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# Learning-based transformations towards sustainability: a relational approach based on Humberto Maturana and Paulo Freire

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## ABSTRACT

This article investigates the relevance of the work of the Latin-American thinkers Humberto Maturana and Paulo Freire to learning-based transformations towards sustainability. This analysis was inspired by a case study of a Brazilian urban community seeking to develop pathways towards sustainable living and was informed by a review of their key works. The paper aims to obtain a better conceptualization of learning-based transformations and provide insights into collective learning processes focused on advancing sustainable practices. We present notions of the transformative social learning approach that underpins the case study, using the concepts of Maturana and Freire as a lens. Our results indicate the importance of a relational approach in fostering collective learning processes. Finally, we derive three principles that can guide such processes: (1) facilitating transformative interactions between people and places, (2) enabling dialogic interaction within a climate of mutual acceptance, and (3) creating space for ontological pluralism.

## ARTICLE HISTORY

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## KEYWORDS

Sustainability; community-based initiatives; dialogue; transformative social learning; relational pedagogy

## Introduction

This paper is inspired by the doctoral research experience of the lead author in the community of Lomba do Pinheiro, in the city of Porto Alegre, South Brazil (Table 1). Within this socio-ecologically vulnerable community, a self-organized group of citizens is trying to simultaneously improve livelihoods and the ecological quality of a local watershed through several technical and learning-oriented actions. This case links ecological themes with issues such as poverty and social inequality and requires a range of coordinated responses and actions if they are to lead to sustainable outcomes that include: environmental regeneration, improved social justice, healthier lifestyles, a robust local economy, re-established community identity, and new forms of grass-roots governance (Krasny 2018). Therefore, the case of Lomba do Pinheiro raises a key question: How can learning processes aimed at advancing sustainable practices in such a community be designed and supported? Responses to this type of situation normally involve community mobilization, multiple objectives, coordinated actions, and a systemic approach within a context of collective learning that stimulates reflexivity on local praxis (Schusler, Decker, and Pfeffer, 2003; Coudel et al. 2017; Phuong et al. 2018). In this context, the research on this case adopts the perspective of transformative social learning as a fundamental theoretical background to

**Table 1.** The community of Lomba do Pinheiro and the Taquara Stream initiative.

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Lomba do Pinheiro neighbourhood is characterized by a heterogeneous area with densely populated nuclei and ecological preservation areas (such as the Saint Hilaire Park, which contains the 'ring of springs' of Porto Alegre). Over the last decades, the neighbourhood has been occupied by informal settlements that present serious problems of infrastructure and basic sanitation, such as in the local watershed of the Taquara Stream, whose spring is part of the 'ring of springs'. This neighbourhood presents a well-structured community organization and a recognized engagement of its population in creating better living conditions. For instance, an important local initiative is the Lomba do Pinheiro Community Garden, inaugurated in 2011 and located in a plot adjacent to the Taquara Stream. This space, which is a reference for this kind of initiative in Porto Alegre, is maintained by volunteers and has been crucial for the articulation of actions towards environmental preservation and restoration of local natural areas. The community garden supports environmental education activities involving the local population, students of local schools, and interested groups in general. One of the actions driven by this place was the reactivation of the discussions around the degraded conditions of the Taquara Stream and the area comprised by its watershed, resulting, in 2015, in the creation of a working group to tackle this issue. The working group is composed of local residents, teachers, and students from local schools and from the Federal University of Rio Grande do Sul, and technicians from various public sector departments. The group holds regular meetings at the community garden and at residents' houses. These meetings are mainly focused on comprehending local issues and designing technical solutions and learning-oriented actions to be implemented in the territory. These actions and solutions seek to promote practices aimed at reducing environmental risks for the local population with regard to sanitation and ecological hazards, while enhancing social conditions and fostering the autonomy of the community in the maintenance of the balance between ecological and social systems. Small-scale actions (such as cleaning up specific spots along the stream through joint effort) and larger thematic events to mobilize and engage a greater number of people in this movement (such as parades and seminars to promote debates and bring awareness about environmental and socioecological conditions of the watershed), have been organized by this group.

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comprehend this initiative (Röling 2002; Muro and Jeffrey 2008; Dyball, Brown, and Keen [2007] 2009; Boström et al. 2018).

In this paper, we aim to provide insights into collective learning processes focused on advancing sustainable practices in general and, specifically, in communities like Lomba do Pinheiro, by integrating into this research the thinking of two key Latin American scholars whose work is cited across the globe but rarely in relation to sustainability: Humberto Maturana, a Chilean biologist, and Paulo Freire, a Brazilian educator. Maturana and Freire are recognized worldwide within the context of socio-ecological (mainly Maturana, in relation to life sciences) and socio-democratic (mainly Freire, in relation to education) transitions or movements. Integrating Maturana and Freire's thinking into this case study also means capturing a universe of ideas that reverberates with the decolonization discourse present in the Latin American context (Mignolo and Escobar 2010). At the same time, it reaffirms the significance of Freirean critical pedagogy in the Brazilian context, at a time when his legacy is facing the threat of being banned from within the national educational system (as noted in an *Independent* article on 12 February 2019). For a more elaborate positioning of environmental and sustainability education within this context, we refer to a recent issue in this journal (Thiemann, Carvalho, and Oliveira 2018).

