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The potential of transformative learning for sustainability transitions: moving beyond formal learning environments

Mandy Singer-Brodowski¹

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Abstract

Transformative learning has become one of the most prominent learning theory in regard to sustainable development. It holds enormous potential for explaining and accompanying learning processes related to processes of transformation for sustainability, especially due to its emphasis on changing meaning perspectives in discussions with others in spaces free of coercion. In addition, it inspires learners and educators to pay particular attention to emotional challenges when they engage in critical thinking. This theoretical paper explores the potential of transformative learning theory by examining informal learning environments where people do not explicitly intend to learn but learning happens en passant or incidentally. It shows the ability of transformative learning theory to explain what can happen on the level of individual learning, organizational learning, learning in multi-professional networks, and learning in transdisciplinary or transformative research cooperation processes. Based on this analysis, recommendations can be derived to stimulate, enable, and accompany transformative learning processes for sustainability.

Keywords Transformative learning · Sustainability transitions · Organizational learning · Transdisciplinary research

1 Introduction

Global sustainability problems are characterized by uncertainty, controversies, complexity, and dilemmas. They challenge humanity to find completely new ways of recreating societies in order to stay within planetary boundaries (Steffen et al., 2015) and create a just and safe space for humanity (Raworth, 2012). For this reason, these challenges are very much entangled with education and learning. To create a sustainable future and reach the Sustainable Development Goals (SDGs) by 2030, people in western societies in particular must fundamentally and quickly unlearn their current ways of consuming, producing, economizing, living together, and creating their communities. In the end, this is a deeply collective and lifelong learning endeavor for people from all age groups which should be

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voluntary in democratic societies. It also alters all societal forms of organizing institutions and even how research about these transformation processes is done.

Nevertheless, current approaches to and research projects on Education for Sustainable Development (ESD) are in a large majority focused on individual attitudes, single teaching units, and ways of fostering individual learning outcomes for sustainability through specific and structured didactical formats for young people in the formal educational system (e.g., Rickinson, 2001; Sinakou et al., 2019). Furthermore, many attempts to learn in the context of sustainability involve an optimistic and individualistic bias that does not consider the systemic and institutional roots of the global lack of sustainability (Boström et al., 2018). On the conceptual level, there are ambitious efforts like the Whole Institution Approach (e.g., Schopp et al., 2020, Holst 2022) that focus on organizational changes with the aim of creating more authentic learning environments and helping to green educational institutions. Additionally, there are some insights related to network creation and governance within the context of ESD (e.g., Bormann & Nikel, 2017; Kolleck, 2019; Sol et al., 2018). In the end, however, the question of how to create learning environments for collective learning processes for sustainability transitions in informal learning contexts beyond educational institutions—that is, contexts in which people do not explicitly *intend* to learn something or gain a specific qualification—has thus far remained largely under-theorized (van Poeck et al., 2018). Informal learning can be described as learning that is not structured regarding learning goals, does not lead to any qualification, and takes place outside of educational institutions (European Commission, 2001). While informal learning is one of the dominant fields of learning, especially for adult learners (Livingstone, 1999), its potential for sustainability transformation remains largely unresearched. This potentially concerns individual learning for sustainability, learning processes for sustainability on an organizational or a network level, and even learning processes within transdisciplinary or transformative research processes (for this differentiation in the context of ESD, see Barth & Michelsen, 2013).

This paper aims to explore the potential of one theoretical perspective from educational theory in general and ESD in particular—transformative learning—for creating supportive learning conditions within informal and less-structured learning environments, like the workplace, public spaces of negotiation, or local voluntary activities. It will illuminate how transformative learning can enrich educational and communicative practices beyond formal educational institutions. The article discusses perspectives for sustainability transitions, especially in terms of enabling collective learning processes through examining the theoretical perspective of transformative learning for sustainability in individuals, organizations, multi-professional networks between practitioners, and transdisciplinary and transformative research processes.

Transformative learning can be described as a process of changing deeply held assumptions (i.e., *frames of reference* or *meaning perspectives*) about the world and oneself, thereby strengthening one's capacity to contribute to social change processes. Mezirow, the founder of transformative learning, described different phases within these processes of perspective transformation that can shed light on the conditions under which people can begin to actively engage in such perspective transformation. By reviewing the literature on transformative learning for sustainability, this article explores the potential of transformative learning theory to foster sustainability transitions. It will consider what this theoretical perspective can offer regarding how to foster informal learning environments that empower people to contribute more strongly to sustainability activities. This paper also enhances the understanding of how learning processes can take place within different learning environments, thereby contributing to better enabling learning processes in contexts that are not

explicitly framed as learning environments but where learning usually also takes place. In the end, this can also shed light on how to facilitate conditions that enable transformative learning processes and thereby accelerate the speed of the necessary sustainability transformations.

