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Permaculture and its axiological dimension in the affect(action) of elementary school students

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ABSTRACT

Through implementation of the thematic project "Pomar", conducted in a public school in Minas Gerais with 6th-grade elementary students, pedagogical activities were carried out with the aim of disseminating practices related to Permaculture and its social technologies. Data for a master's research study was collected from experiences of this project, characterized as qualitative, descriptive, and ethnographic, grounded in the Actor-Network Theory framework. Marked by environmental contradictions and conflicts, as well as the presence of agroforestry transition systems in rural communities, students' reality was problematized through activities guided by ethical principles of Permaculture — care for the Earth, caring for people, and fair share — and structured through the STSE approach and socio-scientific issues. The research methodology employed controversy mapping to identify the actants in the network formed throughout the project's execution. Findings indicate that ethical principles of Permaculture can enhance the axiological dimensions of critical environmental education by integrating regenerative practices, ethical values, and social technologies, fostering affectations in students and leading to behavioral changes in caring for people, the environment, and promoting social justice.

KEYWORDS: Permaculture; Critical Environmental Education; Actor-Network Theory.

A permacultura e sua dimensão axiológica na afet(ação) de estudantes do ensino fundamental

RESUMO

Através da implementação do projeto temático “Pomar”, realizado em uma escola pública de Minas Gerais com estudantes do 6º ano do Ensino Fundamental, foram realizadas atividades pedagógicas com o objetivo de disseminar práticas relacionadas à Permacultura e suas tecnologias sociais. A partir das vivências desse projeto, foram coletados dados para uma pesquisa de mestrado, caracterizada como qualitativa, descritiva e de cunho etnográfico, embasada no marco teórico da Teoria Ator Rede. Marcada por contradições e conflitos ambientais, e pela presença de iniciativas de sistemas de transição agroflorestal nas comunidades rurais, a realidade dos estudantes foi problematizada com atividades guiadas pelos princípios éticos da Permacultura — cuidar da Terra, cuidar das pessoas e partilha justa — e estruturadas a partir da abordagem CTSA e questões sociocientíficas. Como metodologia de pesquisa, foi realizada a cartografia de controvérsias, a fim de mapear os actantes da rede que se formou ao longo da execução da proposta. Os dados apontam que os princípios éticos da Permacultura podem favorecer dimensões axiológicas de uma Educação ambiental crítica, ao integrarem práticas regenerativas, valores éticos e tecnologias sociais, promovendo afetações nos estudantes e levando-os a mudanças de comportamentos no cuidado com as pessoas, com o ambiente e na promoção de justiça social.

PALAVRAS-CHAVE: Permacultura; Educação Ambiental Crítica; Teoria Ator-Rede.

INTRODUCTION

We are part of different realities across the globe, marked by social, environmental, political and economic crises. Our relationship with this home, common to all humans, is leading us towards a future with less energy and resources available to everyone (Holmgren, 2013). For example, the 2022 report by the Intergovernmental Panel on Climate Change (IPCC) warns that the Earth's average temperature has already increased by 1.1°C, mainly due to human activities. This warming results in negative impacts on biodiversity, leading to mass extinctions and degradation of important ecosystems, such as those that support pollination and water purification. Furthermore, the frequency of extreme weather events such as droughts and severe floods is increasing, directly affecting food security and the lives of populations. The oceans are also suffering from warming and acidification, causing phenomena such as coral bleaching and threatening marine habitats. According to Bruno Latour (2020b), the only certainty is that "everyone is faced with a universal lack of space to share and habitable land" (p. 18). Some authors, including Latour (2020b) himself, have suggested a change in the geological era from Holocene to Anthropocene, marked by the impact of human activities on planet Earth. For Mendes (2019), one of the strengths of the term Anthropocene, by placing human beings as the driving force behind a change in geological era, is to become aware of anthropic actions in evolutionary, biological, historical and cultural processes.

Environmental Education (EE) plays an essential role in educating generations committed to overcoming the challenges of their realities with critical awareness and responsibility. According to analyses by Zupelari and Cavalari (2020), academic productions in Environmental Education field show that socio-environmental crisis is understood as complex, involving interdependent dimensions and cannot be explained by a simplistic logic of cause and effect. For the authors, there is consensus among the research analyzed, that certain characteristics related to Modernity - such as the fragmentation of knowledge, the dualism between subject and object, and separation between human beings and nature - need to be overcome, as they directly contribute to intensification of environmental crisis.

For Guimarães (2004), there are different EE proposals supported by different world views. Layargues and Lima (2014) consider that EE can be characterized by three main aspects: Conservative, Pragmatic and Critical Environmental Education. The first one is linked to principles of ecology and focuses on environmental preservation and natural resources, without including social, political and cultural dimensions of reality. The second one follows market logic, also seeks to reconcile economic development with practical solutions to environmental problems and does not question the social structure. Critical Environmental Education (CEE), which inspires us in writing this work, "emphasizes the critical review of foundations that provide domination of human beings and the mechanisms of Capital accumulation, seeking the political confrontation

of inequalities and socio-environmental injustice" (Layargues & Lima, 2014, p. 33). For the authors, this EE perspective encourages questioning about reality, aiming at social transformation and environmental justice. Guimarães (20004) points out that, in CEE, "student and educator are social agents who act in the process of social transformations, and in this process, they transform themselves" (p. 17).

For us, critical EE is in line with the Latourian perspective, which alerts us to how we should orient ourselves politically in Anthropocene. Latour (2020b) states that, faced with a ground slipping beneath our feet, we need to dedicate ourselves to radical changes, which make us understand that there is no plan B, another planet to be inhabited, or a saving technology that will reverse climate change. For him, we need to be "earthly" and "ground" ourselves on this planet, here and now. Without prophesying ready-made answers, Latour invites us to critically examine our ethos and our oikos from a political ecology perspective. This reflection dialogues with Stengers (2018), who explores the inseparability between ethos and oikos, suggesting that human practices and choices cannot be dissociated from the environment we inhabit. The author argues that ethos - the way we act and behave - is inextricably linked to oikos, that is, the habitat we share with other beings. Our actions and decisions, therefore, should not be seen as something isolated or separate from the Earth, but as a complex network of interactions that responds to demands and limitations imposed by the environment. This perspective aligns with Donna Haraway (1995), who proposes the idea of "situated knowledge", in which knowledge is always situated, linked to specific contexts, inseparable from bodies and places. Loureiro and Layrargues (2013) complement this reflection by stating that the political ecology approach is important for environmental education practices, as it avoids abstract discourses that attribute an intrinsically good or bad nature to the human species. It also avoids blame individual behavior, recognizing that human actions are always mediated by social factors, since individuals are part of and produce the society in which they live.

