksepp and Watt 2011).

The present review therefore examines, among others, what theoretical perspectives on emotions are used by the body of research on transformative sustainability learning. This could also include more concrete examples relevant to education, such as the differentiation between achievement, social, topic, and epistemic emotions (Pekrun 2014) or specific theoretical approaches, such as the control-value theory of achievement emotions (Pekrun 2006).

Emotions and transformative learning for sustainability

In Mezirow’s (2000) and Nohl’s (2015) work, emotions only play a subordinate role. Although early work on the relevance of emotions in TL exists (e.g., Scott 1997; Dirkx 2001, 2006), it seems that their significance is still underestimated (Ali and Tan 2022) and “much more attention needs to be given to both the role of emotions and implicit memory in the transformative process” (Taylor 2001, p. 220). Sterling’s (2010) assumption that a TL process “can be deeply uncomfortable, because it involves a restructuring of basic assumptions caused by the recognition of ‘incoherence’ between assumptions and experience” (p. 25) is further explored by current research on “edge emotions” (e.g., Mälkki 2019): negative and mostly unconscious emotions that result from an incongruence between meaning structures and experience and can therefore hinder TL processes. Overall, it is argued that sensitivity and an open, curious attitude toward all emotions, positive and negative, is central for a TL process (Mälkki 2011).

Despite increasing research on TL and emotions, no systematic overview and analysis of emotions in TL for sustainability exists to date. Examples of existing insights are, among others, that the initial moment triggering TL for sustainability is sometimes connected to positive emotions (Ball 1999; Lange 2004; see Lipkina 2021 for a broader debate), and sometimes mainly associated with conflicts, struggles, and dissonance (Wals and Heymann 2004; Walter 2011). The emotional complexity of sustainability learning is also illustrated by a biographical analysis of environmental activists showing that they underwent “a process of juggling hope and despair, an unconscious interplay of emotions” (Kovan and Dirkx 2003, p. 113). Nevertheless, we are only at the beginning of extending discussions of learning for sustainability beyond the limits of purely cognitive perspectives

(Boström et al. 2018). With this review, we therefore aim to synthesize existing evidence on the relevance of different emotions in different phases of transformative sustainability learning.

Aims of the systematic review

Given the need for a systematic approach to investigating emotions and TL for sustainability, we conducted a systematic review and addressed three specific research questions. First, we wanted to better understand how emotions and TL have been described from a theoretical perspective. Emotions can be conceptualized in several ways, which also affects how the results can be interpreted. To describe how the reviewed papers conceptualized emotions and TL, our first research question was:

Research question 1 (RQ1): What theoretical approaches to emotions and TL have been used?

With the second question, we were interested in a more nuanced understanding of emotions in the different phases of the TL process:

Research question 2 (RQ2): What emotions play a central role in which phases of the TL process?

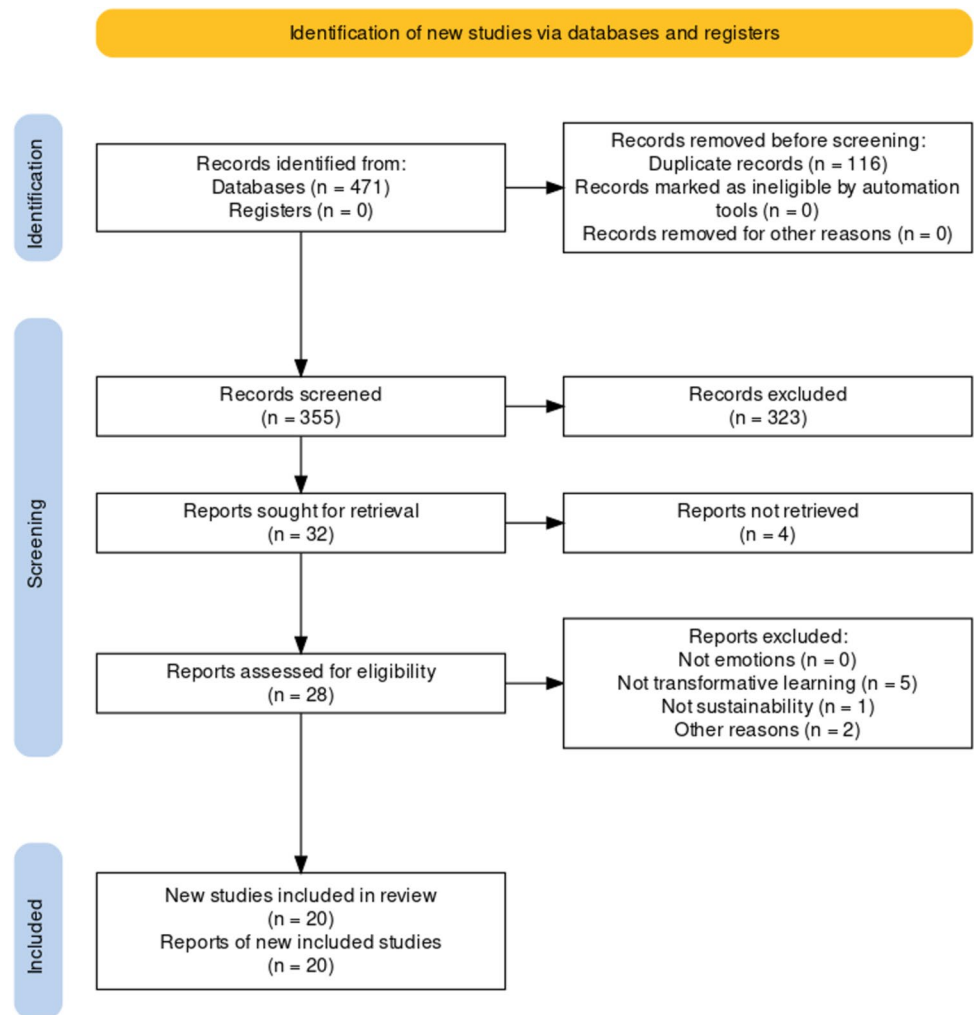
To derive implications for educational practice on the role of emotions in the different phases of TL, we addressed a final research question:

Research question 3 (RQ3): What implications for educational practice can be identified?

Methods

For our systematic review, we followed the latest PRISMA guidelines (Page et al. 2021). Based on the three components of the review (emotions, transformative learning, and sustainability), we systematically searched the databases of Web of Science (full search string: TS = "emot*" AND TS = "transform*" AND TS = "sustainab*"; 215 articles) and Scopus (full search string: TITLE-ABS-KEY("emot*") AND TITLE-ABS-KEY("transform*") AND TITLE-ABS-KEY("sustainab*"); 256 articles) on 06.07.2021, without restricting publishing years or document types. All results were then exported and automatically searched for duplicates with Mendeley. This resulted in an overall number of 355 articles (see Fig. 1).

Before the abstract screening, we defined the inclusion criteria based on our focus (see Table 2). Studies should deal with (1) emotions and refer to (2) TL by either mentioning a TL theory or by referring to a deep personal transformation,

Fig. 1 PRISMA flow diagram for the identification, screening, and inclusion of studies**Table 2** Overview of inclusion and exclusion criteria

Criterion	Inclusion The paper deals with...	Exclusion
1) Emotions	... emotions in general or specific emotions as part of the results or theoretical/methodological considerations	... emotions implicitly or only as part of the theoretical background or only as reference in the discussion
2) Transformative learning	... transformative learning at least implicitly within learning and education (including informal learning in civil society, regional development etc.) ... transformative learning in an educational context but no explicit theory is mentioned	... transformation is understood as change of external subjects or processes
3) Sustainability	... sustainability is explicitly or implicitly understood as a normative and political concept referring to inter- and intragenerational justice	... sustainability is understood as a longer timeframe or time-stable learning process

even if no explicit theory was mentioned. Finally, the studies needed to understand (3) sustainability explicitly or implicitly as a normative and political concept referring to inter- and transgenerational justice (in contrast to e.g., a time-stable learning process).

All three authors then independently screened the abstracts. Each abstract was manually evaluated using the platform *sysrev.com* by at least two authors to ensure common understanding of the inclusion criteria. Conflicting decisions about articles ($n = 49$) were discussed and

agreement for in- or exclusion was reached by all three authors. Given the high number of initially similarly coded abstracts (86.2%), the understanding and fulfillment of the inclusion criteria can be described as sufficient. The abstract screening process resulted in the further retrieval of 32 publications, of which four were manually excluded as duplicates.

For the full-text screening of the remaining 28, we equally divided the papers among the three authors. While one article was excluded because it was in Portuguese and one due to a large redundancy with a newer study that was included, six articles were removed either because they did not include TL or had a different understanding of sustainability. This was not apparent in the abstract screening. The final sample for the systematic review therefore included 20 publications.

In the course of the analysis, the papers were read in-depth. Each researcher coded the theoretical approaches to TL and emotions (RQ1) and the relations to specific phases of the transformative learning process (RQ2; see Fig. 2 in the results section) using a Google form as a standardized way of extracting information. The full dataset can be accessed as part of the supplemental material. All statements relating to emotions for the specific phases were collected in a table based on these codings. Every occasion of emotions in the specific phases was then abstracted to the word, which describes the emotional reaction. While these words are presented in the results to give an overview of the emotions relevant in the particular phases (Fig. 3), we explicated these occasions in the text. Finally, every researcher coded possible educational implications based on their papers (RQ3). We also evaluated if the papers focused on formal education (e.g., higher education) or non-formal learning (intended, structured but not leading to a formal degree) / informal

learning (unintended/unstructured). The codings for the theoretical approaches and phases can also be found in the supplemental material.