Section 2 will lay out the theoretical foundations of transformative learning in adult education in general. Section 3 will introduce the potential of applying transformative learning theory to the discussion of sustainability for individual learning, and Sect. 4 looks for the multifaceted possibilities of explaining transformative learning processes in organizations and local governance networks to foster sustainability transitions. Section 5 explores transformative learning potential regarding researching sustainability issues, especially in transdisciplinary and transformative research processes. The concluding section summarizes the potential of transformative learning theory and poses questions for further research.

2 Transformative learning

The concept of transformative learning has been well developed since the 1970s, when Mezirow worked out this theoretical perspective in the context of the women's movement. Mezirow conducted biographical interviews with women who participated in re-entry programs for college after their family obligations and analyzed their learning processes within these programs (1978). The roots of transformative learning are therefore connected to adult learning and inspired by social-constructivist theory, humanistic approaches, and critical theory (Eschenbacher, 2018). Mezirow's main argument was that adults hold deeply rooted assumptions, so-called *frames of references* and *meaning perspectives* (Mezirow, 1978), that form the basis of adult identity, providing one with orientation for everyday actions. For this reason, they are relatively stable and cannot be changed easily.

The aim of transformative learning is to create conditions that enable the adult learner to reflect on these frames of references (or broader habits of mind), to recognize how they influence the way learners are interpreting individual, organizational, and societal developments, and how they affect the individual and collective creation of meaning and sense-making, and on this basis, plan their actions. When learners can critically reflect upon and change their meaning perspectives, they can develop a more inclusive, critical, open, and reflective perspective on the world and continuously cultivate a deeper level of critical thinking (Mezirow, 2000). Mezirow described that transformations "often follow some variation of the following phases (...)

- A disorienting dilemma
- Self-examination with feelings of fear, anger, guilt, or shame
- A critical assessment of assumptions
- Recognition that one's discontent and the process of transformation are shared
- Exploration of options for new roles, relationships, and actions
- Planning a course of action
- Acquisition of knowledge and skills for implementing one's plan
- Provisional trying of new roles
- Building competence and self-confidence in new roles and relationships
- A reintegration into one's life on the basis of conditions dictated by one's perspective" (Mezirow, 2000, p. 22).

These ideal phases of learning clearly show that, for Mezirow, transformative learning is a learning process of the individual but always takes place within a group of learners and is deeply entangled with this group. He described the conditions in which such learning can occur, based on the Habermasian ideal of communication within discursive spaces with ideal speech conditions that are free of coercion and lead to the search for the best argument and democratic thinking. He therefore suggested specific conditions for creating learning environments for transformative learning: for example, that all participants have access to the same information or are open to alternative points of view (Mezirow, 2000, p. 13). Under these conditions, other people are critical to the learning individual because they critique current meaning perspectives, share their own feelings, and create room for the exploration of new meaning perspectives and practices.

While one of the main critiques of Mezirow is that he focused strongly on rational thinking and largely ignored emotional aspects within transformative learning processes (Taylor, 2001), in recent years several studies have theorized the role of emotions in changing meaning perspectives. Mälkki argued that neurobiological dynamics in particular may lead to resistance regarding developing critical reflection because questioning deeply held assumptions represents a risk to the stability of the identity and thereby provokes specific emotions, so-called *edge emotions* (Mälkki, 2019). She argues that people always want to maintain a certain stability in their identity, and questioning meaning perspectives therefore provokes stress. To avoid stressful perspective transformation, when negative emotions are too intense, people tend to deny or ignore demands to change their assumptions so that they can keep their neurobiological level of arousal relatively stable. This often happens without the individual learner's conscious awareness that it is occurring (ibid.).

Another stream of critique is rooted in Mezirow's assessment of learning in the context of social change. Especially in the early years of his theory, Mezirow warned of the negative consequences of reducing education to the goal of social change due to the risk of possible indoctrination (Moyer et al., 2016, p. 315). In his later publications, he emphasized the role of education as a contribution to societal-transformation processes (Chen & Martin, 2015, p. 89; Hoggan, 2016, p. 59). Based on the work of Freire (1970/2014), especially his concept of conscientization, Mezirow integrated perspectives from critical theory. He argued that adult education can lead to a "rigorous critique of the dehumanizing social, political and economic structures supported by ideologies. Through praxis, the union of reflection and action, learners engage in action to bring about social change" (Mezirow, 1991, p. 136).