In order to explore how Maturana and Freire's thinking could bring new perspectives to collective learning processes in general and, specifically, in communities like Lomba do Pinheiro, this paper is structured into four sections. The first section presents the conceptual framing of the case study on Lomba do Pinheiro, which is underpinned by the notion of 'sustainability as learning' and by conceptions of transformative social learning. The following section introduces Maturana and Freire's key ideas. Subsequently, we propose three guiding principles that emerge from the ideas presented in the previous sections and that seek to promote insights into collective learning processes. These principles are illustrated by the case of Lomba do Pinheiro. Finally, in the concluding remarks of this paper we present some implications of applying the proposed principles in real contexts.

## Sustainability as learning

The idea of *learning* for sustainability is often referred to as a way to promote alternative values and lifestyles that can respond to the contemporary challenges faced by our society (Sterling

2001; Orr 2004). Such challenges include climate change, loss of biodiversity, water and air pollution, resource depletion, soil degradation, persistent social disparities, and rising poverty and inequalities (FAO, IFAD, UNICEF, WFP, and WHO 2017; WWF 2016). These challenges can be considered interrelated manifestations of systemic global dysfunction (Lotz-Sisitka et al. 2015) and create an avalanche of so-called wicked problems (Levin et al. 2012). In this context, cities, which today represent the main human habitat (UN-Habitat 2016), are spaces designed in a way that sustains a lifestyle grounded in high rates of consumption and emission of waste that surpass the planet's carrying capacity (Rees 1996; Steffen et al. 2015).

It appears that hegemonic structures and ways of living in urban environments are based on values, principles, and assumptions that are deeply rooted in a worldview that can be described by adjectives such as: anthropocentric, fragmented, positivist, and capitalist (Wahl 2016). Hence, the transformation of people's thinking and behaviours and of cities' structures and functioning towards sustainability, can be viewed as intertwined aspects of the same conundrum.

This view leads to a comprehension of sustainability from at least two intertwined perspectives: a more immaterial one and a more material one (Wahl and Baxter 2008). The more immaterial perspective refers to the transformations required in what we think and value and how we behave. The more material perspective refers to the way we literally build our world and the tangible objects we use. While there has been a tendency to focus on hard, measurable material outcomes in advancing sustainability (e.g. reducing emissions, increasing waste separation and recycling, improving diets, cleaning up rivers and streams), there is an increasing realization that, without paying attention to the immaterial aspect of sustainability (e.g. compassion, care, empathy, morality, and community), such efforts might be largely temporary and cosmetic (Abson et al. 2017). In other words, effective sustainability outcomes that have an ongoing impact need to be supported by reflexive processes that consider the deeper values and principles upon which people as individuals and as part of collectives are currently building their future (Brouwer et al. 2016).

So, when we refer to sustainability, we refer to ways of living and being that are grounded in a reflexive value system that requires continuous learning to respond to ever-changing circumstances. This notion of continuous learning should allow for a rethinking, and even disruption, of current values, routines, and structures, as well as the creation of new ones, and new ways of thinking (Heymann and Wals 2002). It also implies developing the relational capacities and agency needed to help people transgress limiting routines imposed by systems, norms, and hegemonic powers that hinder advancements towards sustainability (Lotz-Sisitka et al. 2015).

From this perspective, the search for sustainability goals can lead to *social learning* when citizens engage in active dialogue, emancipatory action, the creation of common knowledge, collaborative decision-making, and elaboration and implementation of an agreed-upon action plan to carry out transformations that they themselves consider necessary (Jiggins, Røling, and van Slobbe [2007] 2009; Chaves 2016; Jacobi, Toledo, and Grandisoli 2016; Aguilar 2018). Such learning can be considered *transformative* when dialogic interaction and associated learning lead to a mirroring (Mezirow 2000) of one's own beliefs, perceptions, values, assumptions, and, indeed, behaviour, against alternative ones represented by others as well as against those that arise in the search for solutions to socio-ecological challenges. Transformative social learning contains elements of transgression when the critical thinking and collective agency that is cultivated leads to the questioning and disrupting of hegemonic structures, powers, and features of society that have become normalized over time and which pose barriers for a broad sustainability transition (Lotz-Sisitka et al. 2015; Wals and Peters 2017; Macintyre et al. 2018).

### ***Lomba do Pinheiro community: seeking pathways towards sustainability***

The case of Lomba do Pinheiro is relevant for this perspective of sustainability as learning, since the actors engaged in this community-based initiative have been promoting learning-

oriented actions in the territory that seek to create dialogical spaces and stimulate reflexivity among participants in order to advance in the solutions of local issues. This initiative focuses on the restoration of an important local stream, the Taquara Stream, and its watershed. This watercourse presents widespread degradation due to the existence of irregular settlements along its banks, direct sewage discharge, and solid waste accumulation in its waters (see Table 1).