The objective of this text is, therefore, to propose a reflection on epistemological and axiological dimensions of Permaculture as a way of landing on the terrestrial globe. We intend to demonstrate how ethical principles of Permaculture can be taken as axiological dimensions of a Critical Environmental Education, aiming at transformation of realities based on affectation of subjects during their exercise of "landing" on this planet. Thereunto, we present an excerpt from a master's research that seeks to understand how 6th grade elementary school students in a school in Minas Gerais countryside understand the way they occupy the world. The research seeks to answer: what are the potential and challenges of Permaculture regarding the processes of raising awareness among individuals about the way they perceive that they occupy the world?

LEARNING TO BE AFFECTED TO LAND IN THE WORLD

We were inspired by the Actor-Network Theory - ANT (Latour, 2012) and the works by this French author, who died in 2022, a philosopher, anthropologist and historian of Sciences who dedicated much of the last years of his life to socio-environmental issues, seeking to relate the evidence of Anthropocene to the need for a political reorientation of humanity. As one of the precursors of Actor-Network Theory, Latour warns that it is necessary to redefine the notion of "social" based on the network association between humans and non-humans, which he calls actors (or actants), i.e., everything that has agency in the world, which can be entities, viruses, people or things. These heterogeneous, fluid and dynamic networks are formed by actants that associate through translations (Latour, 2001), which would be alliances that displace the original objectives and interests of actants in fabrication of realities (Law, 2004). To translate is, therefore, to make interesting. Latour explains that the translation process is not always simple and smooth and is instead immersed in controversies and disputes between actors and groups with divergent interests (Latour, 2016). It is not difficult to find controversies and disputes surrounding socio-environmental discourses and practices. Current climate denialism can be seen as the result of a controversy that was once "hot": the one that disputed whether the origin of climate change was natural or anthropogenic. Latour (1994) shows that, in some cases, interest groups insist on keeping the flame of controversy burning, even though the evidence already speaks for itself, transforming the debate into a cacophony of interactions that produce interdependent realities. We, human beings, as part of this network, belonging to a global scenario in crisis, need to re-signify our way of being "earthly". According to Latour (2020b), "to resist this loss of common orientation, it will be necessary to land somewhere. Hence the importance of knowing how to orient oneself[...]" (p. 11). In his work, "*Where to Land?*" (2020b), he considers that, in the face of the global ecological crisis, it is necessary to abandon abstract theories and "land", that means connect knowledge and action in the territory to networks, recognizing the interdependence between human beings and the natural world.

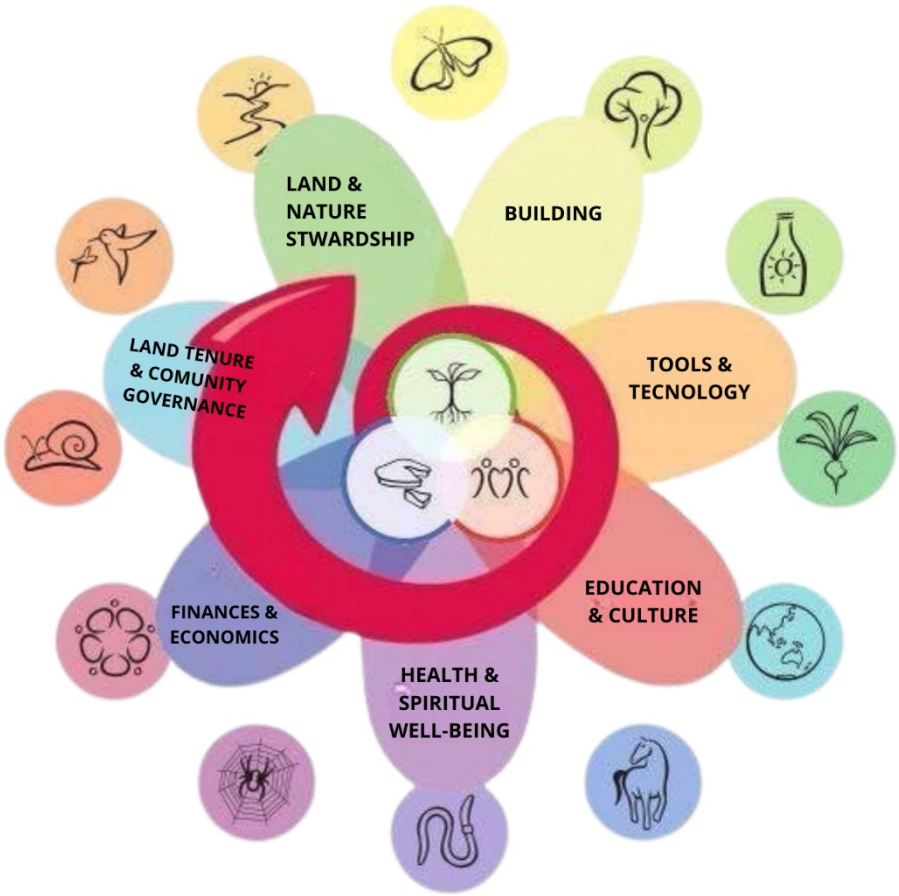
Another central concept to this text is "affectation". Latour (2008) explains that having a body is "learning to be affected" (p. 39). Using the work by Vinciane Despret, he states that having a body is being put in motion, being moved, being placed in relation to other elements (human or not). In that regard, the body is not "the temporary dwelling of something higher - an immortal soul, the universal, thought - but that which leaves a dynamic path through which we learn to register and be sensitive to what the world is made of" (Latour, 2008, p. 39). Then, Latour aims to define the body through how it relates or how it becomes sensitive when encountering other elements of the world. As Souza and Lima (2017) state, in this learning process, the body becomes increasingly precise, definable or narratable. Therefore, the more you learn, "the more differences there are" (Latour, 2008, p. 46). In this text, we seek to describe the networks of human and non-human elements that affected the students who participated in the Pomar Project, presented below.

