

Bringing the Practice of Education in Sciences and Biology Back into Life

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ABSTRACT – Bringing the Practice of Education in Sciences and Biology Back into Life. The article discusses science teaching practices based on notions of life and nature as generative contexts, in contrast with the usual conceptual definitions in biology. The proposal is to approximate these practices to the horizon of ecological epistemologies (Steil; Carvalho, 2014), where multiple and diverse contemporary comprehensive efforts come together, appraising the materiality of life as well as criticizing human-centered science, which tends to reduce the multiple emergences of the living. The present article analyzes two experiences, being the first one in basic education and a second one within university settings. It concludes, for the sake of the quality of productivity in the realm of science teaching, that returning to the condition of ‘being alive’, through an ‘education of attention’ (Ingold, 2015) is necessary: multiplying forms of life, while promoting an expansion of one’s perception regarding the plurality of existing worlds where existence takes place, through the permanent co-production of life, is the path to walk upon. **Keywords: Science and Biology Education. Learning. Ecological Epistemologies.**

RESUMO – Trazendo a Prática da Educação em Ciências e em Biologia de Volta à Vida. O artigo objetiva discutir práticas de ensino de ciências partindo de noções de vida e de natureza como contextos generativos, não idênticos às suas definições conceituais na biologia. A proposta é aproximar essas práticas do horizonte das epistemologias ecológicas (Steil; Carvalho, 2014), em que múltiplos e diferentes esforços compreensivos contemporâneos se aproximam, valorizando a materialidade da vida e criticando uma ciência humano-centrada, que tende a reduzir as múltiplas emergências do vivo. Toma em análise duas experiências, uma na educação básica e outra na educação universitária. Conclui pela produtividade para o ensino de ciências de voltar-se à condição do ‘estar vivo’, através de uma ‘educação da atenção’ (Ingold, 2015), multiplicando as formas de vida, à medida em que promove a percepção de mundos plurais, onde a existência se dá pela permanente co-produção da vida.

Palavras-chave: Educação em Ciências e Biologia. Aprendizagem. Epistemologias Ecológicas.

Introduction

Considering that biological sciences seek to understand life, the current time within which these sciences are being produced, in its rupture with the past and the negation of hybrid differences and emergencies¹ (Latour, 1994), leads us to ask ourselves which are the lives that are being (dis)regarded in the learning environments we inhabit. Several lives overflow from the dichotomy in between culture and nature and, therefore, become unheard of - or, in some cases, not even minimally acknowledged - within the political/ecological fields of biological sciences, given the “great division” (Latour, 1994) which constitutes both the epistemological and the ontological matrixes of these sciences. Having posed these questions, the reflections provided by the educator and anthropologist Tim Ingold - through works such as *Bringing Things to Life: Creative Entanglements in a World of Materials* - locates us in the midst of the critical debate regarding modern dichotomies, as well as evokes a processual and ontological perspective “[...] that assigns primacy to processes of formation as against their final products, and to flows and transformations of materials as against states of matter” (Ingold, 2012, p. 26).

Bringing the practice of education in sciences and biology² back into life involves acknowledging that such perspectives are preferable, not merely for being truthful or efficient, but for being capable of multiplying beings in the construction of worlds, as it is also suggested in Latour’s symmetric anthropology³ (1994). As we find ourselves immersed in educational practices, performing our activities as engaged practitioners from the viewpoint of particular stances, be it as teachers on elementary and basic education or as professors on graduation and post-graduation courses, and, therefore, also responsible for the formation of future educators, we have been questioning ourselves about the present life of our pedagogical practice.

Two experiences will be analyzed in the present paper: one which has taken place in the system of basic education and a second one which was held in a setting of university education. The first one encompasses the pedagogical process, as well as a participatory research, systematized by a Biology teacher in the modality of Youth and Adult Education. Such experience occurred with a group of students which were attending Biology during the period of the coronavirus pandemic (2020), in a regime of emergency remote learning. Narrating such co-produced experience renders clear a certain notion of learning which stems from an attentional process regarding the things of the world.

In its turn, the second experience herein reported comprises a teaching practice which took place in a subject of scientific methodology, in a *stricto sensu* post-graduation course. Through the means of narrating the reflections which arose from discussions during the classes, concerning a serpent’s life, one discusses, dialoguing and in continuity of the first experience reported in the present work, a notion of life which springs from the argument that being alive is related to moving

in the world, being part of it – along with people, things and forces that inhabit and produce the world itself.

