



# Taking Care of Life from Amazonian Indigenous Cosmogony: Implications for Teaching Biology as a Cultural Practice

Norma Constanza Castaño Cuellar <sup>1\*</sup> , Leidy Marcela Bravo Osorio <sup>1</sup> 

<sup>1</sup> Biology Teaching and Cultural Diversity Research Group, Biology Department, National Pedagogical University, Bogotá, COLOMBIA

\*Corresponding Author: [ccastano@pedagogica.edu.co](mailto:ccastano@pedagogica.edu.co)

**Citation:** Castaño Cuellar, N. C., & Bravo Osorio, L. M. (2022). Taking Care of Life from Amazonian Indigenous Cosmogony: Implications for Teaching Biology as a Cultural Practice. *Interdisciplinary Journal of Environmental and Science Education*, 18(3), e2281. <https://doi.org/10.21601/ijese/12024>

## ARTICLE INFO

Received: 1 Mar. 2022

Accepted: 8 Apr. 2022

## ABSTRACT

In Colombia–South America, there is an urgent need to address educational processes in culturally diverse contexts that permeate the understanding and contribution to the training of teachers in situated processes, because this is a multi-ethnic and multicultural country. From this perspective, we present the results of an investigation that analyzed the biology degree projects of Indigenous students from La Chorrera (Amazonas) at the National Pedagogical University of Colombia, in order to characterize the different epistemological and ontological aspects that underlie them and as a way of guiding the initial training of teachers.

The methodological perspective of this research is critical hermeneutics, using documentary analysis as a strategy. As for the theoretical foundation, it is oriented from the approaches of critical inter-culturality and epistemological pluralism.

In a nutshell, it is necessary to think about the teaching of biology as a cultural practice, which places in the debate the place of biology as a science of life and the living, its relationship with the contexts of students and the possibilities of empowering knowledge for the defense of territories and life itself. This implies the idea that as human beings we are constructed in relation to other organisms; hence, the importance of understanding the living from life, allowing respect for all forms of life and forging a world where there is room for biological, cultural, epistemic, and ontological diversity.

**Keywords:** biology teaching, ancestral knowledge, life care

## INTRODUCTION

This article presents the results of the systematization of the degree projects developed by the Indigenous students of La Chorrera–Amazonas (Colombia)<sup>1</sup>, led by Biology Teaching and Cultural Diversity Research Group<sup>2</sup>.

The research problem focuses on the investigation of experiences, practices and knowledge that enable the training of Indigenous biology teachers in La Chorrera–Amazonas, hence their influence on the teaching of biology. For this matter, the research posits the question: What epistemological and ontological aspects are evident in the degree projects that

can contribute to the training of biology teachers from the indigenous context, and within an intercultural approach?

The aim of the research is to characterize the epistemological and ontological elements present in the training of Indigenous biology teachers, from undergraduate work<sup>3</sup>. These degree projects comply with the graduation requirement and are focused on educational research. These projects are developed by young Indigenous students who have been in their training process as biology teachers in La Chorrera (Amazonas). They belong to the Muruy, Bora, Muinane and Okaina people (Figure 1).

The educational process is oriented towards the training of biology teachers for the Amazon in particular, with the aim of

<sup>1</sup> Research project is funded by the Centro de Investigaciones de la Universidad Pedagógica Nacional-Colombia. Project Code: DBI-408-15.

<sup>2</sup> The research group attached to the Department of Biology of the National Pedagogical University has carried out teacher training processes (through academic spaces, pedagogical practices, degree projects and research) in different Colombian regions and cultural contexts, contributing to an education that enhances the research and pedagogical skills of teachers in training, their sense of belonging and leadership, also guiding actions that contribute to the qualification of educational, political and cultural processes, from an intercultural approach.

<sup>3</sup> The undergraduate works are open access, they have a creative commons license, so they are authorised by the students in the repository of the Universidad Pedagógica Nacional: <http://repositorio.pedagogica.edu.co/handle/20.500.12209/3460>