LEARNING TO BE AFFECTED TO LAND IN THE WORLD: PERMACULTURE AND ITS AXIOLOGICAL DIMENSIONS – THEORETICAL PROPOSITION FOR CRITICAL ENVIRONMENTAL EDUCATION

Permaculture is a movement that integrates traditional and scientific knowledge, and according to Mollison and Stay (2008), aims to create sustainable human settlements. It prioritizes systemic vision, integrated relationships and actions on scales (from local to global). It has ethical and design principles that guide practices aimed at regeneration and self-sufficiency. According to Holmgren (2013), "Permaculture principles and strategies provide ways to meet our needs while allowing other species to meet theirs" (p. 57). When worked on the school context, it has the potential to contribute to transform the school environment and community (Allain & Fernandes, 2022).

Figure 1

Flower and Permaculture Ethical and Design Principles



Source: Permacultural (2012).

Permaculture Flower is a visual representation that illustrates the fundamental principles and elements of this movement. At the center of the flower are the ethical principles that guide human occupation in the world. According to Holmgren (2013), each petal symbolizes a

fundamental aspect or “key domain”, to be considered and transformed by societies. The spiral represents our evolutionary path, which starts with ethics and is intertwined with all domains, forming a network that expands in scales. Around the flower are the design principles that guide the planning and drawings of space to be occupied by human beings.

Ethical principles illustrated in the center of Figure 1, “Caring for the Earth,” “Caring for People,” and “Fair Sharing” form the fundamental basis for implementing practices that seek to establish a syntropic and harmonious relationship between humans and the planet. The principle of “caring for the Earth” highlights the responsibility to protect and regenerate the ecosystems that sustain life, promoting the conscious use of natural resources and practices that ensure their preservation for future generations. Holmgren (2013) reinforces that this principle involves the acceptance of all forms of life and the reduction of total environmental impact of human beings. The principle of “caring for people” begins with the individual and expands to the family and community spheres, emphasizing that caring for oneself is the first step to being able to care for others. This principle challenges our dependence on the global economy, encouraging the appreciation of local and domestic economies, promoting self-sufficiency and social responsibility. The principle of “fair sharing” seeks to establish limits on consumption and reproduction, proposing the redistribution of surpluses as a way of strengthening communities through collaboration and mutual support. Holmgren (2013) suggests that “caring for people” and “fair sharing” can be understood as principles derived from “caring for the Earth”, because by protecting the planet, we also ensure the well-being of people, and the construction of a more equitable society prepared to overcome the various crises that surround it.

According to Souza and Cavalari (2020), the environmental crisis has been widely linked to a crisis of values, the result of a historical imbalance in the way society relates to nature. As the authors point out, although this ethical issue is urgent, much of the research in Environmental Education still deals with environmental ethics superficially. Therefore, they highlight the importance of discussing the values that guide our ways of inhabiting the world, alerting to the need for a more consistent and critical ethical approach within the field of Environmental Education.

Then, we consider that Permaculture can be a powerful theoretical proposition for Critical Environmental Education, by integrating ethical principles and practices that promote transformation in its various dimensions (social, political, economic and environmental). Ethical principles of Permaculture offer a perspective that goes beyond simple environmental preservation, incorporating values of social justice, cooperation and regeneration. In our view, these axiological principles are aligned with Critical Environmental Education, since according to Layargues and Lima (2014), it seeks to “contextualize and politicize the environmental debate, problematize the contradictions of development and society models” (p. 33). The exercise of these principles, through permacultural practices, can be fertile ground for the movement of

affectation proposed by Latour (2008), since it can provide different articulations between forms of interaction and enable mutual transformation.

RESEARCH METHODOLOGY – CARTOGRAPHY OF CONTROVERSIES

Firstly, we emphasize that this research is part of a broader investigation, approved by the Research Ethics Committee under the number: 64530622.1.0000.5108.

In this research, carried out during development of the Pomar project (Orchard Project), the Cartography of Controversies was used, a "didactic version of ANT" (Venturini, 2010), which involves detailed observation and description of disputes, generating a mapping of socioscientific controversies. More than a methodological guide, cartography of controversy uses some observation lenses, paying attention to different layers of controversies (Venturini, 2010). The process of analyzing controversies can be understood through five observation lenses proposed by Venturini (2010). The first lens helps us understand what the controversy is about, moving from scattered arguments to debate, where those arguments are connected and organized. The second lens focuses on identifying who the actors involved are, which means who is acting in the controversy. These actors can range from people, animals, to abstract entities, such as laws. The third lens seeks to understand how these actors are connected to each other, since their identities are not isolated, but defined by networks of alliances and oppositions they form. The fourth lens leads us to consider the space of controversy, that is, where it takes place. From this lens, we move from network to cosmos. Every controversy is embedded in a larger context and is related to other disputes, smaller or larger ones. The final and fifth lens questions when the controversy occurs, which the author (Venturini, 2010) considers one of the most challenging aspects. Cartographers need to not only identify controversies, the actors involved, how they connect and where they happen, but also understand how these elements evolve over time. This time of controversies is not homogeneous, since the different parties involved in the controversy may, at one moment, be stagnant, and at another, moving and expanding rapidly. According to Allain and Coutinho (2017), this is how we go from the cosmos to cosmopolitics. In this work, we explore the first three lenses of cartography.

In the context of our study, it was possible to explore several controversies. Initially, the scenario in which the school is located is already the scene of heated disputes: the municipality is in Minas Gerais, and is part of the 7th natural biosphere reserve, in a region with immense tourist potential, with untouched caves, beautiful waterfalls and well-preserved natural environments, in transition between the *cerrado* and the Atlantic Forest. However, it is under great mining pressure, as the neighboring municipality is home to a large iron mining project. This town in Minas Gerais does not have a water and sewage treatment plant, and

basic sanitation and waste management are important issues rarely considered by the government. Therefore, the town lacks movements and practices aimed at raising community awareness regarding caring for the Earth and people.