Members of the leading group of this initiative advocate that local socio-ecological and environmental improvements depend on a more relational approach to facilitating a process that brings in the voices of the community and enables the integration of technical and local knowledge. Within this understanding, practices for sustainability are brought together in this case by: (1) implementing diverse, small technical solutions, and practices throughout the watershed for environmental restoration, sanitation provision, and promotion of health of the local population and (2) fostering emancipatory dialogical practices and critical debate on the issues that affect the population so as to strengthen community autonomy and local governance systems. The Lomba do Pinheiro Community Garden (located near the banks of the Taquara) is strongly associated with this initiative. This place has promoted, since 2012, sustainable practices, agroecological production, and social inclusion with great success in this community, thus inspiring and guiding the practices advocated by the leading group.

Given the characteristics of this case and drawing from a transformative social learning perspective to comprehend it, the research on Lomba do Pinheiro applied a framework of analysis composed of three interconnected dimensions: *individual*, *collective*, and *territorial*. The *individual dimension* refers to the subjects' roles and views within this movement. The *collective dimension* is related to forms of dialogical interaction and collective learning strategies. And, finally, the *territorial dimension* brings in the space of concrete action and the social, environmental, economic, and political conditions that shape local processes. We refer to these dimensions as they were used in this paper to (1) guide the selection of relevant concepts of Humberto Maturana and Paulo Freire for this study and (2) to bridge the concepts that we propose in the following sections.

## Entering Humberto Maturana and Paulo Freire

Humberto Maturana and Paulo Freire both brought innovative perspectives to traditional 'transmissive' educational approaches by challenging established views on reproductive forms of learning and, as alternatives, instigating learning practices aimed at the transformation of individuals, society, and the world. In this section, we present key concepts of Maturana and Freire as they relate to and can inform learning-based transitions towards sustainable living.

The theoretical review presented in this section is based on an in-depth parallel literature review of relevant works, primarily in English, in terms of numbers of citations of Humberto Maturana (1987, 1988, [1998] 2002) and Paulo Freire (1970, [1974] 2005, 1998). The framework of analysis of the research (individual, collective, and territorial dimensions), previously mentioned, were used as parameters that guided the reading process and enabled the identification of the most relevant concepts of Maturana and Freire for this paper.

### ***Maturana: learning as a biological phenomenon***

Education takes place all the time and in a reciprocal way. It occurs as a structural transformation contingent upon a history of living together, and the result is that people learn to live in a way that shapes them according to the life they share in the community in which they live.

Maturana ([1998] 2002, 29)

Humberto Maturana was born in 1928, in Santiago, Chile. He studied biology and acquired a PhD in neurophysiology. In 1987, he published, with Francisco Varela, the influential book 'The

Tree of Knowledge: The Biological Roots of Human Understanding'. Maturana explored the implications of his theories, built from the field of life sciences, in different areas of knowledge, such as cybernetics, psychology, sociology, and, indeed, education, producing an extensive body of work. In the field of education, his ideas inform learning processes grounded in systemic thought and in the understanding that learning is the transformation that takes place in coexistence, in mutual acceptance and the interplay between individual and context (Maturana and D'Ávila 2006).

Maturana ([1998] 2002) explains cognitive processes as a biological phenomenon and defines *learning* as structural changes that happen to us that are contingent upon our interactions in life and not, as conventionally defined, as an act of 'capturing' a world that is independent from us through abstract operations. Central in his conception of cognition and learning is the notion of *autopoiesis*, which suggests that organisms are self-referring systems that have a particular way of knowing and interacting with the world (Maturana and Varela 1987). Based on this conception, Maturana (1988) explains that organisms are not able to be instructed, as their responses cannot be defined by the external stimuli and the properties of the agents they are interacting with, but only by their own self-referring structure. In this continuous interaction between systems, the organisms and external environment co-adapt to and with each other. He calls this phenomenon *structural coupling*, that is, all encounters between organisms and between organisms and environment will trigger changes in all participants involved, and they will change together as a result of their interactions (Maturana and Varela 1987). From this perspective, he conceives *learning* as a process that takes place in this structural encounter among participants, as a process of transformation in coexistence, during which previous participants' conditions are altered as a result of their interaction (Maturana [1998] 2002). These explanations apply to all living systems, including human beings.

### ***Human beings, emotions, language, and conversations***

According to Maturana ([1998] 2002), human beings are autopoietic organisms that, like any animal, behave within domains of action that are always founded on certain emotions. From a biological perspective, emotions are defined as bodily dispositions that determine different domains of action (Maturana 1988). However, for him, what is exclusive to humans is that we live in language and there is no way of referring to ourselves or to what is external to us without language. Although he stresses that language is not exclusively related to verbal actions, it is also the basis of our thinking and our practical activity.