Altogether, transformative learning has substantially contributed to many fields of education, like higher education and adult education, in recent decades. Over the years of development of this theory, it has been differentiated in certain theoretical streams and integrated insights from other disciplines or theories: for example, psychological insights or perspectives from critical theory (i.e., Brookfield, 2000; Taylor, 2007). It focuses mainly on how learning processes take place rather than operationalized learning outcomes, like certain competencies for solving respective tasks or problems. This is one of the main advantages of transformative learning theory in understanding how to create viable learning conditions (especially where people sometimes do not want to learn or are not involved in structured educational programs). One of the most concrete result of transformative learning processes can be described as an increased reflexivity regarding how people interpret and make sense of certain incidents happening in the world around them (Mezirow, 1991, p. 160).

Furthermore, transformative learning theory strengthens the perspective that learning processes can be facilitated by creating certain learning conditions instead of trying to steer

the processes themselves because the individual learner stays responsible for his or her own learning journey, especially when it comes to less-organized informal learning. This argument is also rooted in the theoretical perspectives of social constructivism and situated learning theory (Lave & Wenger, 1991/2011), in which knowledge cannot easily be transmitted or assimilated from one person (usually the teacher or an expert) to another person (usually the student). Instead of such a one-way perspective on learning, Lave and Wenger suggest the concept of learning as participation in a community of practice and changing one's own roles from that of novices to that of experts in a community through meaningful practices (*ibid.*). Facilitators who intend to enable situated transformative learning processes within particular groups of learners cannot and should not guarantee the occurrence of transformative learning processes. They can, however, create some supportive conditions to make them more probable while opening up possibilities for participating in a community of practice and trying to ensure communicative standards that support meaningful spaces for discourse that are free of coercion.

3 Transformative learning for sustainability on the individual level

In learning about the path for sustainability transitions, transformative learning has become one of the key concepts discussed (e.g., Lotz-Sisitka et al., 2015; Förster et al., 2019, Rodriguez Aboytes & Barth, 2020). It can make several contributions to sustainability issues: transformative learning links the collective search for a sustainable future to the ambiguity and uncertainty of this future as well as the controversies about the pathways to this future. Transformative learning for sustainability involves a paradigm shift in the sense of leaving and transcending our fundamental epistemology, which starts by recognizing our current way of thinking (Sterling, 2011). It comprises “the experience of seeing our worldview rather than seeing *with* our worldview so that we can be more open to and draw upon other views and possibilities” (*ibid.*, p. 23, emphasis in original). This experience of seeing our worldview instead of seeing *with* our worldview shall be illustrated through three examples of meaning perspectives within the context of sustainability.

3.1 Three examples of meaning perspectives in the context of sustainability

A first example is the 1.5-degree target in climate politics (IPCC, 2018), which does not fit the consumer and lifestyle habits of most people in Western societies. If social movements, politicians, or the media start to report on the necessary transformation paths to reach carbon-neutral societies and discuss their implications for the individual, people can become irritated and feel that their lifestyle and privileges and the connected meaning perspectives or worldviews are being questioned—meaning perspectives that might include the existence of endless resources and the continuously increasing economic growth that maintains resource-intensive lifestyles. Understanding the necessity of carbon-neutral lifestyles¹ to the relative stability of the global climate can provoke disorienting dilemmas and subsequently transformative learning processes.

¹ To reach a just transition, structural transformation processes on the political and economic levels are also needed (see below).

A second example in which problematic assumptions lead to unsustainable practices and can thus be questioned within transformative learning processes is the relationship of humans to non-human beings (Barrett et al., 2016; Spannring & Grušovnik, 2019). Transformative learning theory could raise questions about how connected or disconnected our relationships are as human beings to non-human beings and what implications this might have for treating these non-human beings in a particular way. Questioning a typical Western attitude of disconnection to non-human beings or excluding certain non-human beings from a more connected and less alienated relationship challenges anthropocentric meaning perspectives on and routines of meat consumption and the legitimation of extensive livestock farming (e.g., Rowe, 2016).

A third example for meaning perspectives can be seen in postcolonial perspectives: that is, the critique of Western concepts of “development” and the appreciation of indigenous forms of knowledge (e.g., Stein et al., 2020): Which ideas do people socialized in Western societies have about modernity and development, and how do these ideas influence colonial meaning perspectives about “development” in the global South? Which violence is connected with the Western style of thinking and what is the cost of ignoring indigenous perspectives? Questions like these have the potential to provoke irritation and disorientation within learning individuals. With this special focus on irritation and the accompanying disorienting dilemma that appears when one’s own assumptions do not fit new insights, entry points for transformative learning can be created.

3.2 Exploring transformative learning for sustainability on the individual level

These three examples show that transformative learning for sustainability enables educators to focus on irritation and disorienting dilemmas that arise when current meaning perspectives or worldviews do not fit the necessary change toward sustainability. Nevertheless, these examples also represent situations where questioning basic assumptions can hinder transformative learning processes and therefore fuel a resistance to change, especially when challenging (edge) emotions arise because the stable identity of learners is questioned and neurobiological dynamics lead to a denial or ignorance of the call for perspective transformation. This risk points to the necessity of adequately dealing with the normativity inherent in every sustainability debate. While normative demands of sustainability are bound to one overall direction—inter- and intragenerational justice—these demands cannot only imply simple answers or call for actions on the individual level within democratic societies. Here, discussions from educational theory can further illuminate the challenges of individual transformative learning within the context of sustainability.