In common, as we address such research experiences in teaching, we have sought to promote an interlocution in between the so-called natural sciences and the so-called human and social sciences. We understand that such reflexive initiatives are crucial once they shed light on the very obsolescence of dichotomic analytical models and, particularly in the case of natural sciences, they do demonstrate the insufficiency of biologizing discourses. Such reductionism within the realm of sciences and biology might be perceived as one of the factors responsible for the production of subjectivities which do not contemplate the idea of mutual dependency amongst all forms of life. As pointed out by Delizoicov, Angotti and Pernambuco (2018, p. 25) in their renowned publication *Science Teaching: fundamentals and methods*, there is an embedded pedagogical common sense, within this teaching field, as well as in the training processes of future professionals – and such common view is encrusted with elements as

[...] tiny rules and recipes, taxonomic classifications, excessive value granted to the systemic repetition of definitions, functions and attributions of living or non-living systems; poor questions designed for equally impoverished ready-made answers; indiscriminate and acritical usage of formulas and calculations in repeated drills, non-articulated or poorly contextualized tables and graphs in relation to the magnitude of the phenomena being contemplated; experiences whose sole objective is to 'verify' the theory....That is, teaching activities which merely deepen the distancing of the usage of models and theories from the real understanding of both natural phenomena and those which emanate from transformations carried out by human beings, beyond de-characterizing science as a finished and unquestionable product: a didactic-pedagogical work which favors the establishment of an *undesired dead science* (Delizoicov; Angotti; Pernambuco, 2018, p. 25, emphasis added).

To begin with it is important to broaden the concepts of biology, science and education that we consider in our practices. If science can be considered the aesthetics of intelligence (Bachelard, 1996, p. 13), teaching and learning in the field of biological sciences demands our attention, and critic, regarding certain epistemological and ontological domains which inhibit expansion and, therefore, the transformation of knowledge, holding it hostage to dichotomies such as nature/culture, subject/object, life/death. Our wish here is not to seek equivalences but to stir up teaching and learning science practices so that we may learn with life and carry out reflections and propositions based on our practices as being in/from the world, contributing to the field of education on science and biology from a perspective of ecological epistemology or, one could also – along with Ingold – call it an ecology of the living or an ecology of life itself.

But what is this life which is worth living as well as learnt and taught? First of all, it is about lives, in the plural - or even about forms of live. Lives which cannot be depreciated to a state of carbon imaginary (Povinelli, 2016, p. 37), in which the opposition between life and non-life is established when we make sure that certain entities will be able to be born, grow, reproduce and die – while others, will not. In the logic of carbon imaginary, life and death are held as fixed and deterministic stances, turning ontologies into real bio-ontologies (Povinelli, 2016, p. 5).

We make an allusion to the lives from which we may learn, for instance, the lives of plants. Through their whole exposure and plain continuity with the surrounding environment, these are lives which may only become comprehensible within the worlds they dwell in, and, therefore, produce, under the light of such perspective, what it means to make worlds (Coccia, 2018, p. 13 and 42). In this sense, the body of plants is a body that experiments, bodies which are not separated from the world (Ingold, 2012). “Plants transform everything they touch into life, they make, out of matter, air and sunlight, what shall become, to other living beings, a dwelling space, a world onto itself” (Coccia, 2018, p. 15). The life of plants is this extreme force which pervades and encompasses everything, which communicates with deep elements – soil, earth itself, through its roots – but is also in togetherness with the sky and the atmosphere, creating and recreating the interstice among quite distinct spheres, as well as plans, which interconnect through the life shape of plants. Interstice which presents certain regularities, but not certainties. Hence, following the example we have elected, considering the life of plants from the perspective of an ecology of life is to acknowledge life not as a fixed entity, associated to form and substance – as described in the Aristotelean materialistic philosophy, or yet, reducing life to autonomous entities of existence which sum up but do not mingle with one another, as in the frequentist logic of Carl Popper – which assumes the amount of uncertainties that have been refuted by the hypothetical-deductive method, as a path of knowledge validation.

Considering the life of plants⁴ – and of other beings – opens ourselves to the constant transformations of a living matter in movement, which blends and produces crossbreeding. It is not to tie ourselves to indisputable arguments which can be found in consecrated disciplines as a means of knowledge domination. We would rather become closer to the interstices enlightened by inter-discipline, or even by a certain indiscipline, once we do accept its pedagogical worth:

The point is not exactly to overcome disciplines, but realities which comprehend and partially transform themselves, moving within certain boundaries imposed by stances of action, set by their organizations in accordance with the stances of knowledge they hold, within the wholeness they know of and actuate into (Casanova, 2006, p. 48).