A significant portion of the school's students come from peasant families, rich in knowledge about plants, but economically disadvantaged, which generates in them a feeling of low self-esteem and shame, which ends up having consequences in their school lives. Considered disinterested and with low academic performance, they are victims of various symbolic violence. Pressured by consumerist capitalist lifestyle as a standard of success in society, students have unhealthy habits when it comes to their diet, such as the consumption of industrialized and ultra-processed foods, even though they have access to natural and more nutritious food options.

In this context of disputes between worlds, of ways of being and existing that are quite divergent and antagonistic, the Pomar Project was developed, which we discuss below.

POMAR PROJECT – SCENARIO OF THE RESEARCH DEVELOPED

Inspired by the intention of promoting critical environmental education, the Pomar project provided systematized activities based on the Science, Technology, Society and Environment (STSE) teaching approach. STSE education complements the critical approach by proposing an education that connects scientific and technological knowledge to its socio-environmental implications. This perspective, as an educational approach, seeks to incorporate social, ethical and environmental issues into teaching science and technology. As an educational purpose, it seeks to promote a contextualized scientific education that stimulates critical perception, problematization of current issues and citizen participation. When combined with Critical Environmental Education, STSE education makes it possible to integrate ethical and social values into the knowledge construction, overcoming the idea of neutrality of science and technology (Barbosa, Soares & Robaina, 2020). It has the capacity "[...] to make science more accessible and more attractive to students of different abilities and sensibilities and prepare young people for the role of citizens in a democratic society" (Fernandes, Allain & Dias, 2022, p. 119). Pomar Project was divided into 4 stages: seed, seedling, tree and fruit. This work is an excerpt from the first three stages of the proposal, experienced by the first author. Each cycle was based on a theme that relates to human needs that Permaculture can help to meet. The four themes were: food, energy, housing and coexistence. The intention was that every two months, activities related to one of them would be carried out, in that order. However, when the first author proposed the project had her first contact with students, she was deeply affected. She noticed a very hostile environment and a huge problem related to the theme of "coexistence". Aware of a Permaculture principle that proposes "observing and

interacting" with the environment (Holgrem, 2013), the researcher noticed that the local context, the school, demanded the planning be changed. Thus, she began with activities aimed at improving coexistence in the 6th grade classes. It is worth noting that this project underwent several changes throughout its execution, due to the need to adapt to the local context. Affect(action) generated by this context produced countless reflections on the great complexity of consolidating an educational space permeated by affection and care. As the project progressed, several challenges and new paths of knowledge and sensitivity emerged. As an educator, the researcher questioned herself several times about their behaviors, which led her to reflect and study possibilities for transforming the reality in which she was inserted.

The next section shows how controversy cartography was used to map the impact on the school community, based on permaculture practices and its ethical principles. The results are presented through a descriptive-interpretative narrative by the first author, based on data collected from the project records: photos, videos and mainly the researcher's field diary. For this reason, the narrative is in the first-person singular, in quotation marks, when referring to the perceptions and reports by the first author, taken from her field records. Because it is ethnographically inspired, the description of episodes themselves, in dialogue with literature, constitutes the network woven throughout the project. To illustrate the effects and displacements of the actors, visual representations of networks of each stage of the project were created. Throughout the text, the actors of these networks are highlighted in italics in the text.

RESULTS ANS DISCUSSION

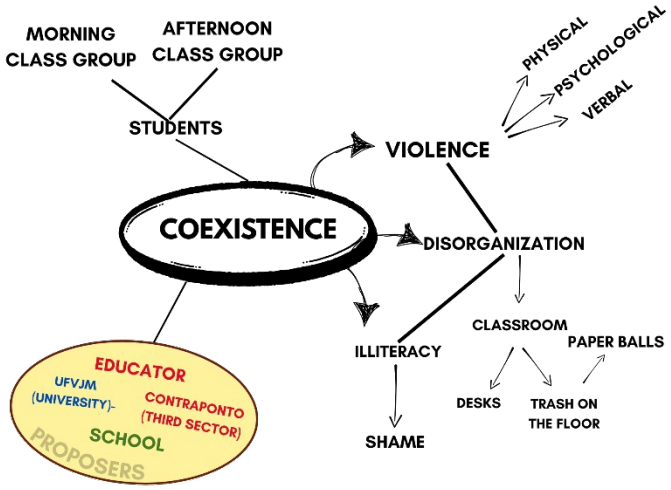
The practices related to ethical principles of Permaculture in an integrated way, although at each stage they connected more clearly with one or another principle. In the "Seed" stage, practices were mainly aligned with the principle of "Caring for People", given the focus on building relationships of respect and collaboration. In the "Seedling" stage, the principle of "Caring for the Earth" was more evident, as the activities addressed soil regeneration and ways of producing healthy food. In the "Tree" and "Fruit" stages, the principle of "Fair Sharing" stood out, with sharing of knowledge and practices related to agroforestry.

From the Cartography of Controversies (Venturini, 2010), networks were created that bring together human and non-human actors present throughout the project. It is worth mentioning that, due to the limited number of pages in this paper, some enlarged excerpts of the representation of each stage carried out are presented. As ethical principles of Permaculture guided the practices carried out throughout the project, we describe this experience based on each principle. Although Holmgren (2013) highlights that caring for the Earth is the first permacultural principle that will lead to "caring for people" and "fair

sharing", in Pomar project, we were faced with an extremely challenging scenario, which emphasized the importance of starting with the exercise of "caring for people". The first controversy we encountered was in relation to coexistence. "I found an environment marked by disorganization and violence, whether practiced among students or by teachers toward students. Given this, the following controversy arose: how can we develop an ethics of care if the work and study environment itself is hostile?" This motivated a change in planning activities. We started with the theme "coexistence", which became a very important and notable factor. This reinforces the idea of Latour (2020), who highlights the need to ground as a response to crises that destabilize the social part, requiring actions to be situated locally. To illustrate the project initial scenario and the actors in evidence, we present the network shown in Figure 2.