Maturana ([1998] 2002) suggests that, due to recursive interactions between human beings over time, within the specific domain of action influenced by the emotion of love, language could arise. He uses the word 'love' to specify a domain of action that is defined by the acceptance of the other as a legitimate other in coexistence. For the author, this emotion has stabilized humans' interactions over time, giving rise to consensual coordinated actions within a climate of mutual acceptance from which language emerged. He also calls the kind of human interactions that take place within a climate of mutual acceptance *social relations*.

Maturana elucidates this interconnection between *emotioning* and *linguaging* in daily life through the concept of *conversations*. This refers to the interlaced flow of domains of action (emotioning) and of consensual coordinated actions (linguaging) that take place between human beings while interacting in language (Maturana 1988). People engage in different networks of conversations with different groups and, in doing so, share common explanations and perceptions of the world. It is important to note that, despite the emergence of language within a domain of mutual acceptance or social relations, Maturana recognizes that conversations continuously occur, not just within social relations, but also in non-social relations, for instance, in hierarchical relations.

### ***Objectivity-in-parentheses***

Based on the concepts so far described, Maturana developed the idea of objectivity-in-parentheses. Objectivity-in-parentheses is based on the understanding of the cognitive system as a biological phenomenon and it conveys that different individuals will respond to external stimuli and make sense of the world differently, according to their life histories and emotions (Maturana 1988). From this perspective, reality and rational explanations cannot be comprehended independently of the role of the observer, as they will be always dependent on the one who is explaining them. Therefore, Maturana ([1998] 2002) claims that, when we listen to an explanation and accept it, what we accept is not something independent of us, a supposed external truth, but a reformulation of experience that satisfies some criterion of coherence that suits us based on our emotions and accepted premises. To be aware of this objective-in-parentheses perspective means acknowledging the role of emotions as the background of rational explanations when attempting to impose the truth of an argument upon the other. This perspective allows us to comprehend that such a strategy will be insufficient to solve an impasse of positions and might result in a respectful joint reflection on the views at stake.

### ***Freire: transforming reality through education***

No one teaches another, nor is anyone self-taught. People teach each other, mediated by the world.

Freire (1970, 80)

Paulo Freire was born in Recife, Brazil, in 1921 and graduated in law in the 1940s. During the 1960s, he developed a successful adult literacy campaign based on the day-to-day vocabulary and reality of peasants in the north of Brazil. After the military coup of 1964 in Brazil, Freire went into exile and returned to the country in 1979. In 1968, he published his seminal book: 'Pedagogy of the Oppressed'. Paulo Freire died in São Paulo, Brazil, in 1997.

Freire conceived of education as a practice of freedom, a way to liberate human beings from oppressed conditions and transform the world (Giroux 2010). He influenced, and still influences, different fields of research. Freire's ideas inspire learning practices that value dialogical problematization, critical thinking, local knowledge utilization, and collective learning based on themes that emerge from the reality of the learners in order to build knowledge aimed at the transformation of existing oppressive conditions (Gadotti and Torres 2009). Freire argued (1998) that *learning* should not be understood as knowledge transfer which, for him, presupposes the existence of a static reality of which few possess its knowledge and many do not. For Freire (1970), learning processes take place within the space of everyday experience, where individuals jointly interpret reality and, consequently, transform themselves and the world they live in.

### ***Praxis and dialogue***

Freire (1970) viewed human beings as 'unfinished beings' that are constantly becoming. The same applies to the reality people co-construct, which both manifests their views and in turn shapes actions and behaviours. From this point of view, he claimed that education as a method of critical reflection is a human need, since, as unfinished beings and creators of the human world we share, we are responsible for either the conservation or the transformation of the conditions in which we find ourselves (Freire [1974] 2005). He considered educational practices as a path to awakening the full creative potential of human beings who find themselves in a limiting context characterized by unequal power relations, domination, exclusion, competition, and injustice (Freire 1970). For Freire (1998), education can only be carried out within a learning environment where each person is acknowledged in his or her legitimacy in co-creating the world and committed to his or her role as a transformative agent.

Freire (1970) considered *dialogue* as the central practice of learning processes, since it is based on critical thinking and can lead to the transformation of *praxis*. Praxis, a core concept in his theories, combines action and reflection: it entails critical thinking about existential conditions and the consequent action that comes from it to transform those very conditions (Freire 1970). Dialogue, then, comprises an atmosphere of open communication, where the free expression of each individual is not barred by judgement, coercion, and fear. A generative dialogical space welcomes a diversity of participants' views and interpretations of the reality they share and invites critical thinking about the underlying differences and commonalities (Freire [1974] 2005).