Such stance of openness is, in and of itself, a challenging task, once it demands teachers to be open to occupying successive stances of mobilization in that search – what does include open knowledge scienc-

es. And it is worth highlighting that we are not refusing to acknowledge the specificities of modern science, nor the relevance of the scientific progress which has been, through it, unfolded. Nonetheless, dialoguing with Stengers (2002), we reaffirm the need to comprehend scientific practices as knowledge producers which do not result from neutral relationships, separate from the relations of social forces. Scientific practices, as well as their results, may be understood as agreements which have been established by practitioners.

Bringing Practices Back into Life

Given the contingencies of our practices, bringing practices of teaching of sciences and biology back into life requires rethinking pedagogical methods. But, *how do we do that?* Education of Attention might be a good strategy.

Exercising attention in pedagogical practices means acknowledging observation and participation as practices which come to be, concurrently, within life. For Ingold (2016), observing is participating, it is tending to people and things, learning with and accompanying them, since, in order to know, it is crucial to be with, it is vital to be in the world. In this sense, Ingold (2016) places his bet on anthropology as a means of seeking the original sense of education – educate, from the latin *educer* -ex (outside) + *ducere* (lead, take) – literally meaning “leading outwards”. That is, thinking education as a conduit towards the surrounding world(s), setting us apart from a fixed stance, gently nudging us into new stances or perspectives. Exercising attention turns encounters into learning moments. Bringing biology back into life means taking students outside, into the world, the very opposite path of striving to promote an accumulation of information inside their minds. “It is to perceive the very pulsing of the world in which we live – and with which we constantly interact – even if such multiplicity of life is persistently erased and silenced in our human-centered culture” (Carvalho, 2014, p. 73).

In these fields, thinking education from an ecological perspective goes beyond knowing/making use of ecological concepts out of a commonplace notion stemming from Sciences of Nature. We are herein activating an idea of a broadened sort of ecology, one which, summons us from the interpretative horizon of *ecological epistemologies* (Steil; Carvalho, 2014). The term *ecological epistemologies*, as it has been proposed, outlines a certain region within theoretical-philosophical and contemporary educational debates, which comprise authors originating from several disciplines - and diverse theoretical options - whose convergence is their shared effort to overcome “[...] modern dualities, such as nature and culture, individual and society, body and mind, artifice and nature, subject and object” (Steil; Carvalho, 2014, p. 164). By proposing such deconstruction these authors champion both the plurality and the amplitude of this interpretative horizon which does not “[...] intend to denote a theoretical unity but an area of convergence of new comprehension horizons, different from those which sustain the

aforementioned dualities, as well as the externality of a cognizant human subject out of the world, out of nature, and independent from his/her objects of knowledge” (Steil; Carvalho, 2014, p. 164).

From the viewpoint of this interpretative horizon, representation, so dear to the field of Science and Biology education, may be redesigned, since it is understood that meanings, concepts and abstractions do not result from a process that has been set apart from the material experience, nor separated from being engaged with things; but on the contrary, as being fully immersed and dependent on them. In this sense, knowing, from the ecological perspective pointed out by Steil and Carvalho (2014), is the ability acquired through a relationship with the world – and with beings which inhabit such world – as opposed to a human prerogative which emerges from a mind that has been detached from a body of an individual who knows – as well as from the body of the world that enables the very existence of an individual who knows.

Based on the arguments so far laid out we shall now address the particular learning circumstances that were previously announced. Such experiences relate to the participatory research among educators who, as they perform their professional activities in classroom settings, also record their practices in their work diaries so as to systematically reflect on what they develop, on a daily basis. In other words, what we want to affirm is that, in this sense, we have methodologically attempted to study with - as opposed to study about - people, beings, as well as phenomena. Such approach may be named in several ways, but in this present study, inspired by Ingold (2019), we have coined this particular way of working as participatory observation.

Education of Attention and the Knowledge which flourishes from Youth and Adult Education

Youth and Adult Education (*Educação de Jovens e Adultos – EJA*) has got its own specificities. In the scope of schooling education, the individuals who attend EJA's classes are those who – for several and complex reasons – did not conclude their schooling cycle within a period that is regarded as the “right” time. Let us pause to mention that this “time regarded as the right one”, needs to, invariably, face a few ponderations: right to what? Right to whom? These are questions which immediately invite us to reflect, whenever we refer to learning individuals who attend this particular educational modality.