For young learners in structured and formal learning environments, simple calls for action, like the plea for a vegan lifestyle as part of reconsidering the relationship between human and non-human beings, can lead to instrumentalization. These approaches to changing behavior have been strongly criticized since the beginning of the debate on ESD (Jickling, 1992) because teachers should not intervene with a specific perspective in individual opinion-forming and behaviour-changing processes (Yacek, 2020). In addition, the assessments of expert opinions on which actions are the most effective are controversial and subject to ongoing change. Instead of proposing a single recommendation for a more sustainable or carbon-neutral lifestyle, educators should create spaces for discussion, foster critical thinking (e.g., about structural barriers of sustainability transitions and emancipatory value education; Vare & Scott, 2007). This creates a more differentiated way of dealing with

normativity in which controversial issues are neither neglected nor solved by the teachers for their students (van Poeck & Östmann, 2020).

When considering adult learners in informal learning environments, reductionist perspectives on individual sustainability solutions or lifestyle changes risk provoking avoidance or denial because learners may feel stressed by the demand that they change their meaning perspectives and by the consequences for their daily actions (Mälkki, 2019). It then becomes less likely that they will enter a process of critical reflection and more likely that they will instead evade the demands posed by the necessity of transformation processes toward sustainability. The Habermasian ideal of communicative learning (Habermas, 1986/2007) within transformative learning theory enables a more sophisticated handling of normativity here. It strengthens the focus on democratic communication processes and conditions for discourse in which the best argument and pathway toward sustainability can be identified collectively. This gives rise to learning environments characterized by deliberative discourses that are free of coercion and thus stimulate controversial negotiation processes instead of posing single normative proposals for actions. Within these deliberative discourses, several communicative conditions are needed to create safe enough spaces safe for all learners involved (Singer-Brodowski et al., 2022).²

Within these processes of negotiating the best solution or strategy for certain sustainability problems, emotions will probably arise. Transformative learning theory can inspire educators or facilitators to examine these emotions, which occur when certain assumptions are questioned or challenged. Mälkki argues that it is necessary to be aware of emotions like fear, anger, or anxiety, as when they are too strong they can prevent critical thinking: “the theory of edge emotions depicts the resistance to reflection as deeply rooted in the biology of emotions and cognitive functions acting together in favor of self-preservation” (Mälkki, 2019, p. 60). Edge emotions lead to the maintenance of comfort zones and impede the transformation of “shared assumptions and social structures” (ibid., p. 63) before learners even enter a process of critical thinking. To maintain our internal stability, “we may rationalize, blame others or ourselves, avoid the situation or even meditate—whatever has become part of our implicit toolkit” (ibid, p. 65). To better address edge emotions, Mälkki suggests training our ability to recognize subliminal signals when edge emotions occur, assessing the cognitive threat they represent, and embracing them based on this assessment (ibid, p. 69f.).

For collective informal learning environments in discussions about sustainable transformation processes and the necessary individual and collective pathways, these insights imply a communication culture that is respectful and sensitive to challenging edge emotions. Educational scholars have only begun to better understand the role of emotions, like anxiety, anger, or grief, in learning processes about climate issues and sustainability (e.g., Ojala, 2016).³ What is known so far is that it is necessary to address them as a main force behind resignation or motivation to act for sustainability transitions (Grund & Brock, 2019; Verlie, 2019).

² It is this emancipatory approach in transformative learning theory that also creates the necessity of coping with expert opinions in a critical manner without aligning one’s personal views with conspiracy theories or fake news.

³ The multifaceted emotions that arise in the context of the climate crisis, like ecological grief or even feelings of guilt for being part of a Western elite that structurally produces systemic injustices, require pedagogical approaches to climate-change education that are sensitive to these emotions (Bryan, 2020).

When applying transformative learning theory to sustainability-related learning processes on the individual level, several insights can be derived that can also inspire learning in sustainability transitions in general. The first insight is a recognition that irritation can occur when people are confronted with the requirements of the necessary transformation toward sustainability. This irritation may lead to strong emotions and sometimes to reactance, especially when people do not have the capacity to take the time to reflect on their current meaning perspectives in more depth and share their feelings within a group of peers. As sustainability challenges like the climate crisis are not individual or biographical phenomena but collective ones, people in Western societies are currently experiencing collective disconcertion, irritation, and dilemmas, although they are usually not addressed as such. This gives rise to the second insight, which is the embrace of edge emotions and appreciation of them as signals of possible perspective transformation. Educators in informal communicative contexts could strive to collectively work with edge emotions by creating spaces for addressing and expressing them. Instead of supporting people in ignoring or avoiding threatening edge emotions by staying only within a rational discourse, they could use creative methods like theater and role playing. The third insight is the arrangement of communicative conditions that allow controversies to be addressed in an emancipatory manner, opening space for a discussion in which everybody is free to speak and people show responsibility for protecting the deliberative culture of communication and a space safe enough for transformative learning for everyone.