Figure 2

Representation of the initial scenario



Source: Author's personal collection.

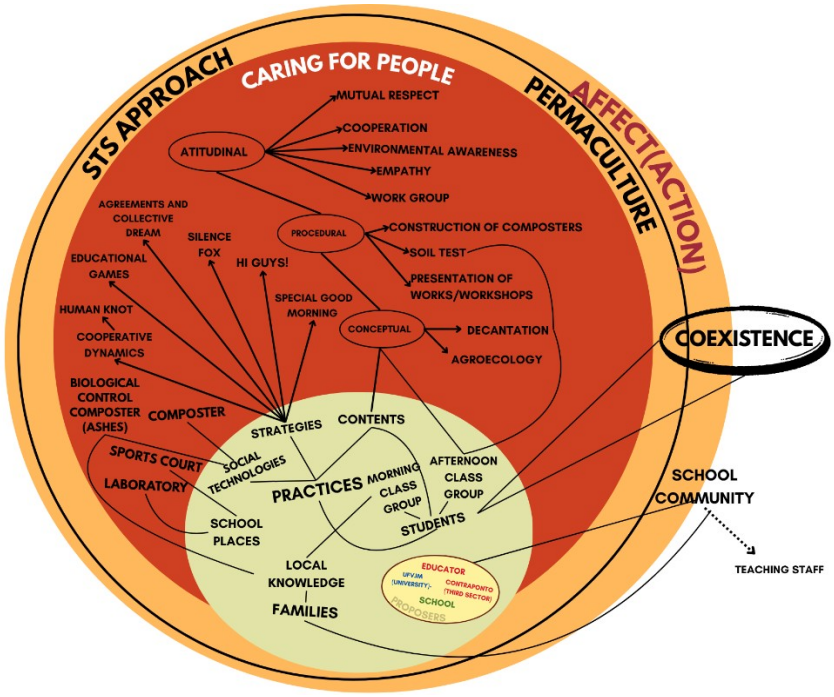
This network represents the beginning of the project, proposed by *Espaço Educacional Contraponto*, a third sector organization, in partnership with a *state school* and a *university*. The activities were carried out with two *classes*, one in the *morning* and the other in the *afternoon*, from the 6th grade. "In my first contact with students, I noticed a hostile environment in which students verbally provoked and/or physically always attacked each other. Furthermore, the relationship between some teachers and school staff and students was also quite violent. The classroom was full of *trash on the floor*, mainly *paper balls*, and the desks were badly damaged. Another issue that arose during the first activities was the *illiteracy* of some students, who, as they were unable to carry out activities involving writing, felt embarrassed about it." From this context, several strategies and practices were adopted, permeated by ethical principles of Permaculture (Holmgren, 2013), based on care to transform this reality.

CARING FOR PEOPLE

The following network represents the "Seed" Stage of Pomar Project. As in the previous network, the actors are highlighted in italics in the text, to make it easier for the reader to see them.

Figure 3

Representation of the "Seed" stage



Source: Author's personal collection.

"This principle began to be worked on in the 'seed' stage, firstly by me, the educator who proposed the project. A way to take care of my own affections was to study ways of carrying out educational practices that made a difference in the reality of those involved. Affected by the school context and the behavior of students and their teachers, I began to use strategies based on care and focused on affection, such as the 'special good morning' (a way of welcoming students as they would like to be welcomed), the dynamics of collective dreaming and coexistence agreements." This practice reflects what Guimarães (2004) highlights about CEE, which values the transformation of educator and student as social agents in processes of change. "I also tried to occupy other school places as much as possible, besides the classroom. This displacement affected students, who, being in places they did not frequent, were sensitized by the environment. An example was the second meeting that took place in the *Science laboratory*, an environment full of different elements that aroused curiosity. In this practice, we discuss what care is and what it means to care or not to care for the planet. I noticed many ready-made answers coming from experiences related to the

sustainability topic and little criticality regarding to what was shared by them."

As Carvalho (2004) emphasizes, CEE must confront superficial discourses, problematizing behaviors and practices that reflect alienation or lack of critical engagement. An example of an uncritical response, which also presents itself as a controversy related to the practice of care, was "don't pollute the planet". At the same time, most students were throwing trash on the classroom floor. This practice highlighted the importance of problematizing students' attitudes and speeches, seeking to reduce the distance between them. Without a critical perception of reality, we continue to perpetuate alienated and destructive behaviors that impact both people and the environments that surround them.

"By starting the project, talking about care and at the same time taking care of the relationship between us and with ourselves, we began to weave a network full of affect(action). Dealing with two completely different classes in a violent and excluding environment was quite challenging. The morning class was made up of 26 children, most of whom live in rural areas of the region. The afternoon class was made up of 40 children and the majority of whom live in the urban area. In both classes, a big challenge was the silence during the explanation. As an exercise in perception and attention and an alternative to not acting in an authoritarian manner, I introduced the '*silence fox'*, a hand movement, like this animal, which became a code for students to realize that something important should be heard and the whole class needs to be silent."

"The challenge of creating a caring environment proved to be more intense and relevant in the morning class, where inattention and verbal and physical violence were more frequent. Furthermore, there was a clear segregation and comparison made by teachers, who labeled the 'best' and 'worst' students and/or classes, further reinforcing the feeling of exclusion among students. These aggressive behaviors, which students reproduced, reflected their own experiences of exclusion and disrespect, both inside and outside school. At the beginning of this relationship with students, I sometimes reacted with punitive actions, such as prohibiting them from playing on the sports court, because there was no silence during the explanation. When I realized that my actions were based on punishment and reward, I reflected on the need to change this behavior and felt affected. I resumed the activity of coexistence agreements, proposing reflections on individual and collective attitudes to transform 'unfulfilled agreements.' I stated that no one would be excluded and that we would face the challenges together. Throughout this stage of the project, students were affected by the union of affection with action. A '*special good morning'*, which used to consist of several handshakes, turned into several hugs and fun dances. Days marked by physical violence became days with little provocation and aggressive physical touching."