The learning situations which we will consider in this section involve these individuals. These are human beings who have become “left overs” of the schooling process – many times excluding and pain-inducing processes – and who, despite having considerably learnt out of the schooling system, must, later in life, return to such space due to an important concern: better access to working positions. In the experience we herein reflect upon, the need to acquire qualifications in order to find better jobs is the main reason these human beings return to the schooling environment – in this particular case a private school⁵.

From an ecological learning perspective, places to learn (and also to teach) can be multiple. Classrooms are merely one of these places, a place among an enormous set of possibilities; since, from the ecological perspective, it is necessary to be immersed in the materiality of the world, through a continuous process of engagement with the environment:

What have we learned from throwing open the windows of the study, leaving the house and taking a walk outside? Have we encountered an environment that is as cluttered with objects as is my study with furniture, books and utensils? Far from it. Indeed there seem to be no objects at all. To be sure, there are swellings, growths, outcrops, filaments, ruptures and cavities, but not objects. Though we may occupy a world full of objects, to the occupant the contents of the world appear already locked into their final forms, closed in upon themselves. It is as though they had turned their backs on us. To inhabit the world, by contrast, is to join in the processes of formation (Ingold, 2012, p. 31).

Notwithstanding the fact that we are dealing with the context of a private school, this one, in particular, may be characterized as a medium-sized school maintained by a teachers' cooperative which perceives the segment of Youth and Adult Education as being significantly differentiated. Such school is located in a privileged region in the municipality of Porto Alegre, on the corner of one of the most bustling avenues in the North area of the city - it receives, to this particular modality, students stemming from suburbs in the outskirts of the city, as well as from neighboring municipalities within the Metropolitan Region, cities such as Alvorada, Viamão, Cachoeirinha and Gravataí. These students must conjugate their studying routine with extensive working routines. They perform their working activities as seamstresses, waiters, housewives, cashiers at supermarkets, packers, electricians, foremen in civil construction work, telemarketing agents, mechanics, among other professions.

Throughout the years of 2020 and 2021, in the midst of the coronavirus pandemic and the consequent interruption of in person school activities, teaching strategies planned for the scope of Youth and Adult Education had to be reviewed. In the year of 2020, several adaptations were implemented for the subject of High School Biology, such as: active search for students via messaging apps, expansion of the usage of virtual environments, synchronized encounters via Google Meet platform, extension of the due dates to have school work handed in, production of audios, videos and other didactic materials through the means of self-instructional scripts, usage of digital microscopy resources, use of practical class simulators, online visits to natural sciences museums, among others. A set of strategies was set in motion throughout 2020 and 2021 in an attempt to provide, under the circumstances, adequate schooling experiences for those students.

Amongst the lived experiences we herein highlight one in particular seems quite illustrative to us, in terms of what we understand, from

the perspective of ecological epistemologies, as a practice immersed in life. In the third year, one of the topics to be worked with is health. Students worked with this theme by analyzing diverse concepts of what health has been considered to be in different periods of time - and also, from narratives coming from diverse peoples. One of the discussed formulations involved the precepts related to Social Determinants of Health (Brazil's National Commission on Social Determinants of Health – CNDSS, 2008) which correlate health conditions of populations with socioeconomical, cultural and environmental general conditions. Such discussions took, as a case of analysis, the circumstance of the pandemic, and encompassed the understanding about the structure, as well as the functioning, of the Brazilian Unified Health System (*Sistema Único de Saúde – SUS*).

Throughout the classes a certain need, which was actually posed by the class members of around 15 students themselves⁶, came to be: the wish to address the theme of mental health. The group brought up the need to exchange thoughts about that matter and, therefore, planning classes became populated with inquiries about that thematic. We planned a session in the format of an online conversation circle, open to all the classes of Youth and Adult Education, about the theme of mental health in pandemic times. The objective of this proposal was to address this matter from the logic of the production of care, discussing strategies for such production, on a daily basis, in our own houses and working spaces. The conversation circle was mediated both by the teacher of Biology and a guest – a psychologist who carries out his professional activities at *Nossa Senhora da Conceição* Hospital – a hospital in the Municipality of Porto Alegre which is 100% focused on seeing SUS patients. This professional, throughout the mediation and due to the questions asked by the students, also shared his knowledge on how to access the public health system of the city – bringing into life, as well as providing meaning, to abbreviations such as *UBS* (Basic Health Care Units), *CAPS* (Centre of Psychosocial Attention), *CAPS AD* (Centre of Psychosocial Attention – Alcohol and Drugs), *CAPSi* (Centre of Psychosocial Attention – Childhood and Adolescence), among other public services focusing on mental health.