4 Organizational learning and learning in multi-professional networks

In addition to the potential of transformative learning to enable a better understanding of individuals' informal learning processes regarding sustainability, transformative learning can also elucidate how learning in organizations and multi-professional networks (e.g., governance networks) takes place. Organizational learning has much in common with transformative learning theory, and vice versa (Henderson, 2002), with the primary difference that organizational learning focuses on the entity of the learning organization, which is more than the sum of its parts (the learning individuals within the organization). One key question that can be addressed regarding organizational transformative learning for sustainability is how organizations can deal with the complexities, uncertainty, and controversies inherent in sustainability problems in order to embrace their responsibility toward sustainability.

The starting point of an organizational learning process is often a mismatch between a situation that is perceived as problematic for the organization (Argyris & Schön, 1978) or a discrepancy between the demand of the organizational environment and organizational performance itself. The literature on learning organizations asserts that, within organizations, two theories are at stake: those that are explicit and communicated (*espoused theories*) and those that are more implicit and used in the daily practices of the organization (*theories-in-use*; *ibid.*). When organizations begin to develop sustainability strategies, they try to change their espoused theories by adopting new sustainability guidelines or inventing and mainstreaming new organizational policies, like sustainability assessment or reporting. This does not, however, automatically have implications for the culture of an organization and therefore for the theories-in-use, which are often deeply influenced by new governance measures but also affect them in particular ways (e.g., Bauer et al., 2020).

The work of Argyris and Schön (1978) is particularly interesting regarding the question of how to change theories-in-use. They suggest a differentiation of certain forms of organizational learning. With reference to Bateson's (1972/2000) classification of proto- and deutero-learning, they assume a first-order learning (*single-loop learning*) and second order learning (*double-loop learning*). While the first one represents a kind of classical additive learning, the second one comprises both the critical inquiry and change of the organizational frame of reference and thus changes how organizations learn (Argyris & Schön, 1978). For this reason, double-loop learning alters the organizational preconditions for and capacity for perceiving, interpreting, and deciding on certain issues—actions that are usually anchored within the theories-of-use. Double-loop learning aims to increase organizational reflexivity regarding the phenomena and dynamics that occur in the organizational environment as well as the intra-organizational routines and practices.

The aim of organizational learning is to make the implicit assumptions more explicit and, like Mezirow's aim of supporting reflective individuals, to contribute to higher organizational reflexivity as a precondition for changed organizational practices. Organizational theories-in-use function similarly to frames of references or habits of mind, as they are also not easily accessible and therefore contribute to a certain stability of the organization. For this reason, some irritation or interruption is needed to get members of the organization to reflect on these theories-in-use and enter a process of "collaborative inquiry" (Yorks & Marsick, 2000). The four central steps of organizational learning are (1) the discovery of the different espoused theories and theories-in-use, (2) the invention of new meanings, (3) the production of new actions, and (4) the generalization of the results.

When combining transformative learning theory and organizational learning, it can be argued that certain groups or departments within an organization can function as learning environments or communities of practice in which reflection processes and collaborative inquiry can be organized, informal learning processes can be stimulated, and different communicative ways of working together and within the organization can be explored. Transformative learning theory would support the arrangement of these learning environments in such a way that they are created in spaces free of coercion and as "liberating structures" (Yorks & Marsick, 2000, p. 270) in which organizational assumptions can be criticized and emotions can be recognized and addressed. It would also encourage organizational members to experiment with alternative collective frames of reference that would meet the demands of the organizational environment better than the old ones. This holds the potential to change not only the espoused theories but also the theories-in-use, which are deeply connected with the organizational culture. Elias argues for transformative learning as organizational triple-loop learning, which "focuses on the habits of mind that produce the limiting norms, policies, and objectives" (Elias, 1997) of the organization.