Results

Overview of the sample

The largest proportion of the 20 papers were written by authors from Europe (65%). Three papers originated from North America and two from Australia. One publication each originated from Africa and Asia. 75% of the articles were empirical papers and 25% theoretical. Within the empirical work, most articles (67%) used qualitative methods, three used mixed methods, and two quantitative methods. More than half of the articles (62.5%) focused on non-formal informal learning and 37.5% referred to formal education (mostly in a university context).

Theoretical approaches to emotions and transformative learning (RQ 1)

Most articles (75%) did not reference a specific theory of emotion as a basis (in the broadest sense). The emotion theories or conceptualizations used were moral emotions (Haidt 2003), core affect (Russell and Barrett 2009), theory of constructed emotion (Barrett 2017), Porge's Polyvagal Theory (2017), Pekrun's (2006) control-value theory of achievement emotions, socio-emotional competencies (CASEL 2003), emotional intelligence (Mayer and Salovey 1997), and the interconnectedness of cognition and emotion (Pessoa 2008). These references were mainly made very briefly in the articles. The lack of references to emotion theories was also visible in the diversity of concepts referred to as emotions and

Fig. 2 Frequency with which the different phases of transformative learning (blue) and emotions within the phases (red) are implicitly or explicitly addressed within the 20 in-depth reviewed publications

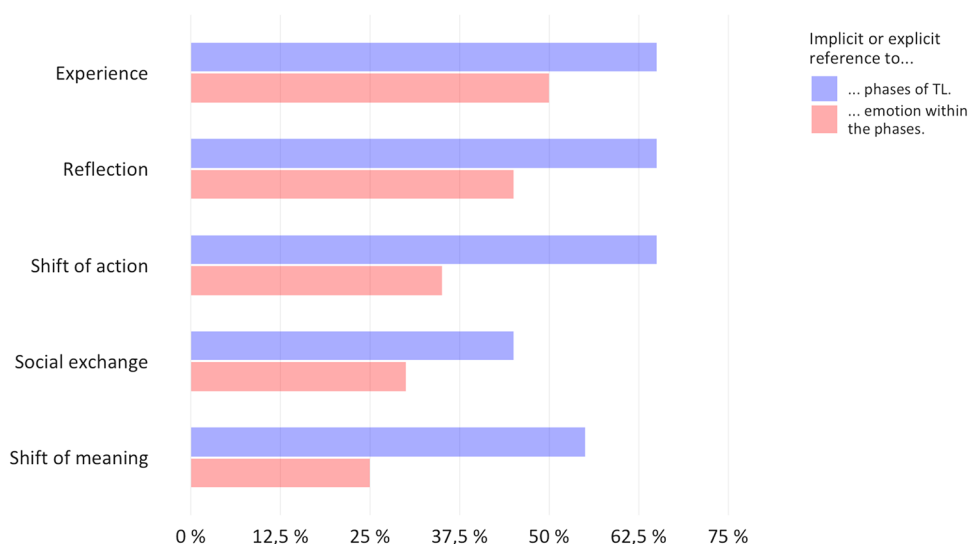
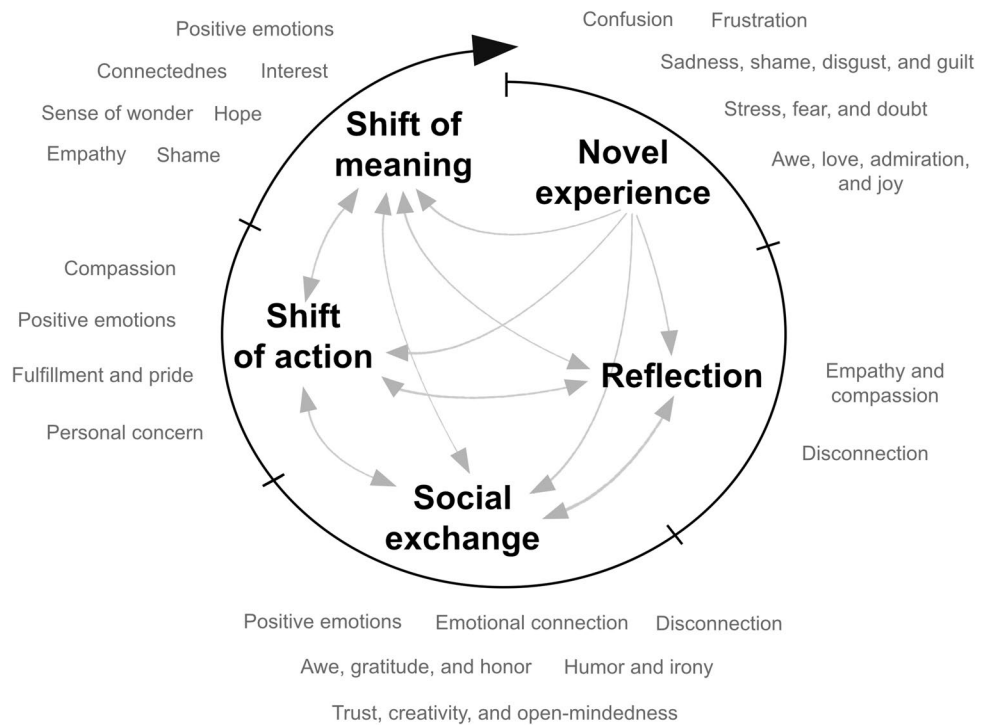