The 'dialogical being' should be encouraged not only to question his or her own views and interpretations of the world, while supported by equals, but also to actively engage in the creation of a new existential condition (Freire 1970). Therefore, Freire (1970) asserted that dialogue is only possible in the presence of faith, humility, and love. For him, love is perceived as an act of courage that leads individuals to mutual commitment in a collaborative learning process where there is no domination of one over another. Humility, in turn, stresses the egalitarian condition of people in co-creating the world and eliminates any possible identification of a privileged group that illusorily holds a truth that less privileged ones do not possess. Finally, faith is the comprehension that the situations in which human beings find themselves are not crystallized, rather, they are changeable due to the very capacity of humans to transform it.

### ***Generative themes and conscientization***

Freire (1970) also created the concept of *generative themes*, that originate in the way people comprehend, interpret, and act upon the world. They are the meaningful existential themes that are part of the everyday life of social groups and which are filled with emotional content that constitutes experiences and shared values. Hence, as part of the reality of an individual, the generative themes have the potential to activate a dialogical process oriented to transformation.

Freire's educational approach, based on dialogical interaction around generative themes, aims to strengthen critical thinking and, ultimately, create *conscientization*. Conscientization may unfold when people become aware of the contradictions of their situation and change their perception of reality. It generates a deepening of consciousness, brings a sense of commitment to people, and stirs the agency of the individual to actively engage in the process of (re)creating the world (Freire 1970).

### ***Connecting Maturana and Freire's concepts***

Figure 1 presents the selected concepts of Maturana (in white) and Freire (in dark grey) and captures correlations between them. The proposed correlations are based on the individual, collective, and territorial dimensions applied in the research on the case of Lomba do Pinheiro.

Objectivity-in-parentheses and conscientization were correlated as they both relate to the way an individual perceives reality and responds to it, connecting them to an individual dimension. Social relations, conversations, and dialogue were also brought together as they refer to a certain form of interaction between individuals within a collective dimension. Furthermore, structural coupling, praxis, and generative themes were approximated, as it is suggested that these notions are manifested in the world we inhabit and captured within this realm; they are, in this sense, connected to a territorial dimension.

Despite the proposed correlations between the concepts and specific dimensions, it is essential to emphasize that the theories of Maturana and Freire explicitly convey a reciprocal influence and interdependency among individual, collective, and territorial dimensions and processes (as apparent from the connections among Freire's concepts within the figure). This suggests that individuals, social groups, and the world are constantly changing as a result of their continuous

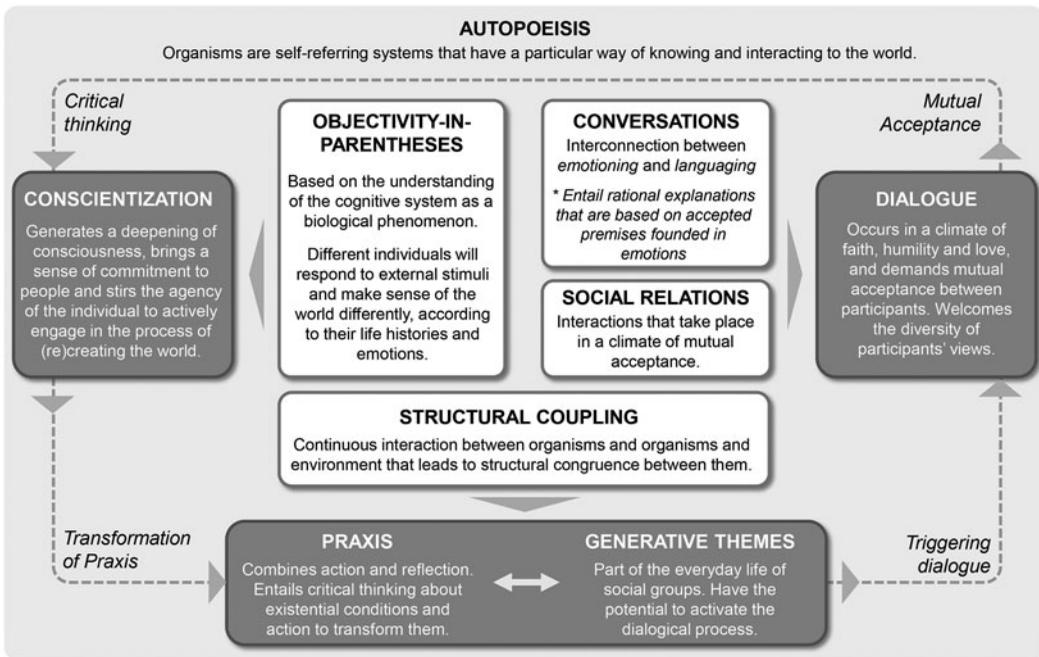


Figure 1. Interconnections between key concepts of Humberto Maturana (white) and Paulo Freire (dark grey).

interactions. Finally, autopoiesis was included in Figure 1 as an overarching concept that captures the dynamics of living systems.

### Guiding principles: insights into collective learning processes

How can the ideas described until now provide insights into collective learning processes and strategies to help communities like Lomba do Pinheiro advance sustainable practices? Based on our interpretation of these conceptual ideas and reflections on interactions within the Lomba do Pinheiro case, we distilled three broad guiding principles that can help answer this question.