At this stage, educational *dynamics* and games focused on group work and community life were also carried out, which showed how

challenging collective work, and the exercise of coexistence are. “A dynamic that reflected this challenge and showed how the unity and organization of the group can overcome it was the ‘human knot’. Students, holding hands and entangled, needed to communicate and work as a team to unwind without letting go of each other’s hands, reinforcing the importance of dialogue and collective collaboration. This tangle represented a problem common to everyone, which could only be resolved collectively, without anyone letting go of anyone else’s hand.” This practice illustrates the concept of a network, by Latour (2020a), in which actors - human and non-human - collaborate and affect each other to produce shared realities. In the case of this activity, interaction between students highlighted the need for communication and cooperation to resolve conflicts, reflecting the idea that “learning to be affected” is essential to recognize differences and find collective solutions.

“This dynamic was applied on two different days. In the first one, none of the classes managed to untie the knot without letting go of their hands. No one communicated, one pulled the other and there was no attention. Some students even got hurt due to carelessness. We discussed the importance of understanding ourselves in the spaces we occupy and observing the challenges that exist within them. We also reflect on how when we are inattentive and distant from the reality that surrounds us, we can hurt ourselves and distance ourselves from care. The other day, this dynamic was applied as a challenge that had to be overcome, so that the class could play on the sports court. After a few failed attempts, the afternoon class managed to untie the knot.”

Figure 4

The human knot dynamics

Source: Author’s personal collection.

We take the opportunity to reflect that, when we have something that motivates us to overcome challenges, it becomes easier to connect and organize ourselves to change. However, regardless the motivation, when we perceive and feel that we belong to a territory, we can, as “terrestrials”, organize ourselves to together overcome problems that are common to us. This experience refers to what Latour (2020a) argues, that “it is necessary to discover paths to care”:

> There is no cure for belonging to the world. But through care it is possible to cure oneself from the belief that one does not belong to the world; that this question is not the essential question; that what happens to the world does not concern us. [...] This is not going to "go away". You must deal with it. It is permanent (p. 32).

"As my body, acting in this network, was 'learning to be affected,' other possibilities were emerging, and new connections were established. For Latour (2008), 'learning to be affected means this: the more you learn, the more differences there are' (p. 46). As I became more involved with the school, the university and my work at Espaço Educacional Contraponto, I began proposing practices that could transform the scenario I found. Project Pomar, as a propositional articulation, affected me as an educator. Affected by the students' affect(ation), I continued to build an articulated proposition."

"The practices also integrated *attitudinal, procedural and conceptual content*, strengthening the learning process. *Attitudinal content*, such as respect, cooperation and empathy, permeated all activities, encouraging a more collaborative and supportive environment. *Procedural content*, such as building composters and testing soil, allowed students to actively engage in practical tasks. In *conceptual content*, the concept of decantation, for example, was addressed by the afternoon students themselves, in such a way that they related it to the practice of soil testing. The afternoon class showed greater ease with school content, while the morning class demonstrated greater connection with local knowledge and social technologies, such as sharing practices related to *biological control*, like the use of *ash* to scare away herbivorous insects."

Social technologies are collective constructions of solutions that involve active participation of beneficiaries (Allain & Fernandes, 2022). These solutions can range from water treatment systems to cultivation techniques. They are economically viable, the community itself can implement them and become more autonomous. "They also break with the relationship of technological dependence, with the purpose of promoting social transformation, observing dimensions of sustainable development, and rescuing the appropriate relationship between science, technology and society" (Allain & Fernandes, 2022, p. 40).

Furthermore, a dotted line can be seen on the network that starts with the school community and goes towards the teaching staff. This shows that the teaching staff was not an actor affected by the project practices. There were some attempts at rapprochement, but only two teachers quickly became involved in a practice that will be reported in the "seedling" stage. The absence of teaching staff made it difficult to connect school content to permaculture practices, but even so, the educator tried to give more meaning to what was being learned in the classroom, by consulting teachers directly about what was being covered in their subjects. The lack of connection between the teaching staff and the project made us reflect on the factors that may have hindered their participation and on the need to also take care of our relationships with our peers and professional colleagues.

A pertinent reflection which also emerged from this experience is that there is no single meaning for care, nor an end point in the act of caring. This meaning, as Latour (2008) considers, is constructed as we are affected by realities. Another issue is that we will never solve all the problems of coexistence, there will always be challenges. However, in the exercise of grounding, coexisting and recognizing ourselves as earthlings, we can learn to interact with the world in other ways and to propose alternatives that seek to solve our common problems. In that regard, as Latour (2008) states, articulated propositions can strengthen connections of the networks we are part of.

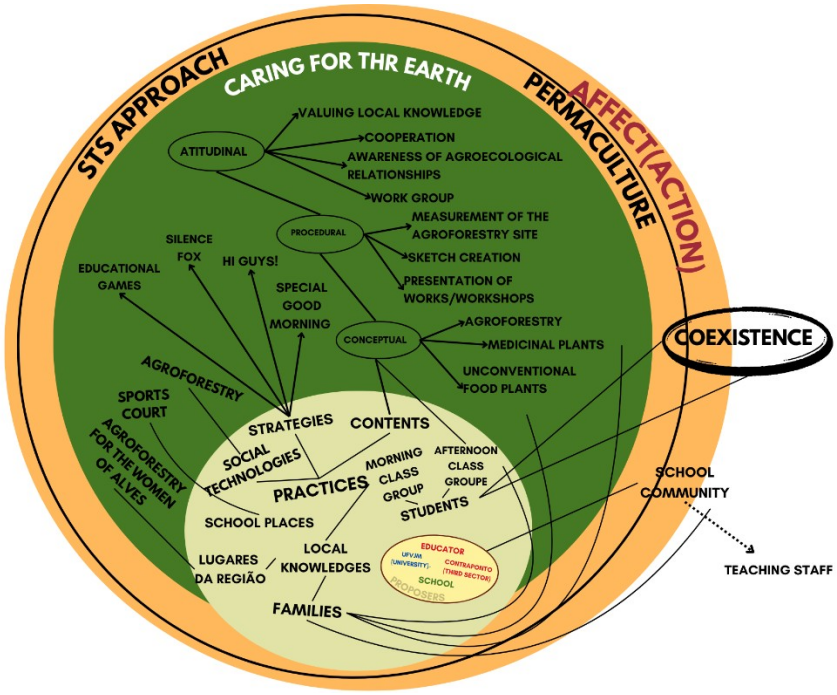
"At the end of the 'Seed' stage, activities focused on social technologies were also carried out, with an emphasis on agroecology. One of these technologies is Agroforestry Systems (AS), as they consist of practices for producing living soil, without using chemical fertilizers and which, in addition to other objectives, can produce food. In all practices, I prioritized knowing what students know, and this time was no different. When I brought up '*biological control*' as an example of social technology for herbivore control, new actants emerged in the network of affect(ation): *families and local knowledge. Some students shared how their families deal with insects that appear on plantations.*" As we said, the most cited method was the application of ashes to the plants. This exchange of knowledge highlights what Haraway (1995) proposes, when stating that knowledge is always situated in a place and interdependent on the bodies that produce it. Therefore, considering the knowledge and traditions of peasant families provided an encounter of knowledge - between academic and popular ones.