Applying organizational learning and transformative learning to sustainability issues, it can be argued that, in order to achieve organizational transformative learning for sustainability, it is necessary to consider that the nature of sustainability problems, like an uncertain knowledge base, divergent interests, and even conflicts, does not make them an organizational challenge that is easy to handle or to deal with. On the contrary, sustainability challenges can place complex demands on the organizational development for reinventing the whole organization from the outside (Laloux, 2014), as well as on ambitions from the organizational members developed from within the organization. Both of these starting

points must address the creation of a strategy for how to proceed and align the espoused theories and the theories-in-use with regard to sustainability.⁴

Nevertheless, organizations do not represent the only learning environment that enables such learning processes. Other environments include those of inter organizational networks in multi-professional teams, where different experts with distinct professional backgrounds meet to create activities that lead to sustainability transitions. Multi-professional networks are increasingly important in fostering local sustainability transitions in different sectors (e.g., energy, mobility, agriculture) because the expertise of individual persons or professions is insufficient for solving complex sustainability problems. Quite often, however, the different organizational and even sectoral backgrounds (e.g., public administration, civil society, business) and their accompanying different ways of speaking about problems and various working cultures are not made explicit or discussed as a potential barrier to ongoing cooperation in order to contribute to sustainability activities. Nevertheless, a network form of cooperation is important and influenced by certain conditions, like the trust between and the reflexivity of the network members (Sol et al., 2018; Singer-Brodowski et al., 2020). Common transformative learning processes among the network members can increase reflexivity, serve as a base for translating different professional identities, and contribute to better network cooperation.

To reach this goal of productive cooperation processes in multi-professional networks, there is a need for communicative spaces where people feel safe enough to irritate each other with their respective perspectives on solving certain problems and where they can enter a common process for jointly searching for alternative strategies on how to proceed with systemic innovations. Moore and colleagues evaluated a Global Fellowship Program based on ideas of transformative learning and constated as a result of the program that participants.

come to better (1) see how and where the agency that is distributed across the system can be mobilized and for what purpose, (2) understand how to engage with difference; that is, diverse worldviews, organizational structures, cultures, and more, (3) recognize how to build opportunity for systemic change in varied contexts, and (4) identify the cross-scale relationships that will ultimately matter to whether or not transformative change happens. (Moore et al., 2018, p. 6)

These results emphasize the need to broaden the perspective of change for sustainability beyond the organizational and include systemic dynamics in collective informal learning endeavors for sustainability. It has been criticized that “within the greater body of literature on learning for sustainable development, inertia, conflicts, anxiety, anti-reflexivity, and power remains largely undiscussed and untheorized” (Boström et al., 2018, p. 5). Transformative learning processes within multi-professional networks working for sustainability transitions (e.g., for urban areas) should actively address these systemic dynamics and try to transform arenas of conflict to spaces of controversial but respectful negotiation.

Some of the main didactic implications for fostering transformative learning within organizational learning and learning in multi-professional networks begin by looking at the implicit theories-in-use while working together and making them an issue of discussion in informal leaning environments. The first insight that can be derived from the

⁴ There are a few approaches for applying organisational transformative learning, for example, in the context of higher education institutions (Cebrián et al., 2013) or in management programmes (Palma & Celia, 2016).

theoretical perspective of transformative learning is that it inspires us to look for certain aspects of working within organizations and networks that do not focus only on the explicitly expressed conditions of cooperation among diverse actors but also on the implicit and usually hidden assumptions within collaborative efforts. Making these implicit assumptions or theories-in-use an object of reflection and discussion can potentially debunk contradictions between official sustainability strategies and the practice and culture on the organizational ground. Here there is the potential to transform these issues of organizational culture into a culture of sustainability (Davis & Boulet, 2016) that can contribute to stronger relationships, better cooperation, systemic reflexivity, and transformative agency (Moore et al., 2018). The same holds true for multi-professional networks, where different organizational cultures sometimes clash and reflection can enable the people involved to step back, observe, assess, and re-invent the culture of cooperation within these networks. The second insight that transformative learning can contribute to the discussion on sustainability transitions is the importance of strengthening the communicative spaces and deliberative spaces of discourse or liberating organizational and network structures, where new ways of communicating and acting are created within meaningful communities of practice. It seems necessary to create and continuously develop these communicative spaces with ideal conditions for dialog and exchange, especially in times of acceleration and increasing pressure to act immediately and where concrete solutions are needed. The third insight and potential of transformative learning lies in the “deeper engagement with the structural and cultural barriers preventing change” (Boström et al., 2018, p. 7). Especially while organizations usually function in a more conservative manner, with a tendency to maintain existing structures, transformative learning can focus on interruptions and counter hegemonic perspectives and thereby unleash critical discussions about the role of organizations and networks, their embeddedness within the unsustainable status quo, and their possible contributions to alternative future scenarios.