One of the working proposals concomitant to the conversation circle involved a group reflection on the following question: “*what have you been doing to look after your mental health during pandemic times?*” The students answered the posed question and their replies were registered on fliers, which were then shared with all school classes.

Figure 1 – Strategies for the Production of Care as Shared by Students

I DO NOT OVERUSE SOCIAL MEDIA

I watch movies or art videos, **I drink tea**

I draw and do things alike *I keep a healthy relationship with my mother*
 I walk in the yard of my house to breath in some fresh air
 I like to go to squares, see the movement in the streets. It makes me feel good.

I use to keep school activities updated, *Treatment with a psychologist*
it makes me happy knowing that Listening to music and writing what I feel,
I am, somehow, progressing. being open to what I feel and being
 sincere with myself.
 I have *chimarrão* with my mother.
 I search for some videos about universities. I intend to start as soon as I conclude EJA.

I GO TO MY BROTHER'S HOUSE. **I've been focusing more** *I have been going to the gym.*
I talk to some friends. **on my future without being** I help my mother in our
even if it's only **so harsh with myself.** vegetable garden.
through the Internet. *I seek for the comprehension of my workmates*
 Meditation. I sing. I take care of cats.
 I routinely plan, day by day. I practice faith. I observe my emotions
I've been trying to have good nights of sleep in order to better understand
 I try, after my working schedule. **I listen to music.** - and deal with - everything to
 disconnect myself
 from the company. I practice collage, painting and arts craft.
I practice physical exercises.

Source: Schmitt (2021).

By sharing this experience, we do not aim at pointing out models to be replicated, since, from the understanding of learning as a situated practice (Lave, 1991), we are fully aware that each learning experience is dependent of a given context. Nevertheless, herein we expose the might of understanding the practice of education in biology (and sciences) as a space of production of life - of life sustenance. We comprehend that practices as the one we have just described, even under the frailties imposed by the circumstance of social distancing, may operate in the sense of convoking individuals to perceive themselves in relation to “things and to the world” (Ingold, 2020, p. 17). We conceive that educators from the field of nature sciences may work as intercessors in this process, promoting a range of possibilities for the understanding that the responsibility for “[...] the continuity of the process of life is not individual, but social” (Ingold, 2020, p. 17).

By elaborating and sharing their strategies for care the students enabled us to see that “in order to respond one must be present” (Ingold, 2020, p. 48), in a movement of attentionality. These students helped us to understand that knowledge also springs from skill. That is, knowledge about mental health does not necessarily come from the directive exposure to “what must be done” but from the reflection regarding the remarks coming from modern science, from the attention provided to lived processes, and, also, from the exercise of living the pandemic experience, trying to cope by using resources at hand. Learning how to take care of oneself during a pandemic is not a piece of knowledge that might be transmitted as an enclosed set of know-hows, but perhaps as a “knowledge which grows” within us (Ingold, 2020, p. 30). Knowledge

which grows out of the attention towards what is being lived – and that includes the observation of the effects regarding the preservation of life itself, applying as a means to such end, knowledge that has been produced by science. Attention to the pandemic experience is also related to the production of learning experiences on the potencies produced by science itself.

The open knowledges to which we made references to do not negate the scientific advancements which have been promoted by modern science – for instance, the need for vaccines and their efficacy. In a movement of attentionality regarding a world in transformation, and therefore, fully aware of the openness and unpredictability of interspecies relations, we understand the need for preservation and for a higher level of comprehension of life, which is enabled by an attentional movement. The situation which was imposed on us by the pandemic has also forced us to face the inevitability that, even considering all the evolution of the scientific apparatus, throughout time, immersed in several contingencies, we had to relearn how to live. And we did learn how to live, not by denying the experience with the virus, but by being attentive to it, so as to attend and respond to its existence.

We know that a large share of the problems we had to face along this period was the dissemination of unreliable information that have set many lives in danger through, for instance, the circulation of fake news, mainly those denying the existence of the virus and its effects. We understand that the open knowledge to which we refer to does not relate to this phenomenon since being in an attentional movement, within and with the world, it concerns understanding the limits of diverse forms of rationalities – having them being originated from institutionalized knowledge, or from the order of religion, among others. The attentional movement permeates such mediation and reflexivity.

The quality of attention required by a pandemic world demonstrates to us a world-environment intersected by several formative and transformational processes, as it has been the case of the several mutations (variants) of the virus, their effects on bodies and daily timespaces, as well as the many strategies/processes of protection and defense against the virus. Thus, understanding how beings inhabit the world means “[...] being attentive to the dynamic processes of world-formation in which, both the ones who perceive and the phenomena they perceive, are necessarily immersed” (Ingold, 2011, p. 117-118).