CARING FOR THE EARTH

Next, the "Seedling" stage deepened the focus on soil regeneration and principles of agroforestry, with intention of implementing an agroforestry bed in the school environment. These practices presented themselves as alternatives to deal with problems common to the community (which is why we consider them as Social Technologies) and are directly aligned with the ethical principle of "Caring for the Earth".

Figure 5

Representation of the "Seedling" stage



Source: Author's personal collection.

This ethical principle began to be more present and emphatic at the end of the first two months, when activities on *social technologies* began. This approach is in line with Critical Environmental Education, which according to Layargues and Lima (2014), to be understood, requires political and social dimensions of education and human life. Carvalho (2004) highlights that CEE is established in a political territory marked by disputes and clashes over ethical values, lifestyles and rationalities, contributing to form environmental cultures that directly influence social practices. By integrating social technologies that involve collective solutions and active community participation, the project sought to redefine the relationship with science, technology and environment, fostering a socio-environmental transformation that aligns with this critical perspective, in which care for oikos is directly linked to ethos.

"In the meetings of this stage, topics such as soil life and agroforestry were addressed, while at the same time we also reflected on agribusiness, pesticides and mining. We discussed the importance of keeping the soil alive to produce quality food. To present an alternative to produce living soil, we built a home composter, the first social technology built by students. In the last activity of the 'seed' stage, the students divided into groups and presented, to other classes, a work on the importance of disposing waste correctly, and the composter as a very important way of disposing organic waste". This practice reflects what Holmgren (2013) argues, that in addition to taking care of planet Earth, it is necessary to take care of the soil as well.

Figure 6

Construction of the composter and presentation

Source: Author's personal collection.

"In the 'seedling' stage, we carry out activities that connect more with this principle of 'caring for the Earth'. We started with an activity on ecological relationships, which highlighted the importance of diversity and interactions that occur in nature. Afterwards, students interviewed their families to learn how they plant and which Non-Conventional Food Plants (PANCs in its Portuguese acronym) and medicinal plants they know, further enriching the project's actions with local knowledge. In this way, the students' families connected to Pomar project's network of impact".

"A significant moment of this stage was the visit to the Agroforestry System (AS) of women of Santa Cruz de Alves (*Sistema Agroflorestal [SAF] das mulheres de Santa Cruz de Alves*), in this town of Minas Gerais. This experience demonstrated how the permacultural principle of Earth care can directly impact soil regeneration while promoting social justice. This AS is a social technology that enables income generation for these women, who sell their production through CSA (Community Supported Agriculture) project. This project establishes a direct relationship between farmers and consumers through the sale of organic baskets. During the visit, students also had the opportunity to see the *principles of agroforestry* (density, stratification, soil cover, biodiversity) applied in practice, enriching their understanding of integration between regenerative practices and solidarity economy".

"Another visit that included actors in the impact network presented was that of undergraduate students from a Biological Sciences faculty at the partner university, who held workshops on *the principles of agroforestry*. These activities helped students to recall and retain concepts previously covered." This experience aligns with the project's intention of establishing a horizontal relationship between the third sector, schools and universities, demonstrating the importance of collaboration between these institutions to consolidate critical education. These experiences are reflected in the network of affectation, which helps us understand what Latour (2020a) proposes regarding the connections between our actions and their consequences. By reflecting on these interactions, we are encouraged to adopt a more conscious and

responsible stance, recognizing that each gesture can contribute to change.

"The first semester ended with practices focused on implementing an *agroforestry site* in the school environment. We carried out a cleaning campaign in the environment, and then, with the collaboration of geography teachers, students made a sketch of the space trying to apply the principles of agroforestry and local knowledge. The teachers' participation was not so effective, but the collective work and the sketch were very important actors, as they were connected as practices that provoked attitudes such as *cooperation*, *group work* and awareness about ecological relationships that occur in nature and in agroforestry bed. *Measuring* the bed and drawing the sketch were important procedures associated with the network".

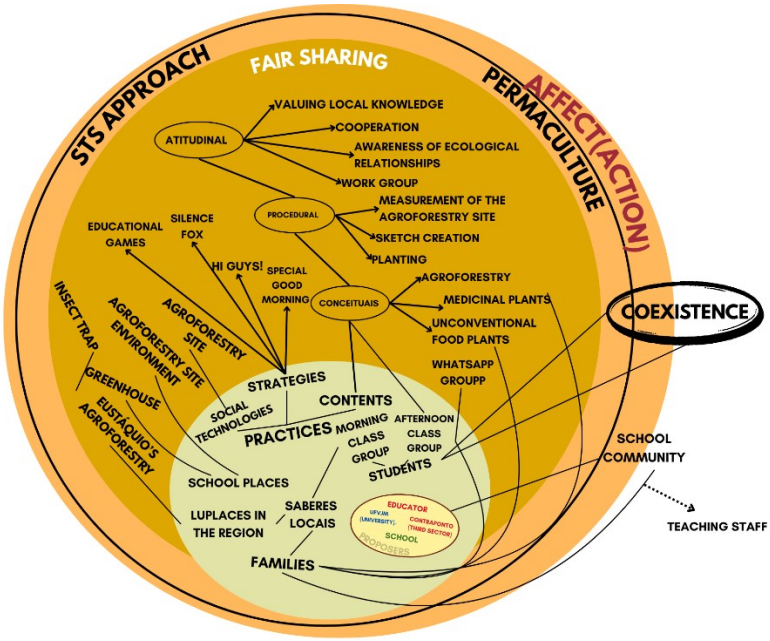
In the second semester, the "Tree" and "Fruit" stages were carried out, which connected more with the ethical principle of Permaculture called "fair sharing".