5 Methodological issues and transformative learning

Besides individual and organizational or multi-professional learning processes, transformative learning also has enormous implications for transdisciplinary (and transformative) research processes about sustainability transitions and how researchers learn in these cooperation processes. Transdisciplinary research was originally conceptualized as knowledge production between researchers and practitioners (Jahn et al., 2012; Lang et al., 2012). It is based on interdisciplinary research processes, together with non-academic stakeholders, and aims for knowledge integration and the contribution of scientific insights as well as practical support for sustainability transitions in order to produce more “socially robust knowledge” (Nowotny, 1999). At its core is the conviction that different forms of knowledge are necessary to advance sustainability transformations: system knowledge, normative knowledge, and transformation knowledge (e.g., Abson et al., 2014).

Transdisciplinary research has been developed since the early 2000s, but in recent years, calls for a more solution-oriented, transformative research approach have been made (Miller et al., 2014; Fazey et al., 2018, WBGU, 2011). Transformative research actively goes beyond the integration of knowledge between scientific and practical actors: while widening the original function and task of research activities—that is, systematic knowledge production about societal developments—transformative research actively catalyzes and accelerates sustainability transitions by building up experimental spaces to

continuously test and learn from more sustainable solutions (e.g., in the form of real-world laboratories; Schäpke et al., 2018). Transformative research builds upon transdisciplinary research approaches, but it more strongly focuses on the experimental mode of supporting actions for sustainability transitions. For this reason, it broadens the demands of transdisciplinary research for knowledge integration between science and practice and strives to intervene in social systems.

Regardless of the conceptual differentiation between transdisciplinary and transformative research, academics themselves create meaning within these processes of knowledge production and learn how to collaborate with non-scientific stakeholders (Barth & Michelsen, 2013). Research-practice cooperation has already been described as an environment for social learning where scientific and non-scientific actors collaborate and form teams that follow typical dynamics of group development (Schauppenlehner-Kloyber & Penker, 2015) or enter spaces of comfort and discomfort while collaborating in diverse teams (Freeth & Caniglia, 2020).

Despite this work, little is known about the concrete processes of how transdisciplinary or transformative researchers make sense of the cooperation processes (Knaggård et al., 2018), how they learn and which kind of perspective transformation this process can include in the informal learning environments of the practice of knowledge production. Here, transformative learning can offer further insights. When producing knowledge for sustainability, researchers might recognize that their own scientific perspective is only one form of observing, describing, and explaining what is going on in their respective research fields. Other forms of knowledge that are contributed by practitioners or policymakers are of equal importance, especially when it comes to cooperation with people representing indigenous knowledge and different epistemologies (Tom et al., 2019).

These differences in forms of knowledge and epistemologies can lead to irritation because researchers are usually socialized in certain disciplinary-shaped epistemic cultures (Felt et al., 2013). These disciplinary epistemic cultures may get confused when researchers work together within interdisciplinary or transdisciplinary teams and try to integrate other forms of non-scientific knowledge. Researchers can be confronted with the experience of epistemic differences, where the knowledge base and epistemic culture of their scientific socialization clashes with the knowledge base in the real world (Singer-Brodowski et al., 2018). An additional challenge occurs in transformative research processes, where researchers do not intend only to describe and analyze transformation processes toward sustainability but also to actively catalyze them in real-world experiments. Here, the classical tasks and roles of researchers are blurred (Hilger et al., 2018), potentially leading to irritation (or even dilemmas), and thereby represent entry points for transformative learning.

Even the normative approach within sustainability research in general (Schneider et al., 2019) can lead to challenges on the part of researchers, because it contrasts with traditional standards of “value-free” or “objective” research processes (Vogt & Weber, 2020). Instead of generating knowledge only in the realm of curiosity-driven basic research, sustainability scholars are guided by the normative principle of contributing to solving sustainability problems and thereby reach inter- and intragenerational justice within planetary boundaries. But this ambition may contrast with the academic conceptions and paradigms of emerging researchers that they learned within their own study programs. Additionally, they may face challenges within the existing structures of doing research (e.g., getting their research funded).

To deal with these multifaceted challenges within transdisciplinary and transformative research, some sustainability scholars argue for the need to develop reflexivity and

epistemic pluralism (Miller et al., 2011) as a precondition for organizing high-quality transdisciplinary and transformative research processes. Reflexivity is also mentioned as one of the core capacities to be developed for conducting transdisciplinary research (Spangenberg, 2020)—and one key result of transformative learning (Mezirow, 2000; Taylor, 2017). The question is how researchers can gain a higher degree of reflexivity and how they can cultivate reflexive practices. It is hard to find formal training programs for transdisciplinary researchers that include theory-inspired reflections on the experiences gained in the field (e.g., Knaggård et al., 2018), and the few that exist are open mainly to emerging researchers. What would be necessary instead would be permanent, accompanying spaces of reflection and discussion about the irritation felt and experiences gained in the respective research field while conducting transdisciplinary and transformative research.