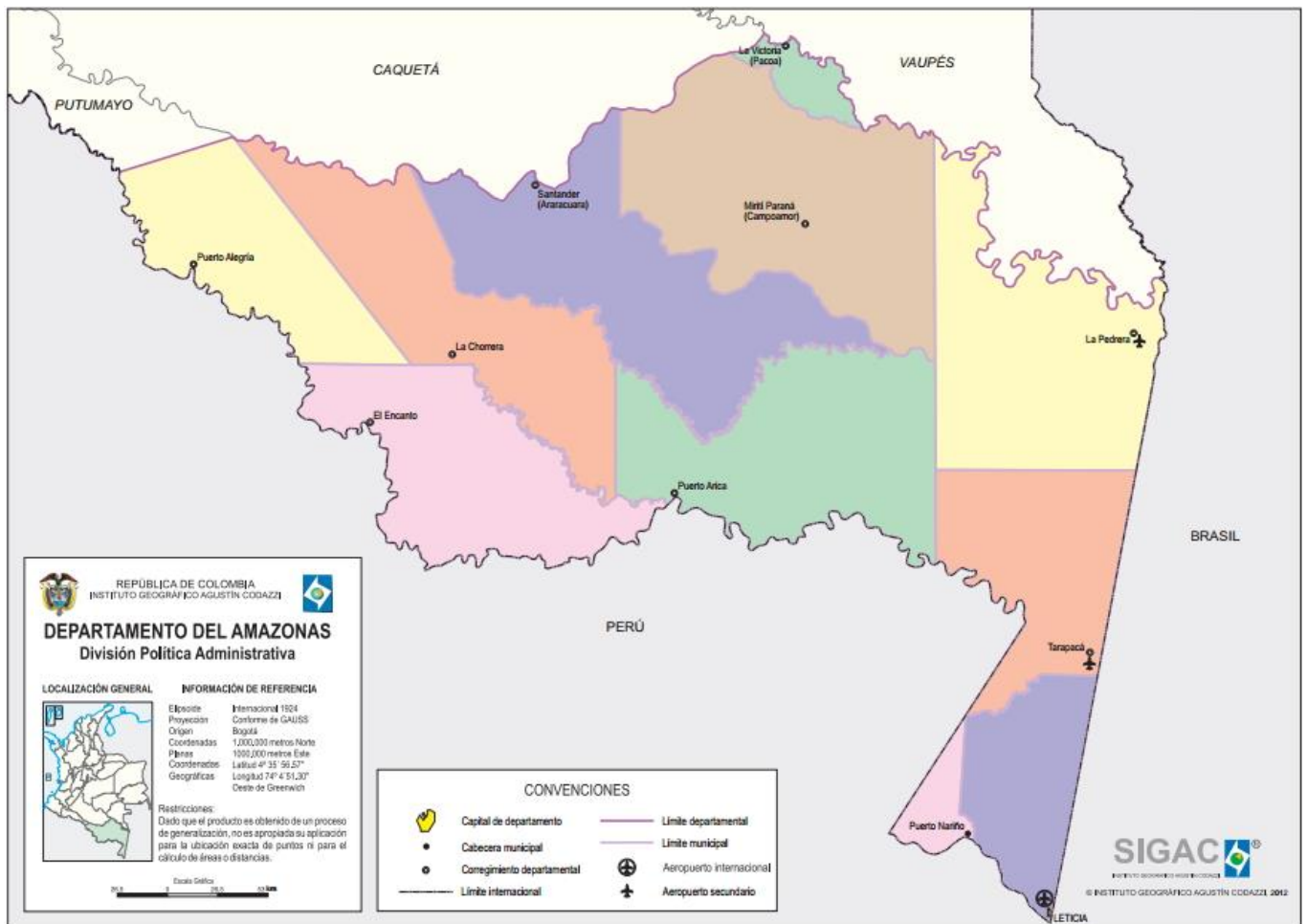


Figure 1. Geographical location department of Amazonas-Colombia. Agustín Codazzi Geographic Institute. [shorturl.at/dy003](https://shorturl.at/dy003)<sup>5</sup>

recovering local traditional knowledge and promoting intercultural dialogue that contributes to the consolidation of their own government and strengthens their life plan<sup>4</sup>. Acquainted with the problems that afflict them, the community requests that the university attribute its teaching towards Western knowledge, while at the same time involving their traditional local knowledge in the curriculum. The objective is to promote educational processes through which the local communities while maintaining their own identity and territory may transform or strengthen their social, cultural and productive dynamics and their understanding of the world (Castaño, 2009).

Given that Colombia is recognized in its political constitution as a multi-ethnic and multicultural country, it is necessary for education to contribute to the recognition of bio-cultural diversity, as well as the value of knowledge about life and the living and of social and cultural practices, and to understand the place of this in the training of biology teachers, which is why conceptual references refer to epistemological pluralism, to relational, non-essentialist ontologies.

## CONCEPTUAL REFERENCES

This section addresses issues related to the teaching of natural sciences as well as the conceptual references that guide the research, such as epistemological pluralism and relational ontology, as elements that allow us to understand and structure the training of biology teachers, taking into account the diversity of social and educational contexts in Colombia.

From the teaching of the natural sciences and primarily the teaching of biology, it is necessary to promote a rupture in the knowledge-power relationship that allows us to transform the representations that the academy has about other knowledge. This is fundamentally centered on biological and cultural diversity, geared to contribute to the democratization of biological knowledge, thus making it available to communities, regardless of their educational levels. This notion comes out due to the transcendence of this knowledge in the lives of the people, societies and towards the construction of a country, that assumes itself to be biodiverse, plural-ethnic and cross-cultural.

<sup>4</sup> The life plans shape a world of their own, they involve the know-how of traditions and what needs to be recovered; they incorporate the knowledge of the elders, of the community's traditional knowledgeable people and specialists. They also constitute their educational, economic, environmental, health and territorial planning project (Castaño, 2009).

<sup>5</sup> This map is taken from the official website of the Instituto Geográfico Agustín Codazzi, IGAC, which is the entity in charge of producing the official map and the basic cartography of Colombia, which makes this production available as open data for all persons, organisations and entities that require it.

However, it is crucial to understand that the education they receive has contributed little, as it has revolved around paradigms of control, domination and homogenization that contribute to invisibilization and subordination of subjects and, therefore, to violating the mentalities of the people (Castaño, 2012).

By any means, it is necessary to recognize that there are other perspectives on the relationship between science education and culture. Thus, Cobern and Loving (2001) ask whether science is universal; they allude that the explanations of “good science” will always be universal, even if it is indigenous knowledge, which can be valued on its own merits and can play a fundamental role in science education, implying that the only valid knowledge is not exclusively Western scientific knowledge. Hence, Cobern (1995) argues that the use of local culture is important in promoting science learning and states in reference to demarcation criteria that there is no line of demarcation between science and non-science, or between science and pseudo-science. What “we have to offer is a way of distinguishing reliable knowledge from unreliable knowledge” (p. 56). Similarly, he argues that the construction of traditional knowledge through trial and error and interactions with nature has produced important knowledge, which, however, lacks the formal and controlled characteristics of scientific experimentation.

A commitment to science education that recognizes cultural diversity in a way that enriches conceptual and epistemological perspectives, with semantic, cultural and historical approaches, requires research with contemporary approaches to knowledge, which understands it more as a culturally oriented activity. Thus, it can be assumed that education in the natural sciences needs to be understood within a specific cultural context, given that conceptual appropriation and construction also depend on values, decisions, beliefs about what is true, credible, knowable, logical, for the subject who knows (Molina, 2010).

Comparably, it is considered that the challenges of biology education, and particularly teacher training, lie in establishing relationships between contemporary political forms, education and the search for possible alternatives in the context of what we are. Likewise, it calls for the development of alternative proposals that involve all sectors of society, as an exercise of freedom and human solidarity, with a call to address globalization, post-development and ecological sustainability in socially and politically effective ways (Castaño, 2012).

From the perspective of Beillerot et al. (1998), it is argued that knowledge is produced in a historical and social context. This shows modes of socialization and appropriation; therefore, it contributes to contradictions and conflicts. Because of their origin, knowledge is diverse and multiple, but through power, they become rivals; they organize social hierarchies of those who possess and practice them, knowledge always belongs to some and not to all. If we consider the field of education as a pedagogical task and for the benefit of society as a whole, we have to elaborate proposals, critiques and alternatives, because as Leff (1986, p. 35) states, “knowledge is not constituted independently, nor does it occur in an ideological vacuum”.