Fig. 3 Overview of specific emotions relevant to the phases of transformative learning. Black words inside the circle point to the phases of transformative learning, while gray words refer to descriptions of emotions from the 20 in-depth reviewed articles



missing references to other concepts from emotion theory such as the distinction between dimensional and discrete emotions.

Twelve of the 20 papers did not explicitly refer to a theoretical approach to TL, while seven papers mentioned Mezirow. Additionally, reference was made once to Taylor and Cranton (2013), who in turn refer to Mezirow in their paper. It seems particularly interesting that not one of the 20 articles, all dealing with emotions in transformative sustainability learning, referred to Ball (1999), who, in contrast to Mezirow (2000) and Nohl (2015), specifically focused on sustainability-related learning, although all of them were published after 1999.

The phases of TL (see Fig. 2) that were most relevant in the articles were *novel experience*, *reflection*, and *shift of action* (in 65% of the articles). Regular attention was also paid to *shift of meaning* (55%) and *social exchange* (45%). When looking at the phases of TL where emotions were reported, the frequencies decrease. In 50% of papers, emotions were reported in the *novel experience* phase (one time specifically with regard to the disorienting dilemma). A decreasing number of publications refer to emotions in the phases of *reflection* (45%), *shift of action* (35%), *social exchange* (30%), and finally *shift of meaning* (25%).

The role of emotions in transformative learning for sustainability (RQ 2)

A majority of the studies did not provide an explicit theoretical foundation for TL. As a result, many studies did not address phases of TL explicitly, nor did they analyze the temporal sequence of the phases. Nevertheless, *novel experience* seemed to always act as a starting point for TL. In general, across the different phases, a variety of emotions were described. Negative emotions were predominantly, but not exclusively, reported in response to *novel experiences*. In contrast, positive emotions seemed to be central in the phases of *social exchange* and *shift of action*. At the end of the learning process, positive emotions seemed to result from the fact that one's values and one's being in the world were congruent again. In the following, the individual phases of TL are examined in greater detail (see Fig. 3).

Novel experience

The *novel experiences* were at times pedagogically intended and designed (Saravanamuthu 2015; Tillmanns 2020), represented new experiments within a novel context outside from everyday life (Ulusoy 2016), or happened in everyday life, for example when people were confronted with environmentally relevant behaviors such as taking a plane (Jacobson et al. 2020). Most emotions described in this phase were negative: confusion on leaving one's comfort zone (Ulusoy 2016), frustration (Pisters et al. 2020), sadness, shame,

disgust, guilt (Tillmanns 2020), stress, fear, and doubt (Förster et al. 2019). By contrast, Grimwood et al. (2015) described several positive emotions like awe, love, admiration, and joy as a reaction toward immediate nature experiences, e.g., when “watching the simple peacefulness of a flowing river” (ibid: 143). Other sources of positive emotions were cooperative processes of creating positive future scenarios within a workshop setting (Pereira et al. 2018). This illustrates how not only negative, but also highly positive emotional experiences can initiate TL processes.

Reflection

Reflection was more an ongoing and accompanying activity than a particular phase in the different TL processes described in the studies. In one case, specific pedagogical instructions aimed for reflection through the use of reflective diaries (Tillmanns 2020). In other studies, reflection was the core of interventions fostering mindfulness, which helped to prevent people in adhering to unsustainable behaviors such as impulse buying (Gómez-Olmedo et al. 2020; Sermboonsang et al. 2019). The content of reflection included both emotional self-reflection on one’s own identity (Ulusoy 2016) and on one’s own behavior (Jacobson et al. 2020), as well as reflection on society’s values (Ives et al. 2020; Pisters et al. 2020) and on outer hegemonic structures (Saravanamuthu 2015). Reflection on outer aspects was also connected to personal feelings of disconnection to previous contexts and communities, when people got to know alternative ways of being and belonging (e.g., more communitarian; Pisters et al. 2020). Additionally, reflection was seen as a gateway to building empathy and compassion toward others (Ives et al. 2020). In every case, reflection was not a purely cognitive process of distancing oneself from previous assumptions, but an emotional one as well (Hollis-Walker 2012).