Attention, Nature and Life - Subject of Scientific Methodology - Stricto Sensu Post-Graduation Course

Right from the start, on the first day of class, when we began the activities related to Scientific Methodology and Scientific Residency – both subjects offered to *stricto sensu* post-graduation students in Forest and Environmental Science from the Amazon – the dominance of nature was immediately highlighted by the group in order to legitimize the field of life. Life which grows and, hence, enables both abundance

and the sort of emergence capable of providing what we have come to call as “environmental services” (for instance, climate control; carbon absorption), all of which are essential for the maintenance of a standing forest. Nature comes into sight on the very first lesson since it is what reveals life, imprinting its unquestionable value - to such a point that it is capable of weakening any other domain which does not embrace a vital principle.

Nature, and in our case, forests – bearing in mind that these subjects are being offered in a *stricto sensu* post-graduation programme on Forest and Environmental Science – becomes the reference model for future projects which will be, in the future, developed by these students. Reference which will be the future beacon of the quality of life that will be present in their projects. Nonetheless, not every forest will suffice as a reference of living nature. In order to fulfil such role forests must present certain key attributes: they must be biodiverse, longevous, that is, hold tree representatives presenting advanced, at breast height (DBH) age and diameter; as well as being resilient and sustainable - meaning that they must be capable of guaranteeing their own maintenance and permanence throughout time.

Some forests might represent the model of natural life, while others, classified through the same predictors, but presenting diverse qualities and quantities, shall be defined as degraded, that is, lifeless. Degraded forests are, therefore, related to events that promoted some sort of reduction: reduction of biodiversity, reduction of biomass stored on trees and reduction of environmental services – that is, reduction of life.

In view of these discussions with the class we tended to question ourselves about forests at which life flourishes and forests where life has been reduced. Why are there some which are useful as a model of desired nature while some others are not? What do forests need in order to guarantee their expansion, as well as nature’s growth, since forest reduction would result in a regression to inferior stages of life or even in the very absence of life?

It is likely that such comprehension of living nature as progression, may also be shared by social sciences such as the Evolutionary Anthropology of James Frazer (1854-1941), Edward Tyler (1832-1917) and Lewis Henry Morgan (1818-1881) who believed in an evolutionary process to which every human society was submitted.

Such evolutionary thinking has also reflected on the work of Frederic Edward Clements (1874-1945), botanic and ecologist, who defined plant communities as organized and developed entities, predictably so by the means of the unidirectional and progressive replacement of species – which would then converge, through such process of forest succession, into a final stage of climax or monocl意思ax⁷. This train of thought might bring us closer to evolutionary anthropologists who considered the Western European society as the monocl意思ax of Clements.

Thinking in terms of a single and linear origin of social life, be it related to humans or plants, reinforces epistemological difficulties in

dealing with the domain of nature. Although such matters are dearly held by social and natural sciences, within the field of natural sciences such discussion might be considered as being more recent. Therefore, when we occupy teaching positions in post-graduate subjects which intend to collaborate with the scientific training of our students - as well as with the very craft of making science – what is actually assumed as nature and life will become essential issues in order to legitimize which empirical evidences will be sought and highlighted, as answers to their research questions present in their academic work, by these students in their future master degrees or doctorates projects.

That being the case, reflecting upon these matters, startling students with elementary issues about nature and life, on our very first class of Scientific Methodology and Scientific Residency, might be a good pedagogical strategy. By being startled, we hope that students hesitate, reflect and question themselves about the empirical evidences which will, in turn, refute or corroborate their hypothesis falsification tests, widely used as a source of validation within the field of contemporary natural sciences.

It is actually a simple exercise: by presenting a cardboard box to our students, a little larger than a shoebox, we affirm that, inside it, there is a serpent: “*There is a serpent inside this box, you cannot see it because the box is closed. So, how can we acknowledge that this serpent is alive?*”. That is, therefore, the question which guides our discussions.

Figure 2 – A Serpent Presented in Class to Enliven Discussions on Life



Source: Personal Collection from Alci Albiero Jr., June 2022.

Which are the paths and routes students may take to acknowledge the life of the serpent? Would rattling the box do? Perhaps sniffing it?

Attempting to hear some sort of movement inside the box? These are the usual answers I hear students suggesting, which, most likely, would make the vitality of the serpent evident. Notwithstanding, since Plato's myth of the cave, we have been fully aware that we might be fooled by our senses.