Regarding the teaching of biology in Colombia, Chona et al. (1998) affirm that the teaching of biology in Colombia has been influenced by elements of power and knowledge coming from different standardizing institutions. The approaches, with which teaching has been approached, come more from the structuring of political, administrative and normative elements than from the establishment of criteria on what should be the function of biology teaching in a country like Colombia. Chona et al. (1998, p. 6-7) state:

(...) that the teaching of biology in Colombia is mixed under different approaches in the social, political and economic spheres. The conception of teaching is still confusing and in the educational order we have been able to detect it dispersed or recast in concepts such as pedagogy and didactics (...).”

It is noteworthy that, despite the obvious institutionalization of biology teaching, there are still theoretical inadequacies and a lack of pedagogical practice based on our own cultural elements in aspects such as:

1. In the Colombian education system, biology education is not considered a compulsory area of teaching for preschool, primary, and secondary education. It is included in the area of natural sciences and environmental education (Law 115 of 1994; Ministry of National Education, 1998).
2. Martínez (2018), in doctoral research, states that since the Colombian General Education Law, compulsory and fundamental areas of knowledge and training have been defined, one of these being natural sciences and environmental education, which for some authors has led to a blurring of knowledge such as biology, which “is recast in an environmentalist approach”.
3. In Colombia, there are only three undergraduate programs in biology teaching.
4. In Colombia, there is only one postgraduate program related to the teaching of biology.

It is essential to prioritize the building of space to think about our history in relation to a teaching system that must create new ways of thinking and about the training of subjects in their own cultural context. From these perspectives, it is evident that the field of education has imposed the primacy of Western knowledge, which places knowledge that arises in other cultural conditions in a condition of sub-alternity. It is necessary to deal with other concepts that involve the subject and besides, those that could contribute to the understanding of our own educational problems, particularly those that arise around the training of children, young people and teachers, and biological and cultural diversity (Castaño, 2011).

According to these approaches, it is essential to renew and reconstruct teaching practices (Castaño, 2011), so that, for example, include aspects such as the following:

1. A process of collective construction of knowledge around the problems of biodiversity management and conservation, environmental issues and food security, for example, proposing alternatives to improve living conditions, strengthening cultural identity and territorial belonging.

2. Understanding of the complex manifestation of life and reconsideration of ecosystem-culture-bio-politics relationships, which require the reconfiguration of conceptions about scientific and biological knowledge in particular, as well as its teaching, based on the assumption that living beings and life are not separate fields; in such a way that living is a concern of biology and life of other disciplines.
3. Other epistemologies of biological knowledge seek to articulate the study of living with social and cultural aspects, and even with concepts of economic development. To this extent, it is not possible to think of the teaching of biology only from the point of view of analytical thinking and formal school education.
4. Contemporary conditions demand critical and transformative thinking, around economic, political and cultural aspects of the cultural globalization in which we are immersed, and as well, it requires elements for the formation of citizenship, especially when it comes to the use of natural factors in ecosystems as biologically, politically and economically vulnerable as they are in Colombia.
5. A rupture of the knowledge-power relationship, starting from the transformation of academic representations, democratizing biological knowledge and making it available to the communities, regardless of their educational levels, due to the transcendence that this knowledge implies in the life of people, societies and the construction of a country that assumes itself as biodiverse, pluri-ethnic and pluri-cultural.
6. To displace the paradigms of control, domination and homogenization that do not constitute alternatives to the processes of globalization, but, on the contrary, contribute to the invisibilization and subordination of subjects, thus violating mentalities.

### Epistemological Pluralism

In this overview then, this research requires an epistemological approach and resorts to the pluralist perspective proposed by Olivé (2009, p. 25-26) as the discipline that critically analyzes cognitive practices, i.e., those through which different forms of knowledge are generated, applied and evaluated. It is worth contrasting this idea with the traditional conception of epistemology as the philosophical discipline that seeks to make explicit the first principles of knowledge and explain why they are fundamental, i.e., why they act as the foundations of all knowledge (Castaño, 2020).

Considering that epistemology has a descriptive dimension and a normative dimension, the pluralist perspective analyses knowledge-generating social practices as they exist and have in fact developed, including the axiological structure of epistemic and methodological norms and values that support the validity of such knowledge. A crucial aspect of this approach is to understand that such axiological structure is inseparable from the rest of the cognitive practice, and this, in turn, is part of a specific cultural, social and ecological context.

Olivé and Perez (2011) understand social practices as constituted by populations whose members perform certain

types of actions seeking specific ends and, therefore, in addition to subjects (with subjectivity and emotivity constituted in their cultural environment), these human beings are agents, i.e., they perform actions, aiming to achieve specific ends, using specific means. The ends pursued by the agents are valued and the actions they perform are evaluated according to a set of norms and values characteristic of each practice. Thus, practices include an axiological structure and are guided by explicit representations (beliefs, theories, and models) held by the agents, and more so by tacit knowledge. In all societies, there are economic, technical, educational, political, recreational, and religious practices; in modern societies, there are also technological and scientific practices. Nevertheless, in all societies, there have been epistemic practices, i.e., those where knowledge is generated, including technical practices.

According to Olivé (2009), a practice is a dynamic system that includes at least the following elements that are permanently related and interacting:

1. A collective with common capacities and purposes, which concomitantly interact among themselves and with the context.
2. A context of which the practice is part, and where the agents interact with other objects and other agents.
3. A set of objects (including other living beings) that are also part of the context (seeds, soil, species).
4. A set of structured actions, involving intentions, purposes, ends, projects, tasks, representations, beliefs, values, norms, rules, value judgments and emotions. These include conceptions of the world that guide the actions of agents and include beliefs (dispositions to act in a certain way in the environment), and theories (sets of models of aspects of the environment, e.g., cosmologies).
5. A set of basic assumptions: principles, norms, rules, instructions and values, which guide agents in carrying out their actions and which are necessary to evaluate their own representations and actions, as well as those of other agents. This is the axiological structure of practice.

Olivé (2009) emphasizes that epistemic practices are carried out by collectives and not by isolated individuals; besides, he affirms that the adequacy of these practices is attained gradually as the agents of the practice achieve the ends they propose, and the evaluation of their achievement is based on their own values. From this perspective, the axiological system is correct if the practice to which this system belongs is adequate. This depends both on the cognitive and action capacities of the agents, and on the context within which they carry out their actions and which they must necessarily transform. It considers that social, cultural and ecological contexts are very diverse, and therefore these practices are as well diverse.