Figure 2 presents the principles that emerged from the main concepts discussed in the previous section, within the individual, collective, and territorial dimensions. The principles are interrelated since they refer to entangled dimensions but are represented separately, simply to call attention to different operational levels of learning processes. The entanglement of these dimensions and their reciprocal influence and volatility are represented in Figure 2 through feedback loops illustrated by a linking spiral and back and forth arrows. This ever-changing condition of the represented elements emphasizes the need to deal with uncertainty and ever-changing meanings by cultivating openness to change and continuous learning.

The principle of *transformative interactions between people and places* is illustrated by practices observed at Lomba do Pinheiro Community Garden. The principle of *dialogical interaction within a climate of mutual acceptance* is exemplified by the ways through which people that join the leading group of this initiative interact. Finally, the principle of *ontological pluralism* is revealed in the diversity of existential visions (e.g. what it means to be human or to be in the world) that compose this local movement. The reconstruction of these aspects of the case is based on data obtained by diverse methodological procedures applied by the lead author while in the field in Lomba do Pinheiro. These procedures included participant observation for one-and-a-half years,

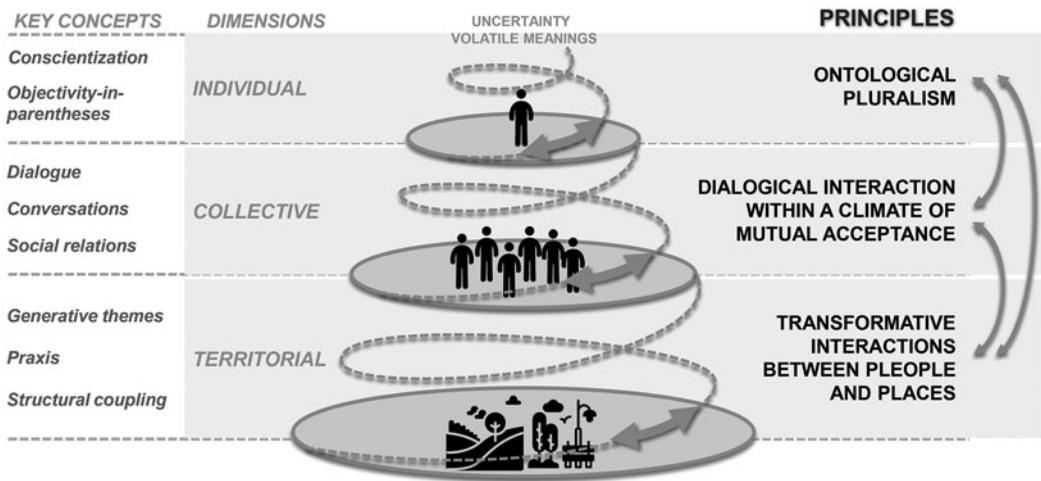


Figure 2. Guiding principles for collective learning towards sustainability based on the ideas of Humberto Maturana and Paulo Freire.

focus group conversations, and in-depth and semi-structured interviews with members of the leading group. We now elaborate on the three principles.

### ***Transformative interactions between people and places***

The guiding principle *transformative interactions between people and places* relates to the territorial dimension, which includes the concepts of structural coupling, praxis, and generative themes. The idea of *place* here includes an implicit notion of the identity of a specific space; it refers to the different meanings of a certain space or location given by people (Measham and Baker 2005). We refer to structural coupling as the way people are structurally connected to a given context and to each other, and to how their behaviour and cognition are affected by the ongoing changes that take place within this structural connection. Thus, new structural couplings trigger reciprocal changes in all the interacting elements (both between people and between people and place). This principle conveys, for instance, that physical alterations of a certain environment (e.g. designing a more sustainable neighbourhood) or even alterations of institutional frameworks (e.g. implementing innovative policies or new cross-sectorial configurations) will trigger responsive learning processes to accommodate these new structural interactions between people and between people and the context they inhabit. A new praxis is correlated to new structural couplings, since the praxis entails the transformation of reality itself. Ultimately, the praxis is intrinsically connected to the concrete world we build and interactions between people. New generative themes emerge from new praxis and from the transformative processes within this dimension. These themes are extracted from the problematization of practical life and might support the development of contextualized critical thinking.

Such critical thinking can be an outcome or part of transformative and even transgressive social learning when it facilitates questioning ingrained values, changing habits, structures, institutions, and disrupting routines that represent blockages for action towards sustainability (Wals and Peters 2017). Disruptive responses entail innovative praxis and new structural couplings. Notwithstanding, it is worth noting that disruption here also means interrupting routines that promote destruction in order to maintain and/or rescue what is/was already sustainable (e.g. the reconstruction of stream ciliary forests or recovery of knowledge systems embedded in cultural traditions). In this sense, disruption also entails a reflection on existing desired states of ecological integrity and life-supporting values that must be sustained.