Social exchange

The phase of *social exchange* was accompanied by often deep, and mostly positive emotions. Especially genuine fun within the group of learners was seen as transformative, because it ensured that the diverse emotions that arose in sustainability learning could be expressed (Ulusoy 2016). There were also several possibilities for social exchange in informal settings: performative methods such as theater plays offered a possibility for using humor and irony when exchanging views on the normally negative aspects of environmental problems like climate change (Juárez-Bourke 2018). Within the context of Indigenous tourism, learners reported a variety of emotional experiences concerning their social interaction with Indigenous People (Lloyd et al. 2015): they felt a strong emotional

connection, bonding, and experienced “a sense of awe and honor at gaining access to privileged spaces, knowledges, and ceremonies” (p. 9). Further, they “felt a deep sense of gratitude” (ibid., p. 9) and were extremely moved by the openness of the Indigenous People with whom they shared lives for the time of their visit. The strong bond and experience of connection (“we’re all the same”) meant that bidding farewell was also a “painful experience” (ibid., 9). For such social bonding to arise, Pereira et al. (2018) pointed out the relevance of a sense of safety in social interactions (achieved here through a: “comfortable physical space with sufficient break-out rooms and privacy”, p. 11). Accordingly, safe spaces can foster trust and creativity and increase learners’ open-mindedness (Pereira et al. 2018). Based on a study of ecovillage residents, it was shown that joining a community was a critical step toward sustainable living and, for many, a reaction to the disconnection they had previously experienced (Pisters et al. 2020).

Shift of action

Few studies described specific emotions during the *shift of action* phase. In those that did, however, it is clear that the shift of action was associated with positive emotions. Specific discrete emotions such as fulfillment and pride were reported to accompany this phase (Ulusoy 2016). Especially the experience of making a difference through the newly integrated action was described as “the best feeling in the world” (Ulusoy 2016, p. 6). Also, the feeling of “giving something back to the environment” in the sense of reciprocating nature’s generosity through facilitating young people’s wilderness experiences was reported (Grimwood et al. 2015, p. 142). Both studies saw positive emotions as reinforcing the newly adopted behaviors and roles. New skills and competencies were also developed due to and connected with shift of action, such as the capacity “to be compassionate towards self and others” (Pisters et al. 2020, p. 402). Finally, critical–emotional connections through personal concern for specific sustainability issues were reported to be a significant motivator for personal lifestyle changes (Saravanamuthu 2015) or more pro-environmental behaviors (Jacobson et al. 2020).

Shift of meaning

Within the analyzed studies, the *shift of meaning* phase was sometimes accompanied by new habits of feeling toward oneself or the world. In one instance, this was experienced as shame toward the old self (Lloyd et al. 2015). Besides this negative emotion, several positive emotions were reported on: greater interest regarding the subject area

(here “Indigenous issues” *ibid.*, 14), a sense of wonder for the world (Moriggi et al. 2020), hope (Wamsler 2020), as well as a stronger connectedness toward oneself, nature and other beings (e.g., Lloyd et al. 2015). The latter was also expressed through a more pronounced empathy (*ibid.*) and care for other beings (Moriggi et al. 2020), also resulting in a stronger commitment to social justice (Lloyd et al. 2015). Accordingly, TL can finally lead to more positive emotions when one’s values and actions become congruent (Hollis-Walker 2012).

Educational implications (RQ 3)

Answers we found to our last research question showed consensus about the need to reserve space for emotions and reflecting on them in education (e.g., Saravanamuthu 2015; Soini et al. 2019). For this purpose, educators need to create “safe spaces to feel” (Moriggi et al. 2020, p. 294; Förster et al. 2019). In those spaces, negative emotions and discomfort can be recognized (Ives et al. 2020; Lloyd et al. 2015) and expressed (Saravanamuthu 2015), leading to emotional awareness being nurtured (Moriggi et al. 2020). This also leads to minimizing the risk that learners might repress or numb negative emotions (Pisters et al. 2020). It is helpful in that regard when educational work is conducted with ample time and in comfortable physical spaces (Pereira et al. 2018).

In emotion-sensitive sustainability education, the role of educational practitioners is characterized by being a facilitator or coach (Hollis-Walker 2012). In the case of time-limited learning settings, it can be useful to create opportunities for learners to share and reflect on their experiences with others in the future (e.g., by organizing a follow-up meeting or exchanging contact possibilities; Lloyd et al. 2015).