The development of an epistemological pluralism is necessary to confront the very frequent position that many so-called traditional knowledge is the result of epistemic practices that cannot in themselves claim legitimacy, but are technical knowledge without scientific basis, and that if the applications of such knowledge are effective at all, this



requires a scientific explanation, which is often provided by research funded by modern innovation companies. This is often used to legitimize its appropriation and commercial exploitation by those who are not the original holders. (Olivé, 2009, p. 29).

Olivé (2009) also emphasizes that the social practices (cognitive, agricultural, economic, educational, recreational, and religious) of traditional communities should not be conceived as separate from their environment, their habitat and the ecosystem of which they form part. In this way, under a pluralist conception, it is also possible to justify the right of Indigenous people to actively participate in decision-making about their territories.

### Relational Ontologies

Approaching teacher training with an intercultural approach and, in particular, the teaching of biology in context requires distancing oneself from essentialist ontologies that show an idealist and universalist perspective of the human being, tending to impose absolute truths that admit only one way of knowing, which, in general terms, refers to the Western way of knowing. For classical Western thought, culture is alien to the ontological order, Mendoza (2008, p. 5) says “it is assumed that the cultural order begins where the order of *being ends*”. The denial of the link between ontology and culture actually follows the assumption that there is a culture superior to the others—that which “is transparent” to being—and which gives itself the right to despise, deny or dominate the others (Ramírez, 2004, p. 12).

However, Merleau-Ponty (1977) proposes, from phenomenology, to understand being from everyday existence: “(...) he re-situates the essences within existence and does not believe that man and the world can be understood except from its “facticity” (p. 7). Mainly, it denounces the absence of the fundamental question about being and its meaning and proposes the world of perception as a source of original meaning, for which it is necessary to abandon the idea of a being fragmented as posited by Cartesian philosophy.

Culture, meanings, the “imaginary” in general, says Merleau-Ponty (1977), have an “ontological inscription”, they are “part” of our experience of Being. However, culture was not only excluded from the objects and concepts of ontological reflection in classical philosophical thought but there was also no significant idea about the relationship between philosophical activity and the cultural order in its concrete and specific reality (Ramírez, 2004, p. 11).

To ask oneself about the meaning and about what perception means, opens up possibilities and also designates the concept of freedom, “man is in the world, it is in the world that he knows himself” (Merleau-Ponty, 1977, p. 10). In the same way, Mendoza (2008) alludes that, it is necessary to understand that the world that is unveiled in perception is not finished in its sense, but it is shown to us as a horizon of possibilities that grants us a destiny of freedom.

In the field of phenomenology and from the perspective of Merleau-Ponty (1977), culture is not a secondary plane of being, but the area where the meaning of being, the human ontological experience, takes place: “culture is no longer a ballast or a mere addendum in the human experience: it is the

way in which human beings creatively understand our “stay” in world and how there is a “being for us” (Ramírez, 2004, p. 13).

Culture is thus constituted in the field in which human life has access to meaning that it carries as “potential”, and therefore it will be in it where it will find its root, every possible project of existence and every possibility of objectivity: spirit and nature, can only be discovered on the basis of cultural significance of all human existence, just as “scientific humanity” can only be conceived from the sense made in culture to realize ourselves (Mendoza, 2008, p. 11).

According to Ramírez (2004, p. 19), the human being is a radically cultural being, that is to say, a being ontologically constituted from a historically and socially determined order of meanings and values. In other words, the human being does not possess an “essence” or a “nature”: he has to form himself, he has to make himself. However, it must also be acknowledged that culture is precisely the set of realizations through which human beings constitute their own nature.

The human being is the subject as well as the object of his cultural praxis; the cause as well as the effect of culture. This implies, simultaneously, that he does not pre-exist in the process of his cultural formation and that culture does not pre-exist in the process of human formation. Both concepts, both realities - that of the human being and that of culture—are perfectly correlative and mutually defining.

From other perspectives such as Varela (1996):

The true units of knowledge are of an eminently concrete nature, incorporated, embodied, and lived. (...) knowledge refers to a situationally; and (...) what characterizes knowledge - its historicity and its context - is not a “noise” that obscures the purity of a schema to be grasped in its true essence, an abstract configuration. The concrete is not a step towards something else. It is how we arrive and where we remain. (...) the world is not something given to us: it is something that emerges from how we move, touch, breathe and eat... (p. 13-15).

In one way or another this ontological view of what the world is, what we are and how we know the world, has a historical perspective. However, as Escobar (2013) suggests, it is necessary to construct a more complex concept of ontology:

Ontologies do not precede or exist independently of our everyday practices...If not dualism, if life is always in connection, then what? The immediate obvious response to disconnection, isolation and so on, of course, is to reconnect—with others, bodies, the non-human world, the stream of life (p. 35).

In that perspective emerges the idea of rationality, which Escobar (2013) understands as an ontology in which “nothing pre-exists the relations that constitute it; in which life is (...) interrelation and interdependence, always and from the beginning: nothing exists by itself, everything inter-exists, we intersect with everything on the planet”; an idea that Escobar (2013) highlights from Varela and Maturana’s affirmation, that “all doing is knowing, and all-knowing is doing”, which implies for Escobar (2013), that “we are immersed in the world