The Lomba do Pinheiro Community Garden illustrates this principle as people there experience new ways of relating to each other and to the space itself. The activities carried out in the garden seek to promote ecological literacy within the community, a healthier lifestyle by stimulating organic food consumption, and the strengthening of community bonds through its shared maintenance. This place supports a variety of learning practices, such as environmental education activities of local schools and workshops to the general public on how to apply ecological techniques to grow food and use native non-conventional plants for a healthier diet, among other related topics.

In the community garden, structural coupling takes place within an anthropized environment that enables *life-enhancing conditions*, that is, this space creates structural conditions that are conducive to life. The praxis in the garden is aligned with sustainable aims and triggers a specific network of conversations on topics such as ecology, social equality, and community identity. Generative themes related to local socio-ecological and environmental issues emerge from these conversations and potentially unfold in community-based initiatives, such as the one for the Taquara Stream watershed.

Lastly, this guiding principle emphasizes the importance of practical experiences promoted by a specific place that embodies values that nurture sustainable living. It brings awareness of the role of places in triggering and supporting transformative social learning processes. Local interventions to create a greater number of such places might, therefore, constitute a strategy to enhance and accelerate sustainable practices in general, and, specifically, at Lomba do Pinheiro.

### ***Dialogical interaction within a climate of mutual acceptance***

The principle of *dialogical interaction within a climate of mutual acceptance* is related to the collective dimension which includes the concepts of dialogue, conversations, and social relations. Similarly, Freire's concept of dialogue and Maturana's notion of social relations refer to interactions that are based on symmetrical relations within a climate of mutual acceptance where multiple and diverse views are invited and respected, allowing for different aspects of reality to be observed. Interactions that take place within a dialogical space stand in opposition to the ones that take place within hierarchical relationships. Both thinkers stress that within hierarchical structures there is no recognition of the other as equal and no acceptance of otherness. On the contrary, opposite views can be seen as a threat which can easily lead to hostility, deterioration of trust, and blockage of open communication among participants.

The acceptance or rejection of arguments of a certain network of conversations does not exclusively depend on rational argumentation but rather on the reviewing of the implicitly accepted premises – rooted in emotions – that constitute an explanation (Maturana 1988). Therefore, the critical analysis of accepted premises and the construction of common knowledge towards life-supporting realities may arise from conversations that take place not in a field of dispute but rather in a field of social relations and mutual understanding (Maturana 1988; Freire 1970).

A safe climate of mutual acceptance can be considered a key element for transformative social learning processes to take place, since it is a vital condition for individual and collective review of assumptions and values. When a diversity of people's views meets in a social learning setting with space for dialogue, individuals are collectively challenged to find new meanings and rethink their own assumptions (Wals [2007] 2009). An effectively dialogic environment is characterized as an exploratory space (Bohm 2004) as to support the free exposure and questioning of views which likely trigger the interrogation of one's own values, beliefs, and assumptions that otherwise might remain invisible and uncontested (Dyball, Brown, and Keen [2007] 2009). Creating such a safe explorative space has the potential to improve collective inquiry and

catalyze co-creative processes towards innovative sustainable responses (Röling 2002; Chaves et al. 2018).

Ways of interaction among the members of the leading group of the initiative at Lomba do Pinheiro illustrate this principle. These participants (e.g. community members, academics, and public sectors technicians) represent diverse interests, have different backgrounds, and utilize different forms of knowledge. This diversity of perspectives meets in socially favourable conditions that are conducive to a generative learning environment and a more holistic, and, possibly, more systemic, understanding of local issues in their wider contexts. The meetings held by participants are based on dialogical interaction within a friendly atmosphere, wherein diversity is welcomed and the expression of different participants' points of view is stimulated and guaranteed through attentive facilitation. In individual interviews, all members reported the presence of a non-hierarchical atmosphere and a climate of mutual trust. Both were seen as important for creating more open-communication and group cohesion. Members also noted that the social actors they represent do not determine hierarchical positions within the group nor interfere with the free questioning and expression of participants' views. This condition results in high potential for the development of individual and collective agency and creates a favourable climate for co-creation as manifested in the ongoing design of a series of actions to tackle local problems by this group.

This principle draws attention to the significance of dialogical interaction as a crucial condition for generating critical thinking and co-creation.

### ***Ontological pluralism***

The principle of *ontological pluralism* is connected to the individual dimension, which includes the concepts of objectivity-in-parentheses and conscientization. The concept of ontology, originated in philosophy, is used here to highlight the study of existential questions related to the different ways of being in the world. Along with the term pluralism, it conveys the existence of multiple ways of being and realities that exist in the world (Escobar 2017).

Both, Freire and Maturana consider that each individual has a particular perception of reality shaped by his or her life experiences within the collective domain and the world, which in turn are shaped by individual views and actions. The individual who undergoes a process of conscientization (as in Freire) and/or operates within the explanatory path of objectivity-in-parentheses (as in Maturana) might become aware of their own hidden assumptions and existential conditions and recognize his or her responsibility and legitimacy in interpreting and co-creating the world. This awareness might lead to the acknowledgment of the legitimacy of different forms of being, doing, and knowing the world.