Besides these general considerations, several articles mentioned specific methods for giving space to emotions in educational settings. This often included the use of embodied and creative techniques (Förster et al. 2019) for example through arts (Moriggi et al. 2020; Galafassi et al. 2018; Pereira et al. 2018) or wilderness experiences (Grimwood et al. 2015). A concrete example is the usage of theater (Juárez-Bourke 2018), where a thematic exploration with imagination, humor, and empathy becomes possible while also maintaining a certain level of distance (Heras and Tàbara 2014). Likewise, practicing mindfulness can increase overall emotional sensitivity, reflection, and the capacity to regulate emotions, making mindfulness both an attractive self-applied practice for educational practitioners as well as a useful technique in their educational work (Gómez-Olmedo et al. 2020; Sermboonsang et al. 2019). Also, specific methods were used to initiate a transformative or disruptive learning experience,

e.g., visual cues, like the picture of Alan Kurdi, “the three-year old Syrian boy, who drowned off the Turkish coast because their boat capsized shortly after leaving Bodrum” (Tillmanns 2020, p. 24). In general, an openness and curiosity to experimenting with new methods and approaches seems important to develop emotionally sensitive education practices (Moriggi et al. 2020).

Discussion

Expanding emotion in transformative learning theories

The results of the systematic review for our first research question relating to theoretical approaches for describing emotions in sustainability-related TL showed that only few papers included explicit references to emotion theories or defined related concepts. Rather than systematically describing their theoretical background, most studies included emotions as relevant phenomena that were reported as new findings. Only few studies were constructed explicitly for investigating the role of specific emotions in a transformational learning process (e.g., Robina-Ramírez et al. 2020). This missing grounding in theory was also visible for the approaches to TL. As described above, the majority of studies did not explicitly define TL, nor did they research specific phases of TL. When TL was defined, Mezirow’s TL theory was most often used as a theoretical framework.

These results illustrate the need for further theoretical clarifications on emotions and TL within this research area. With more clarifications, researchers would be able to further illustrate causes and effects of specific emotions or emotional states in the respective phases of TL (see Carter and Nicolaidis 2023 regarding the disorienting dilemma). One example would be the application of the control-value theory of achievement emotions, which has been prominent in research on emotions in education (Pekrun 2006). In this framework, peoples’ evaluation of control and value to a specific situation predicts their experienced emotions. In the face of sustainability education, due to the global nature, people may experience only scarce control but may attribute a positive value to issues such as climate change, leading to feelings of hopelessness (Pekrun 2006). This feeling may emerge in the phase of novel experience, when people experience the missing control, e.g., when learning about the insufficient political actions. In the course of a TL process, subjectively experienced control and thus emotional reactions may change.

Most studies were qualitative and used interviews, but only few tried to explore the deeper layers of learners’

subjective experience when they are dealing with sustainability issues. By using thick phenomenological methods (e.g., the micro-phenomenological interview; Petitmengin et al. 2019), the depth of knowledge regarding inner emotional experiences could be deepened in future research. Quantitative methods could also be combined more frequently with qualitative methods to analyze connections between specific constructs. For example, it would be relevant for educators to know whether a specific threshold of emotionality for *novel experiences* is needed to initiate TL processes, and how this threshold can be measured. Furthermore, most studies relied on self-reports and no studies made use of methods such as electrophysiological or other non-self-reported methods, which is why self-reporting bias may have affected the results. Therefore, further studies should include a broader range of methods to assess emotions validly.

The role of emotions for transformative sustainability learning

Based on the results of our review and particularly looking at the different phases of TL and the role of emotions in this learning process, it was interesting to see that negative emotions were reported most frequently in the *novel experience* phase, i.e., at the beginning of a TL process. But studies also described positive emotions therein. For further research, this distribution of emotions within the first phase of TL would be an interesting starting point, because it can lead to new insights regarding the debate whether profound educational and learning processes are best initiated through irritations and associated negative emotions (e.g., Koller 2018) or new touching experiences and associated positive emotions (e.g., Lipkina 2021). Based on the reviewed studies, it seems to us that negative emotions (e.g., anxiety, anger, shame) are more frequent at the beginning, since learning about sustainability crises is often accompanied by a realization that the state of the world is worse than it was represented in existing meaning perspectives. The examples of positive emotions were found in the context of experiences, where previous experiences or expectations were positively exceeded. This is the case, for example, with moving experiences in nature (e.g., Grimwood et al. 2015). The latter underscores the relevance of place-based learning within the natural world in sustainability education (e.g., Selby 2017) for fostering positive emotions and reconnecting people with nature (Ives et al. 2018).