**Table 1.** Systematized degree works

No	Job title	Student
1	La Maloka Uitoto como espacio educativo de vida desde los principios tradicionales del clan Eimen+ de la etnia Uitoto de la Chorrera Amazonas Colombia. The Maloka Uitoto as an educational space for life based on the traditional principles of the Eimen+ clan of the Uitoto ethnic group of La Chorrera Amazonas Colombia.	Agapito Buinaje Corsino
2	“El mambeo”: Educación tradicional en la etnia Bora comunidad de providencia La Chorrera (Amazonas, Colombia). “El mambeo”: Traditional education in the Bora ethnic community of Providencia La Chorrera (Amazonas, Colombia).	Diego Diomedes Evachiu Ceriyatofe
3	El Conocimiento Tradicional+vuuhza (Okaina), sobre la relación ser humano-naturaleza, un aporte a la enseñanza de las ciencias naturales en la escuela Divina Pastora de la comunidad Okaina. The Traditional Knowledge+vuuhza (Okaina), on the relationship between human beings and nature, a contribution to the teaching of natural sciences in the Divina Pastora school in the Okaina community.	Ferney Noé Iyokina Gittoma
4	La palabra dulce y sabia de la mujer indígena Bora. The sweet and wise word of the indigenous Bora woman.	Irma Bertina Teteye Silva
5	Saberes tradicionales sobre el uso y manejo del p+cáájke (bejuco de yuca) en la etnia Bora, comunidad de Providencia. Traditional knowledge on the use and management of p+cáájke (cassava bejuco) in the Bora ethnic group, Providencia community.	Josefina Teteye
6	El origen de la vida y lo vivo según los sabedores Zafiama, Manaideke, Firizateke, Buinaje y Remuy de la etnia Murui M+N+Ka de la Chorrera Amazonas, un aporte a la enseñanza intercultural de la biología. The origin of life and the living according to the Zafiama, Manaideke, Firizateke, Buinaje and Remuy, knowers of the Murui M+N+Ka ethnic group of Chorrera Amazonas, a contribution to intercultural teaching of biology.	José Rodrigo Firizateke Kutdo e Iris Emilse Teteye Cañube
7	Concepción de lo vivo de niños indígenas Uitotos del Internado Santa Teresita del Niño Jesús en La Chorrera–Amazonas. Conception of the living of Indigenous Uitotos children from the Santa Teresita del Niño Jesús boarding school in La Chorrera–Amazonas.	Tirso Candre Guzmán, Alex Eduardo Giagrekudo Achanga y Francisco Javier Gittoma Maribba.

together with other conscious beings, who are knower-doers to the same extent as ourselves” (p. 35).

Blaser (2009) goes further when he states that the concept of culture implies the existence of reality with different versions, but ontology implies the existence of multiple realities, with different particularities. Ruíz and Del Cairo (2016) allude that reality is more than a social construction, it is an emergent property that results from the interaction between humans and non-humans in contextual conditions, which results in practices and surely also in specific experiences: “in short, agreements about possible worlds do not obey so much to epistemological arrangements - the way in which the world is known—but ontological—diversity of modes of existence—and even more ontic—the proliferation of what exists” (p. 202).

The importance of highlighting epistemological aspects is thus recognized, however, they are not enough, therefore, an understanding of the ontological is required, especially for teacher training, which implies building relationships between the various ways of understanding life, the living and its teaching in diverse contexts.

## METHODOLOGY

The research methodology is qualitative with a critical hermeneutic approach, which allows us to problematize aspects related to the teaching of biology and teacher training in diverse contexts, which is made explicit in the description of the categories as well as in the discussion. Documentary analysis was chosen as a strategy, considered as an ordering process that generally leads to the identification of research problems and allows information to be obtained for the

purpose of describing events, problems, revealing interests and perspectives for understanding reality (Quintana, 2006). For Díaz and Navarro (1998), as well as for Jiménez (2006), documentary analysis is a set of procedures that seek the production of a meta-text in which conceptual transformation is made possible.

Throughout the research, the documents analyzed are developed by indigenous students Muruy, Bora, Muinane and Okaina, from the biology degree program at the Universidad Pedagógica Nacional (Colombia) in La Chorrera–Amazonas, who carried out their degree work in the research group biology teaching and cultural diversity, in the line conceptions about life for the teaching of biology. The documents analyzed can be found in the thesis repository of the Universidad Pedagógica Nacional and correspond to the titles in **Table 1**.

The documentary analysis was carried out in the following phases, adjusted from Quintana (2006):

1. Inventory of existing documents in the thesis repository of the Universidad Pedagógica Nacional.
2. Selection of relevant documents for the purposes of the research.
3. Identification of relational categories through the Atlas Ti program, version 6.
4. Registration of patterns and trends.
5. Categorization resulting from the cross and comparative reading of the documents, in order to build a comprehensive synthesis.

The categories emerged from the analysis of the documents, as well as from the search for the relationships found between them, from the perspective of teacher training and the teaching of biology in different contexts.



**Figure 2.** Cultural activity, biology undergraduate students. La Chorrera–Amazonas (Castaño, 2013).

## RESULTS

The results are presented below, organized into the following categories that emerged from the cross-categorization and comparative categorization of the documents: Traditional local knowledge and biology teaching; traditional local knowledge, word of life<sup>6</sup> and care for life, care for life is given from the common origin of life and caring for life from own learning scenarios.

### Traditional Local Knowledge and Biology Teaching

From the study carried out, it is evident that traditional local knowledge is present in the teaching of biology and is mainly associated with the care for life. In this category, relationships are established by structuring elements of indigenous life, such as territory, rituality and spirituality. From this, links are established with traditional learning scenarios such as the river, the jungle, the maloca and the chagra<sup>7</sup>.

Accordingly, students express the need for “the different ethnic groups to maintain their identity, solidarity, autonomy and respect for diversity and to learn and teach the knowledge inherited for thousands of years with an adequate intercultural development consistent with an ethic of management and conservation of the natural environment” (Buinaje, 2013, p. 18), following the guidelines set forth in the life and abundance plan agreed upon by the peoples living there (Figure 2).

With regard to the structuring elements of indigenous life, the following were identified: territory, rituality, and spirituality. We found that territory does not refer to geographical space or its limits; from the cosmo-vision<sup>8</sup> of the people, the territory is the very life of the Indigenous people:

Nature is the source of indigenous life; from its origin, the Indigenous people have lived in their ancestral territories maintaining the system of balance with nature. Living according to the word of life guarantees the care of life, guarantees the teaching, and guarantees the learning of traditional knowledge. Our

future lies in the capacity of the Indigenous Uitoto to conserve traditional knowledge and sustainably manage the greatest wealth of the environment (Buinaje, 2013, p. 44).

There is also a decentered view of the human being, recognizing the existence of themselves and other living beings, as well as spiritual beings; assuming that the relationship with them must be based on respect for their ways of life, for the ways in which they inhabit and relate to the territory, which are what ultimately guarantee that human communities can exist in these territories. Rituality is understood as the concrete practices to relate with other beings and existences in the territory; and spirituality, as (...) “a factor [that allows] to understand or look at the elements of the natural environment as objects that have intrinsic values that help the sustainability of life” (Iyokina, 2013, p. 8-9).