Therefore, the matter would not necessarily be recognizing the means, the evidences which attest the life of the serpent, but instead, to acknowledge what actually means, to us, that this serpent is alive. There is a serpent in the box, but it is a wooden serpent! Being made out of wood makes it less alive? It is an articulated wooden serpent which overflows with movement and interaction. Being alive, in this sense, is to move in the world, it is to be part of it, and that the wooden serpent is more that capable of doing: by stirring up the lives of our students and provoking several reactions, such as tension and attention. Being alive, therefore, is to be immerse in the movements of the world, in the people and things which inhabit and produce such world - it is acknowledging that life has granted us with wooden snakes and not necessarily that the serpent has got life.

Nonetheless, it takes a certain level of attention in order to recognize the vitality of the wooden serpent. To recognize life, it is necessary to be attentive to life itself. Attention which, according to Paul Ricoeur, is more connected to being startled than to apprehension (Veríssimo, 2021) – a state of being startled which is capable of affecting students when they are asked about the vitality of the serpent in the box and to reflect about its wooden life. Attention is action, it is spotlighting as well as suspension, and, consequently, every attention requires des-attention. Before such movement, Ricoeur tells us the importance of pausing so that objects may overflow and reveal, to us, the dynamism of life. Pauses do not paralyze, pauses provide intensity. For Ricoeur (Veríssimo, 2021), within the condition of attention, what is existent always outbursts what is perceived. And it is under the light of such understanding that the wooden serpent may assist us – it outbursts the biological concepts of life as fixed by the carbon imaginary. In this movement time is much more important since it sets in place the relationship between voluntary and involuntary attention. Attention is voluntary because we must learn to actively suspend elements, to handle relations between figure and background, in order to eventually have, what is perceived from what exists, highlighted. Concurrently, attention is also involuntary since we are not capable of apprehending multiple existences in all their performativities, synchronically.

It is likely that the voluntary, active faculty of attention can be more easily recognizable by us. Place your finger close to your nose and look at it, see how everything else becomes blurred. In order to reflect on the involuntary character of attention we can become acquainted with the idea of pareidolia; a psychological phenomenon at which we tend to seek familiar patterns in random images. That occurs, for instance, when we visualize a heart on a cloud, or when we see a smile on the coffee grounds – that is what pareidolia is all about. Things⁸ do

not exhaust in and of themselves and it is likely that, therein, is where the involuntary potency of attention actually lies. Involuntary potency which can also be found in the verse “*When the wind turns your dress into a god-sent gift – I will certainly laugh for having seen something the other one had not*” in the song ‘*It was next month*’ (*Foi no mês que vem*) from Vitor Ramil (2013). The dress outburst to the attentive one! Such matters may guide us towards the agency and life of objects as being related to their potency for out-bursting, for overflowing. Things are inexhaustible in their existences and that is what we would like to shine a light on – as in the present life of a wooden serpent in a box, from an activity we carried out with our students.

After such reflections, we take up, with the class, the life of the forests which will be researched. Several of these forests have been fragmented, they are presently isolated, having been destructed by human action and, consequently, they have been classified by biological ecology, as dead. Under such condition, they no longer possess a rich biodiversity, they do not provide the environmental services we wish for, and, they lose resilience, becoming incapable of returning to former stages of development climaxes. Nonetheless, these “dead” forests still overflow in multiple dynamics, and that guarantees their vitality. However, in order to acknowledge such movement, such burst and persistence of life, even under non brimming conditions, it is essential to be attentive - we will then be able to learn with Ricouer as well as with wooden serpents; so that, dressed with the vests of poetry we might, once more, find awe before life.

Conclusions

Throughout the perspectives which were herein exposed, education is not conceived as a preparation, nor as conformity or a synonym to learning. The educational process is a synonym to life, movement, transformation, startles, attention. By being concerned about bringing practices of education on sciences and biology back into life, in schools and universities, we seek to broaden peoples’ fields, things and objects, as well as their reiterations, getaways, openness and possibilities into the political discussions on ecology in modernity. Such discussions lead us to perceive life as outstanding; learning in life – and about life – as something undergoing a process, in movement, as opposed to an understanding of a fixed nature. And it is therein where the complexity of the role of teachers dwell within the field of Sciences of Nature – getting away from biologizing reductionisms, the fruits of modern dichotomies and close-ended versions of Science, as well as the manners to build it: that seems to be our most challenging task.