These concepts might be connected to the notion of agency, which is also present in the ideas of transformative social learning. Agency emerges from an individual's awareness of their inner ability to develop solutions and act on critical issues posed to him or her; it is the potential to bring about change (Bandura 2006). It takes place when a person effectively acts and makes decisions to meet his or her objectivities, individually or as a member of a group (Tassone, Dik, and van Lingen 2017). Agency can be activated through dialogue and reflexive processes (Mezirow 2000) that are foundations of transformative social learning approaches. In this light, it is suggested that an individual's agency might be enhanced by attending one's own psychological needs for autonomy, competence, and relatedness through meaningful interactions and diverse forms of engagement in collective learning processes (Aguilar 2018).

Members of the leading group of the initiative at Lomba do Pinheiro reported acknowledgement and respect for the diversity of views that are present in this movement. They mentioned that respect for each other's views facilitates individual expression and contribution to both the issues discussed at meetings and the roles played in the actions within the territory. They also

noted perceiving diversity as a crucial condition for designing locally appropriated solutions that should be based on the integration of technical and local knowledge. Diversity is mediated within this group from a relational approach that uses dialogue as a key integrative tool. Furthermore, this guiding principle is also reflected by the concern of participants as to how to engage the most marginalized social groups that inhabit the streambanks in conditions of insalubrity and misery. Approaches based on the 'correction of attitudes' or indoctrination, carried out in some activities led by the engaged actors, were shown to be inefficient as they resulted in a hostile response of these social groups in relation to the goals of the movement. After these results, the group adopted an approach based on a non-judgemental posture, listening, and respecting inhabitants' views regarding the situation in which they find themselves, which appeared to be a promising path for their engagement.

It is important to stress that this principle does not advocate that respect for the existence of different views implies the acceptance of ones that are not life-enhancing. First and foremost, the suggested guiding principles should be observed in light of sustainability aims as described throughout this paper. Diversity here is seen as a possibility for co-creation that might emerge from respectful interactions between equally legitimate participants rather than as an impediment for dialogue construction. From this perspective, ontological pluralism should lead to responsible joint reflection and not an irresponsible negation of the other (Maturana [1998] 2002). Only then might the transformation of values and mindsets unfold and shared goals for more sustainable living be constructed.

## Concluding remarks

Maturana and Freire's perspectives shed light on our human condition and on the interactions in which we are enmeshed in order to nourish a sense of ethics and responsibility regarding our role and impact in the world. Their views encompass a comprehension of reality as a continuous, creative, interactive, and emergent process generated by interdependence and mutual influence between existing entities in the world.

The concepts that converge in this paper led us to principles or guideposts that spotlight the importance of a relational approach to collective problem-solving of local issues. The understanding of cognitive processes from a biological perspective and the role of emotions as the basis for our rational explanations of the world constitute the background of these principles. They cherish acknowledgment and respect of diversity and dialogical interactions within a climate of mutual acceptance. As such, these principles – *transformative interactions between people and places*, *dialogical interaction within a climate of mutual acceptance*, and *ontological pluralism* – can help create pathways for critical thinking, construction of transdisciplinary knowledge, and new system-values, as well as place-based transformative experiences both collectively and individually. The transformative potential of actions and practical solutions within the territorial dimension, that is, at the local scale, is especially emphasized in this paper by introducing and connecting the concepts of structural coupling and praxis.

It is important to note, however, that the practical implementation of these principles in real contexts is a complex task. People might avoid engaging in learning experiences that imply overcoming established views and confronting one's own ingrained assumptions. Furthermore, it is also important to recognize entrenched hierarchical structures and power relations in society as well as community contexts and their effects on dialogical processes. Specifically, regarding the case of Lomba do Pinheiro, we call attention to striking social asymmetries in a context of deep inequality. This condition adds complexity to conversations that seek to find priorities for community action in an environment of social vulnerability that calls for urgent responses. Learning processes for sustainability that imply transformation of values, lifestyles, and emancipation of communities are long-term processes. However, vulnerable communities demand feasible

sustainable practices and immediate solutions to promote decent living conditions for populations in extreme precarious conditions. In some areas of Lomba do Pinheiro, there are people without access to sanitation infrastructure who lack the minimum financial resources for their daily subsistence. Within such a context of urgency, conducting a local learning process guided by dialogical interactions among members that lead the initiative and in relationship with the community will only succeed when it leads to the implementation of practical solutions that respond to these immediate needs.

Finally, we emphasize that we do not consider the image that illustrates the guiding principles as a model intending to cover all the necessary conditions for a transformative learning process to take place. Rather, it brings some important insights based on selected concepts of Maturana and Freire in view of the theoretical and practical background provided by the research on Lomba do Pinheiro community. Thus, we aimed at opening space to further this discussion on the contributions that can emerge from the connections between the ideas of these thinkers for future research on collective learning processes for sustainability.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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