Transformative learning theory has huge potential for understanding and facilitating the informal learning processes of researchers working at the interface of science and policy or science and society. When viewing the dynamics occurring within transdisciplinary and transformative knowledge production from the perspective of transformative learning, certain insights can be derived. The first is that the cooperation of researchers with non-scientific stakeholders can lead to irritation and confusion regarding their epistemological knowledge base and their meaning-making within processes of transdisciplinary and transformative research. The ambition not only to produce socially robust knowledge for sustainability transitions but also to actively catalyze ongoing transformation processes in their respective fields especially adds further challenges to researchers. Transformative learning can inspire researchers to become aware of this irritation, then step back for a moment, and reflect on different knowledge forms, roles, and activities in transdisciplinary and transformative research contexts. The particular potential of transformative learning theory lies in the possibility of seeing difficult or even dilemmatic situations as an occasion for examining underlying assumptions and understanding where they come from (i.e., from socialization in certain disciplinary backgrounds). This critical reflection opens the opportunity for learning academics to reach a higher level of observation and thus more reflexivity. It also can help researchers better reflect and work with diverse groups of actors in which not all people are convinced that they should contribute to sustainability challenges. Transformative learning may shed light on certain forms of resistance to change: e.g., those in which people fear losing privileges or a certain form of stability.

The second insight that can be derived from transformative learning theory is that it needs spaces both inside and outside of academia for exchange and discourse about the challenges mentioned. For fostering deliberative discourses within groups of researchers, additional workshops and training formats would be valuable for stimulating reflections on the learning processes when researchers leave their original epistemic cultures. These spaces for communicative action and reflection could enable researchers to better integrate different worldviews, epistemologies, and perspectives. Spaces for discourse would also be necessary between academics and non-academic partners within transdisciplinary and transformative research processes. Transformative spaces represent a kind of “collaborative environment where experimentation with new configurations of social-ecological systems” (Pereira et al., 2020) can accelerate the speed of sustainability transitions, especially when it comes to studies with people from the global South.

The third insight derived from transformative learning hints at emotions within the learning processes of researchers, especially because these emotions are usually neglected in the academic sphere. Nevertheless, emotions are an important part of the human experience in general and of learning processes in particular. Accepting even challenging edge emotions when growing into a transdisciplinary and transformative research community

and working in the real world with different actors to co-create sustainability transformations would be a benefit that could be gained from transformative learning here.

6 Conclusion

The radical movement toward sustainability that is needed to enable humans to remain within planetary boundaries and maintain a safe and just space for humanity is a massive and collective learning endeavor. While most projects within Education for Sustainable Development focus on activities and research findings in formal education that foster individual competencies for sustainability, a great deal of learning also occurs in non-institutionalized and informal learning environments. This article highlights the potential of transformative learning for sustainability transitions that can emerge particularly in informal learning environments. It is necessary to emphasize that, within the daily practice of all these contexts, transformative learning processes do not occur as one completed single and linear process but as continuing reflection and action processes with varying depth and breadth (Hoggan, 2016; Nohl, 2015).

One of the main benefits transformative learning theory can offer for catalyzing and accelerating sustainability transformations is to view multiple spaces of communication and dialog about sustainability transformations as potential learning environments. Normally, these spaces of communication are not explicitly conceptualized as learning environments, and their moderators or managers may have a clear agenda like strengthening sustainability efforts in a respective district or organization or conducting transformative research projects. Nevertheless, while working toward these goals, informal learning occurs for all participants. Transformative learning can elucidate how these learning processes take place and offer important insights for creating more appreciating and empowering learning conditions. Transformative learning can inspire the facilitators of such learning environments to better understand how people can participate in communities of practice, change their understanding of their role in and contribution toward sustainability transformations, and strengthen their identity as an important part of the necessary transformation processes. These informal learning environments about sustainability cannot be reduced to private conversations because maintaining a safe space for humanity is a fundamentally public ambition. While focusing on spaces for exchange that are free of coercion and offer ideal speech conditions and an appreciation of challenging edge emotions, facilitators can arrange learning environments that motivate people to develop critical thinking and contribute to social change. Recent developments also emphasize the necessity of listening to the perspectives of those who do not want to be involved in critical reflections about sustainability transformation processes and their probable feelings of stress, resistance, or being overwhelmed. Here, transformative learning theory holds the potential to shed light on how to work with these feelings within democratic processes rather than ignoring them.

The empirical basis of transformative learning for sustainability in these various contexts is still weak and needs further research. Additional questions for working with transformative learning theory could include how it is connected to what is currently termed the “relational turn” in sustainability research (West et al., 2020), where human–nature relationships are at the center of a potentially new approach within sustainability research. An additional future task would be to supplement transformative learning theory by engaging more deeply with the structural and cultural barriers preventing change (Boström et al., 2018, p. 7), as well as with controversial positions and institutional inertia (*ibid.*).

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