In this context, local traditional knowledge is assumed as

“the word through which the life of human beings is protected in order to truly live and coexist as a person with others and also to live in harmony with nature”. “Everything you do has to be done with that heart of esteem to the other when this order is disturbed; you have to sweeten the word (...) from the concept of the knowledge of the care of the word of life” (Faretkade, 2018).

This knowledge, in the case of these people, is taught in the maloca, which is considered an “educational space of life”. Along with this, it is shown how at present by the processes of homogenization in society, this word is not being learned, which generates disharmony in the life of communities and the world in general, which can lead to the extinction of species (Iyokina, 2013, p. 8-9).

In doctoral research carried out in La Chorrera, it was wangled that from their cosmogony, everything that exists in nature has life, not only because it is endowed with spirituality but also because they recognize a common origin for living beings, including humans. “The role of humans is to give order to nature and to that conception of life from the cosmogony” (Castaño, 2020, p. 145).

Consonantly, the relationship between nature, human beings and spirituality, has implications on the care of life, in such a way that when this sacred character is transgressed, relationships are prone to disharmonize, for instance, leading to disease and death. At a general level, it is found that their worldview is conceived as an integrating relationship between human beings, nature and spirituality. Thus, for Muruy, this relationship is guided by cultural principles such as balance, solidarity, harmony, reciprocity as well as by knowledge learned by young Indigenous about biology (Buinaje, 2013, p. 18).

<sup>6</sup> Word of life refers to the knowledge about life, which comes from the cosmogony of these peoples.

<sup>7</sup> The chagra is experienced as a space for natural and social interaction, where life is recreated through the appropriation of the territory and in the collective work for its maintenance, in the social relations that are forged there and in the possibility of sowing oneself as one more of the beings and existences of the territory, when the seeds are sown that will later feed the family and the community. In this sense, survival possibilities for indigenous people are also configured through the management of the chagra.

<sup>8</sup> Cosmovision refers to the narrative regarding the creation and origin of life and the world and to the practices deduced from the mandate of the gods that contribute to the care of life and social cohesion.



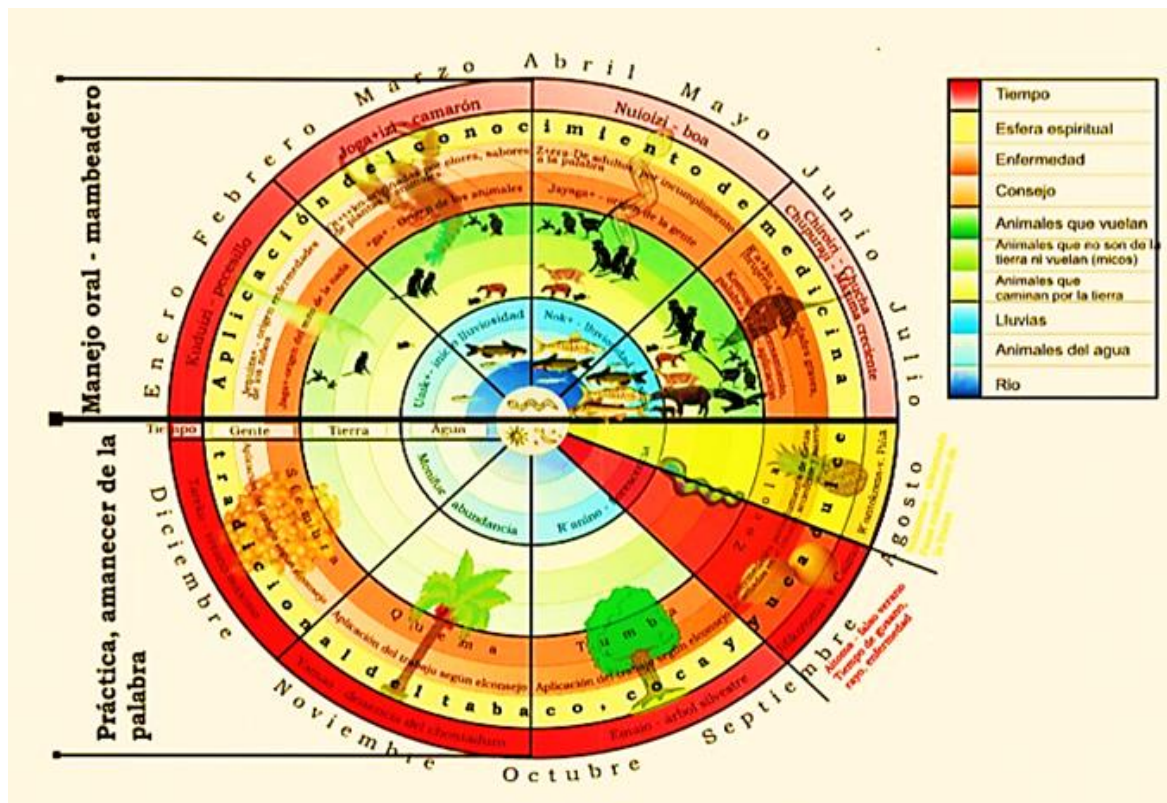


Figure 3. Life plan

In a similar way, the Iyokina (2013) establish that the traditional knowledge of the wise men in their conception of the relationship between man-nature expresses a wide range of knowledge, practices and beliefs associated with the care of nature in its multiple living expressions, spirituality, the teaching of integral ethical values evident in the ecological calendar (p. 8).

In a nutshell, we found that it was possible for the training of indigenous teachers to articulate, from an intercultural approach, local traditional knowledge with the teaching of biology. The territory mark was the main concept, given that it makes it possible to establish relationships with other concepts such as the learning spaces themselves and, above all, with the care life.

### Traditional Local Knowledge, Word of Life and Care Life

Man is part of nature, the relationship that exists is to coexist with it and take care of it, preserve it to maintain life (Siake, 2013 cited in Buinaje, 2013).

From the systematization carried out regarding the ontological aspects, it is recognized that the element that stands out is that these Indigenous people have cosmogonic knowledge, which takes the form of practices for the care of life; this implies protecting the life of human and non-human beings, in order to live in harmony with nature:

and this is where the creator left us, he did not say to us: grow, multiply and dominate the world, no. To us, he said: multiply, work, humanize, and take care of this with the word of life, it is to take care of the life of the human being, and it is the mandate that we have, it is to take care of life (Faretkade, 2018).

It is important to highlight the practices for the care of life as a way of understanding the near realities and with it, the constitution of an ontological unity of human being-nature-spirituality, which contributes to the harmonization with nature and, therefore, to the care of human and non-human life.