FAIR SHARING

The ethical principle of "Fair Sharing" described by Holmgren (2013) proposes establish limits on consumption and redistribution of surpluses as ways of strengthening communities and promoting social justice. It encourages cooperation rather than competition, and the search for solutions that respect the limits of planetary resources, highlighting the need to reduce inequalities and share benefits equitably. This principle was experienced in a practical and integrated way throughout "tree" and "fruit" stages, in addition to practices carried out in the first semester, such as interviews with families and the visit to the Alves agroforestry. "The interviews with families showed that knowledge about plants, *PANCs and medicinal plants* plays a central role to construct practices adapted to the territory, while the visit to the Alves agroforestry highlighted the potential of agroecological systems based on cooperation to generate income and promote social justice". These project experiences promoted exchange of knowledge and appreciation of local knowledge, bringing more elements to the network of impact.

Figure 8

Representation of "Tree" and "Fruit" stages



Source: Author's personal collection.

"At the beginning of the semester there was a significant episode, in the afternoon class, which demonstrates how they were affected by the project's practices. Some students in the class got together with other students from other classes at school and created a group on a social network, which they called '*For a better world*', to carry out work to promote practices aimed at caring for the planet, both for the school itself and for the municipal school in town". This initiative reflects the proposition by Latour (2020b) on the need to ground and create locally situated solutions. Also, to highlight how bodies affected by reality can become sensitive and, consequently, come together to carry out practices aimed at transformation (Latour, 2008). Disseminating the knowledge learned is also a form of fair sharing, which in turn reflects care for people.

"During the 'tree' stage, a visit was made to a local *farmer's agroforestry*. It was a significant experience in which students were able to learn firsthand about the practices of a farmer who supplies food to the school, and who is also involved in the CSA project. On that day, the farmer taught practices aimed at controlling insects, such as the use of traps, and shared foods that he produces in abundance, such as sugarcane, giving us sugarcane juice and brown sugar, in a gesture that exemplified the sharing of surpluses in practice". This act not only awakened affective memories in students, connecting them to family traditions, but also reflects what Holmgren (2013) points out about the importance of sharing resources.

In the second semester, the morning and afternoon classes carried out the construction of a collective sketch to implement the agroforestry bed, as we already mentioned. Then, the "fruit" stage began, in which a practical planting of seeds was carried out in the school greenhouse. During planting, one of the students made an important suggestion, remembering the practices they learned during their visit to the local farmer's agroforestry: "We can make the trap we learned with *John Doe*? He asked." This adds to the movement of affect(ation), since what they learned was thought to be reapplied in the environment that surrounds them.

"After planting the seeds, the project moved on to planting seedlings in the *agroforestry bed*. In this practice, students brought seedlings from their homes and a school employee brought seedlings of *medicinal plants* and *spices*. A larger composter was also implemented to dispose of organic waste from school meals. During the planting of seedlings, a group of students spoke with the school cafeteria staff about what could or could not be disposed of in the composter, delivering a specific waste basket to dispose organic waste. Later, one of the cafeteria workers approached to learn more about the process of producing fertilizer from the composter. After learning the procedure, she expressed her intention to apply what she learned in her own home". This episode highlights the movement of affect(action) towards other members of the school community. It also highlights how the principle of "fair sharing" is realized in practice: exchange information, responsibilities and knowledge for collective good.

CONCLUSION

The objective of this text was to point out the potential of permaculture in development of axiological dimension of a critical environmental education. Regarding potential, we observed that the ethical principles of permaculture were fundamental to understanding the benefits of Agroforestry to face the contradictions experienced by students in the scenario in which they live: a rich sociobiodiversity seduced by controversial mining development.

From the perspective of Actor-Network Theory and the concept of affectation, by Latour (2008), the project exemplifies how networks of interactions between humans and non-humans, mediated by articulated propositions, can create movements of affectation that transform realities. These shifts do not occur in a linear and objective manner. They happened amid contradictions and controversies that, when exposed, mapped and studied, can redefine the social characteristic and challenge us to learn how to be affected. The reflections proposed by Latour, such as "landing/grounding" in the Anthropocene (2020), are deepened by the dialogue with Stengers (2018) and Haraway (1995), who reinforce the inseparability between ethos and oikos, as well as the importance of localized knowledge to respond to current challenges.

Along these lines, the ethical principles of Permaculture — caring for the Earth, caring for people and practicing fair sharing (Holmgren, 2013) articulated with social technologies (Allain & Fernandes, 2022), stood out as tools that promote not only environmental regeneration, but also transformation of social relations. The project, by engaging students in practices such as building agroforests and composting, demonstrated how contextualized learning can stimulate critical reflections and strengthen community ties. As challenges, we point out the need to also involve the teaching staff, which would certainly have further strengthened the project, the learning and the impacts among students.

From a critical perspective, we observe that the principles of Permaculture offer an axiological dimension that aligns with Critical Environmental Education (CEE), as described by Guimarães (2004) and Layrargues and Lima (2014). CEE seeks to politicize the environmental debate and promote social transformation, encouraging the review of power relations and inequalities. Permaculture social technologies play exactly this role, by providing autonomy and self-management to communities, which can solve their local problems in search of social transformation. When approached at school, Permaculture can act as a practical and theoretical tool that not only addresses ecological issues, but also involves social, political dimensions and ethical values, essential for a critical education.

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