In further phases of transformative sustainability learning, more positive emotions were described. During the phases of *social exchange* and *shift of action* in particular, only few negative emotions were mentioned. This strengthens the need to focus on collective action within sustainability education, because it buffers, balances, and counteracts

the prevalent negative emotions. As positive emotions are also connected to sustainable behavior, such positive emotional experiences may also in turn increase motivations to act sustainably (Büssing et al. 2019). Additionally, the *shift of action* phase and associated competency development is critical for finding new stability within a TL process. Furthermore, almost exclusively positive emotions were found in the *shift of meaning*. Regarding those, an interesting typology of positive emotions can be applied: “eudaimonic emotions can be defined as positive affective reactions to human virtues (e.g., moral and intellectual virtues), while hedonic emotions refer to positive affective reactions to self-focused short-term goals (e.g., pleasure)” (Landmann 2020, p. 192). Most emotions found in the shift of meaning can be classified as eudaimonic (sense of wonder, connectedness, hope), whereas no hedonistic emotion was reported, indicating that virtue is the central learning motivator, not short-term self-focused need satisfaction. Accordingly, this reflects the moral orientation of sustainability on the individual emotional level.

For educational practice, the distribution of the different emotions among the different phases of TL can provide insights into emotion-sensitive pedagogical accompaniment of the different phases and emphasizes the importance of learning in the context of sustainability through social exchange and action (see next section). Nevertheless, it remains to be stated that the different temporalities of the phases as we have summarized them in our integrative model (Table 1) remain an ideal–typical conception.

While the implicit references to different phases of TL in the papers reviewed were not that elaborated, the hints about specific emotions within the different phases were at times even more unclear. Further research would benefit from diving deeper and more systematically into the different emotions within each of the different phases of TL to better understand the character of the process of such learning. This could be approached by, e.g., analyzing what cognitive appraisals lead to what emotions (Pekrun 2006), or asking participants explicitly about their emotional experiences (e.g., Oberauer et al. 2022) and how they deal with them. If possible, longitudinal designs should be used in the context of various learning settings (e.g., in different educational areas over different periods of time), learning methods (e.g., knowledge dissemination, situated, or experience-based learning), and sociodemographic groups, so that the complex learning process can be understood in fine-grained terms. This could also help to better understand where new experiences and disorienting dilemmas do not result in a TL process. Furthermore, once a TL process is completed, it may be followed by another one that builds on the previous one. Thus, accompanying learners over long periods of time would be of high interest to research.

Educational implications

In general, TL processes cannot be controlled from the outside: “the locus of learning, of meaning, and of transformation appear(s) to be in the person, not in the event” (Ball 1999, p. 258). Educators can therefore only create supportive learning conditions (Mälkki and Green 2016). As shown in the results section, the diverse emotions that accompany learners in sustainability-related TL processes require specific educational approaches. Learning environments that are safe enough to open up toward emotions are needed (Singer-Brodowski et al. 2022). In these, emotions should not be repressed but explicitly addressed (Selby and Kagawa 2018). This is especially essential because we “cannot selectively numb emotions. By numbing negative emotions, we will also numb joy, gratitude and happiness” (Pisters et al. 2020, p. 404, based on Brown 2012). Thus, sustainability education that invites expressing emotions not only promotes constructive hope (Ojala 2015) it may simultaneously contribute to greater well-being (Hu et al. 2014; Kennedy-Moore and Watson 2001). Inevitably, this challenges the traditional role of educators as mere knowledge brokers.

It seems to be central to nurture trusting interpersonal relationships and to support a togetherness that is characterized by curiosity and mutual appreciation. This therefore means that sustainability-oriented educational work focuses more strongly on relationships and relationality rather than on information (see also Lange et al. 2021). This also makes sense against the background of the increasing informedness of society as a whole: more and more people have new and partly disorienting experiences regarding sustainability issues outside of organized educational settings (e.g., via the media) that alarm them (Leiserowitz et al. 2021). When the quality of relationship is prioritized within education, the role model function of practitioners must be emphasized. Practitioners should show authenticity, vulnerability, and interest in inner worlds; thus, educators’ social-emotional competencies become crucial (Galtseva et al. 2020). To build the trustful relationships and learning environments where emotions can be expressed and reflected on, longer-term learning formats could be advantageous.

In addition, there is a need for methods that are no longer based purely on the paradigm of cognitivism but on embodiment (Bentz et al. 2022), as emotions are always embodied phenomena (Hartmann et al. 2022; Nummenmaa et al. 2014). It is advisable to move toward “holistic, integrative learning approaches wherein the body is made more visible as a source of knowledge” (Freiler 2008, p. 44; Shrivastava 2010). Such an embodied, interconnected, and thus holistic educational work is also described in the context of transformative sustainability education (TSE; Burns 2018).