From a Westernized perspective, this relationship may result from the encounter between the biological and the cultural, as it is expressed in the diversity of knowledge, which can be manifested in what Toledo and Barrera-Bassols (2008) call bio-cultural memory, referring to “memory: genetic, linguistic and cognitive, and which is expressed in the diversity of genes, languages and knowledge or wisdom” (p. 13). From this perspective, the biological diversity of the planet denotes the culture-nature relations and this allows us to find relations between the forms of understanding from our own knowledge, the knowledge of biology and the knowledge of nature.

### Life Care is Given from the Common Origin of Life

The results show that there is a common origin between human beings and living beings, and this is approached from a historical and changing perspective (Figure 3). As an Indigenous knowledgeable person from La Chorrera states: “life is one, it has the same origin, the same principle..but there are some kind of transfers” or transformations between living beings (Faretkade, 2004). According to the results of Castaño’s (2020) PhD research, origins have a relational character that is evidenced in the way in which the explanation of origins influences the social, and even the political. In this sense, assuming the care of life from the perspective of these people is a complex issue that goes beyond the training of



biology teachers, given that it even implies concretizing it in the formulation of their plans for life and abundance<sup>9</sup>.

The care of life has a spiritual character and involves the care of ancestral wisdom, that is to say, of their cosmogony<sup>10</sup>. They consider that "(they are) part of the whole, all of nature including the human species, constitutes a great maloca that always demands a relationship of equality and respect" (Cacique Elio Buinaje, quoted in Buinaje, 2013, p. 51).

From this idea, it would seem that nature, being endowed with spirituality, goes from being an object to being a subject of knowledge. Developing the idea, from this perspective, the care of life is not constricted to the care of human life, but to the relationships between human beings, nature and spirituality, which gives a more complex connotation than what could be addressed through biological knowledge (Castaño, 2020).

As the knowledge about the care of life is based on its cosmogony, it is fundamental for the communities, since it alludes to the fact that as long as it subsists "local communities will be able to live with health, education and welfare, and at the same time guarantee the life of humanity and the conservation of the rainforest and tropical forest for future generations" (Buinaje, 2013, p. 13). The word of life is the main part of ancestral knowledge. Since "if not, there is no life, there is no word, for there to be the life we must maintain, protect, we must respect everything around us, so we can live well" (Buinaje, 2013, p. 9-10). This word is transmitted from generation to generation in the different scenarios of daily activities such as the river, the jungle and the chagra.

As part of these educational processes, it is important to highlight the role of traditional authorities, which makes social practices viable as a way to ensure the care of life in their own cultural scenarios. Emphasis is rated on the chagra as a learning scenario, where the activities carried out in the natural and spiritual environment are reflected upon:

Education is done in the spaces of daily life, in the maloca, in the chagra, in the river and in the jungle, according to the times and cultural values expressed in the ethno-ecological calendar<sup>11</sup>; these foundations set up a deep relationship with the territory and the Amazonian environment. Therefore, it has been considered that the teaching and learning of traditional knowledge are especially important to ensure the survival of indigenous people (Buinaje, 2013).

From this perspective, teaching tends to be seen as a relationship between cultures and more precisely the teaching of biology as a cultural practice: contextualized, for the care of

life, it is understood as a form of understanding and recognition of the surrounding realities.

The importance of plural and intercultural vision for the teaching of biology is highlighted, which takes shape in the reconfiguration of pedagogical and didactic elements that can contribute to the construction of proposals for the teaching of biology as a field of knowledge in context and as a cultural practice. It is also important to understand the teaching of biology from the articulation between life and the living, from elements such as the defense of life itself, based on concepts such as territory, strengthening of identity, recognition of cultural practices and differences. This also implies reflection from epistemological and ontological aspects, as well as an intercultural approach, as a way of fostering the recognition and legitimacy of differences, with a view to inclusion and non-discrimination of other forms of knowledge.

From this perspective, we reiterate the relevance of biology teaching that involves politics. That assumes diversity as a power for the transformation of society, starting from local knowledge, from the possibility of encountering the other and the other, from interaction, debate, proposal and participation in decision-making. In other words, it is also a political question, which implies understanding the knowledge-power relationship and its impact on hegemonic knowledge structures, from which we can deduce the importance of making their epistemologies and ontologies visible and positioning them, in order to overcome the exclusions that this implies.

In terms of the training of biology teachers, in addition to what has already been stated, the value of experience is highlighted, in terms of experiences, facts and social and natural phenomena. This contributes to re-signifying not only the teaching of biology but also biological knowledge itself and the importance of recognizing that biology as science can contribute to the recognition of the self, the other, and the lived world.

As already mentioned for biology teaching, this implies establishing relations with ontological aspects that have to do with territory, nature and spirituality. Along with this, and thinking about the training of biology teachers, it is necessary to assume a critical stance in the selection and organization of the topics to be developed, in the teaching methodologies and in the perspectives of approaching life and living things. Thus, as stated by Buinaje (2013), from his training as a biology teacher, belonging to the Muruy people, this view invites the possibility of:

acquiring Western knowledge and appropriate it to our thinking, to our way of life and build a new basket, a new word that is already being woven with this

<sup>9</sup> Abundance Plan: From the management point of view, it constitutes the materialisation of processes that contribute to solving community problems such as, for example, health, education, production, social welfare, governance, among others. Plan of life and organisation of the children of tobacco, coca, and sweet cassava. AZICATCH. 2004.

<sup>10</sup> According to Eliade (1981), cosmogony refers to the explanatory model of creation and origins.

<sup>11</sup> From the ethnoecological calendar, depends the productive activity, the care of life, and the teaching or training of people in these peoples. In this sense, the ecological calendar is an element that allows the indigenous communities to program their daily activities, to have a good productive success, to prevent diseases and to teach the new generations a knowledge from the experiential, thus inheriting the knowledge to the new generations: each season indicates an activity to develop and a knowledge to teach the new generation from the maloca or mambadero or from practical work, summer season, rainy season, reproduction of different animals, fruiting season of vegetable plants. (Atama, 2013, cited by Iyokina, 2013).