Teachers, men and women, from a stance of intercessors in the process of bringing curricular components into life, may guarantee a dignified place to an *accurate improvisation*. Improvising, in the sense we apply it, does not qualify as an absence of theoretical and methodological accuracy in the realm of educational practice. Improvising,

herein, takes on a sense of “[...] to follow the ways of the world, as they unfold, rather than to connect up, in reverse, a series of points already traversed” (Ingold, 2012, p. 38). There is a necessary openness from this teacher, this individual, since improvisation gives birth to “alive and active” things (Ingold, 2015, p. 63) which are, insofar, as such understood because “[...] are bound into tightly woven bundles or tissues of extraordinary complexity” (Ingold, 2015, p. 63).

Bringing things back into life, or as we herein proposed, bringing educational practices in the field of the Sciences of Nature back into life, is not a point of adding a certain agency which had been previously absent. Instead, it is a matter of restoring such educational practices within the fluxes which generate worlds: diverse, disparate, uncontainable. We live in a moment in the history of Earth, as well as in social history, in which creating/unveiling worlds, and likewise, learning how to cohabitate, have become interesting paths to understand the life we, ourselves, are – and, additionally, it grants us the gift of learning how to handle the complex dynamics of social-environmental phenomena and face the urgencies of our present time which jeopardize the future of multiple existences in the planet.

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Notes

- 1 For Latour (1994) modern constitution is grounded on the alleged purification of beings between the domains of nature and culture. Nonetheless, meanwhile searching for such purification, they are incapable of halting the hybrid emergency that does not permit itself to become imprisoned in the structures of the modern project.
- 2 We are aware that, in the field of schooling, subjects of Sciences are also taught by Physics and Chemistry educators, therefore, we direct the present reflections to all of those who, somehow, align themselves with the work of education in the fields of Science and Biology.
- 3 It is important to highlight that, although Bruno Latour and Tim Ingold share a deleuzian-guattarian matrix and produce strong critics against anthropocentrism and dichotomies such as subject/object, nature/culture, as well as the fact that both of them acknowledge the need for non-human incorporation in relations with the environment, such authors also present significant divergences. One of them may be observed in the concepts of network from Latour and in the concept of meshwork from Ingold. Latour's network are active associations amongst heterogenous entities, at which each entity casts effects on others, and therefore, a co-determination takes place which ends up going beyond the immediate relationships as they expand onwards, into several directions, producing interdependent and immanent chains (Muñoz, 2011). Nonetheless, Ingold does pose critics to the concept of network since he questions a supposedly static condition in associations which actually do move. For Ingold networks associate, connect and gather points, nevertheless, their composition remains as concluded objects once the lines with constitute such networks, despite actually uniting things, they do not grow nor develop (Muñoz, 2011). In this sense, there are elements which seem to move solely

whenever they find themselves associated with others. Seeking to strengthen the body, the concept of meshwork from Ingold accentuates the displacement of individuals, as well as their movements, as an active experience with their environment. In a simplistic way of putting it, the divergencies between Latour's networks and Ingold's meshworks occur between the articulations which actually sustain both associations and heterogeneous entities.

- 4 Notwithstanding the fact that we are presently highlighting the case of plants, it is necessary to emphasize that plants are not the only beings which transform what they touch. Stones, the wind, computers, animals, bacteria, fungi, among other entities, do actively participate in the material transformations that may be understood as life promoters.
- 5 The article reunites authors who presently work in several states of the country. Regarding the case of Youth and Adult Education the context is located in the municipality of Porto Alegre, State of Rio Grande do Sul. In the municipality of Porto Alegre, as Santos (2018) makes clear, despite the fact that there is significant demand for that educational segment, public schools have been continuously shut down - and their vacancy offers constantly reduced - generating opportunities for private schooling systems, at which, by the way, vacancy offers have been on the rise.
- 6 For us, these "curricular openings" also define what actually is an educational practice immersed in the world of life. We understand, in accordance with Deleuze (1988) that a class is matter in movement. When a class truly happens, interests are somehow displaced and, within such experience, each student, each group, selects what is, to them, most convenient. Exercising teaching demands such quality of self-inquiring about what that movement actually is. Is there any curricular availability - and disposition - in the classes we are about to propose?
- 7 Climax and Monoclimax are usual concepts in the field of Plant Ecology applied in order to represent steady plant communities which find themselves adapted to their particular landscape environmental conditions (for instance: edaphic and climatic) in which they do establish themselves, therefore guaranteeing that the composition of such species may remain constant throughout time.
- 8 We have been considering the notion of thing as it is used by Ingold (2012) who, by differentiating it from objects brings forward a notion of thing as porous and fluidic, permeated by vital flows, integrated to cycles, life and environmental dynamics.

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