The large proportion of publications with a focus on non-formal / informal learning in this review might indirectly

indicate that the formal education sector in particular adopts an educational paradigm that includes emotions and embodiment only with great precaution. This is supported, for example, by the lack of curricular anchoring in the school system (Grund and Holst 2023). The neglect of emotions in educational systems can partly be explained by the separation of critical thinking and emotions inscribed in Western thought (Barbour 2016) and the risk that emotions are used to manipulate and indoctrinate (Zembylas 2022). Emotionality might have also been avoided in formal educational settings because strong emotions are challenging to deal with and therefore may overwhelm teachers or learners. However, it is possible as an educational practitioner to influence the potential depth of emotionality. For example, expressing one's feelings can be preceded by talking about possible emotions of other people or expressing the emotions of a character that one embodies in a theatrical performance. Thereby, educators can create emotionally sensitive sustainability education, even with large and unknown groups, and adjust the level of emotional depth along with increasing trust. By whatever methodology, holistic change “requires a healthy interdependence between affective and rational ways of knowing” (Davis-Manigault et al. 2006, p. 27).

Beyond these suggestions regarding transformative sustainability education, what also needs to be considered is the extent to which aiming for TL is ethically legitimate (see Yacek 2020). This concerns, for example, the deliberate setting of disorienting stimuli to initiate a TL process (Tillmanns 2020). On the one side, a confrontation with sustainability crises may cause lasting psychological distress because the new insights about the world are too disorienting, or the learner has too few resources to integrate the new experiences at that specific moment. On the other side, it has been argued that a ‘pedagogy of discomfort’ may be ethically ambivalent, but nevertheless necessary to achieve far-reaching social change (Zembylas 2015). The question of how much disruption and disorienting dilemma learners can be expected to face and what pedagogical strategies do not leave learners alone with the disruption remains an essential question for further research.

Limitations

An important discussion that can hardly be conducted on the basis of our sample, but is crucial for further work, is the question of taking emotions into account in TL processes among people in the Global South (see Varela-Losada et al. 2022). Here, disorienting dilemmas are triggered to a much greater extent in people’s everyday lives by existential crises such as droughts, famines, or extreme weather events that are the long-standing historical consequences of global injustice and colonial history. Trying to pedagogize these crises is

highly problematical, and political action may be needed first and foremost. Against this background and the general Northern bias in peer-reviewed publications, it is not surprising that hardly any studies from the Global South could be found in our original scanning of the literature (exception: Pereira et al. 2018). However, differences in the emotions that arise and how they are dealt with have already become apparent, for example, in a comparison between climate activists from the Global North and South (Kleres and Wetters 2017).

Another limitation concerns the search criteria: it is possible that articles were not found because the search terms were chosen on an abstract level (“emotion” instead of searching for a wide variety of discrete emotions). As a result, the research findings are less precise than they could be. Furthermore, the varying degree of detail of the different publications made it sometimes difficult to compare them and integrate the results.

Conclusion

Our systematic review has shown that sustainability-related TL processes are permeated by diverse emotions, these should be expressed, and appropriate pedagogical spaces and relationships are necessary for this. Today, emotions such as climate anxiety and ecological grief are far more common and it seems to us that many people are likely to have already gone through a disorienting dilemma related to sustainability crises. Accordingly, a special pedagogical focus on social exchange and action might be appropriate within education. In this context, positive and “negative emotions (...) can act as key drivers of positive transformation in collaborative groups” (Hogan 2020, p. 698).

At the same time, our results show that this branch of research is still in its infancy. Indeed, the studies presented are rare and mostly based on a thin theoretical foundation with regard to emotions and TL and often lack detail. This is in line with our impression that the studies we found came from different disciplinary backgrounds and therefore do not yet speak a unified language with clear definitions and concepts. The question remains open to what extent the diverse emotions described in the different phases of TL occur specifically with reference to sustainability learning or play a general role in TL, regardless of the topic. The meta-phases of TL that we derived from the literature may help structure research without simultaneously assuming limiting presuppositions about a specific sequence of phases.

To sum up, emotions provide the “motivational force for what is best and worst in human behavior” (Dolan 2002, p. 1191). From this, it seems that global sustainability transformations depend on the development of new feeling habits.

The current literature shows that these changes come about through learning processes that are infused with emotion. Accordingly, future research should acknowledge and further explore the central role of emotions in sustainability-related TL. For educational practice, this means avoiding the instrumentalization of emotions while giving them space for expression. This is a first step toward emancipatory, emotionally competent sustainability learning.

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Data availability The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

Declarations

Conflict of interest The authors declare no conflict of interest.

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