**Figure 4.** House of Indigenous knowledge (Maloca). La Chorrera–Amazonas (Colombia) (Castaño, 2013)

research, from the intercultural perspective to continue to exist as indigenous people and to assume the current world, which is not only an indigenous world or only a Western world, but a world of relations between the two (Buinaje, 2013, p. 18).

### Caring for Life from Our Own Learning Scenarios

The epistemological aspects are analyzed from their own educational scenarios, such as the chagra, the maloca, the jungle and the river. Specifically, the chagra is experienced as a space of natural and social interaction, where life is recreated from the appropriation of the territory. In addition to being a productive space, the chagra is experienced as a collective and historically constituted process, a living and respectful community based on diversity.

The activities are chiefly focused on the preparation of the land for planting, which brings the community together to remember the history, myths and cosmogonies. The chagra is mainly used to grow food for the family and the community, which allows the survival of these people, based on their own knowledge and educational processes (Figure 4).

In the same perspective, the degree work carried out by Iyokina (2013) with Okaina children in third grade, reaffirms the chagra, the river and the jungle, as their own learning scenarios, where they are in the company of their parents, grandparents and uncles show a relational knowledge of their environment, as a means for the care and sustenance of life:

1. The jungle, whose space is viewed as the place where humans access to the use of timber and medicinal trees, the care of trees with edible fruits, the hunting of animals. In this sense, the care of nature is associated with crops, the care of life through food, health (medicinal plants) and handicrafts.
2. The river, whose relationship is associated with the use of water in the preparation of food, medicinal plants, for transportation, fishing, toileting of the human body and play, in correlation with the space of the jungle.
3. The chagra, where they associate activities related to edible crops that are necessary and useful for life.

The elements described above show how education in this context implies a direct relationship with life experiences in a

territory, has a collective and historical character, and also allows cultural and identity empowerment for the defense of life in particular territories.

The link between human beings, nature and spirituality is materialized in practices with a strong educational component, such as, for example, those related to the ethno-ecological calendar:

Their productive activity, the care of life, and the teaching or training of people depend on it. In this sense, the ecological calendar is an element that allows the indigenous communities to: program their daily activities, have good productive success, prevent diseases and teach the new generations knowledge from the experiential, thus inheriting the knowledge to the new generations: each season indicates an activity to develop and a piece of knowledge to teach the new generation from the maloca or mambadero or from practical work, summer season, [rainy season], reproduction of different animals, a fruiting season of vegetable plants... (Atama, 2013, cited by Iyokina, 2013, p. 66).

This relationship between human beings, nature and spirituality are explicit when in the maloca they teach and learn the traditional knowledge about the care of life, which has been received from their ancestors through a disciplined, ritual and deep study by the cacique. In the same way, for the Muruy, the care of the territory, the protection of the communities as well as the protection of nature are fundamental, "... for those who are educated with traditional knowledge within the culture, learn to know and respect nature (Buinaje, 2013, p. 13).

From an epistemological point of view, to educate is to live by doing, it is to become human in the relationship with nature, in this sense, life and its care are learned from everyday life. As said by Buinaje (2013), it is relevant to consider "the importance of teaching traditional knowledge for the care of life, complementary to intercultural training processes related to the teaching of biology in biologically and culturally diverse contexts" (p. 9).

## DISCUSSION

Due to the systematization carried out, the way of teaching biology institutionalized by educational policies is questioned, particularly in view of the lack of knowledge and appreciation of the owner, of the same biological and cultural diversity. As mentioned by Chona et al. (1998), largely these policies reduce the teaching of biology to the repetition of contents, with no relation to the contexts or the lives of students and teachers. When done from an analytical viewpoint, it fosters an individualistic perspective in accordance with a modern vision of nature, in which the human being is outside of it, with the purpose of dominating and controlling, where there are universal truths and unique ways of knowing. From these reflections, the question arises: is this the biology teaching that this multiethnic and multicultural country needs?

In response to this question, the bet is to approach the teaching of biology from the relations between epistemological pluralism, relational ontologies, interculturality and context. There is an urgency of making room for local knowledge in order to contribute to the understanding of the diverse realities in which we are immersed.

Consequently, it is a priority to understand one's own knowledge as historical and praxical; dynamic and changing, which, placed in dialogue with scientific knowledge, can expand the possibilities of understanding and reinventing life itself. This panorama allows understanding that knowledge is not static, that it is reconstructed in interaction and that therefore there are no universal truths, on the contrary, these are situated, therefore, they are built collectively and their "validation is only possible under the contexts and particularities that originate them" (Alarcón Cháires, 2015, p. 181).

Likewise, it is important to establish dialogues between different ways of knowing, which, as Tovar-Gálvez (2021) states, invites the building of epistemological and ontological bridges, as a way of proposing inclusive cultural practices for the training of biology teachers in culturally differentiated contexts.

In this sense, the political character that the teaching of biology can have is highlighted, as the possibility of contributing to the care of life on the planet. Likewise, to position a human being-nature relationship beyond the utilitarian character of modern thought; having as a horizon a re-signification not only of the teaching of biology but of biology itself. Thus, a dialogue could be projected between the scientific knowledge of biology and ancestral forms of knowledge, which give a character of protection and care to human and non-human life.

Likewise, as expressed by the Indigenous students, not only does the human being know, every being knows and to that extent, but the relationship with nature cannot also be one of domination; it is necessary to put it in dialogue, tension and agreement among diverse world visions. This approach invites us to delocalize the conventional views on nature since it is not common to assume it as a subject of knowledge and what is found in the systematized degree works is the priority of re-understanding it in this way, in times of global, environmental and socio-cultural crisis, such as those currently being experienced; in which not only human populations are affected, but also other species and nature in general, are assaulted by the practices of a market-based development model.

The above aspects invite us to think of a biology teaching that is re-signified from the dialogues of knowledge and that takes shape in practices that are experienced in different contexts, according to local ways of inhabiting the territories and in constant interaction with those other views of the world that circulate and with which the educational processes can be enriched.

Part of this re-signification implies the understanding of biology as a science of life, from a knowledge that is not only interdisciplinary but also transdisciplinary, that contributes to the recognition of oneself, the other and the lived world, based on elements already stated such as the defense and care of life

itself, the relationship with the territory, the strengthening of identity, the recognition of cultural practices and differences, in a country that, from its political constitution, is recognized as multiethnic, multicultural and megadiverse.

Likewise, it could be enriching to involve in the teaching of biology the recognition of experience as a builder of behaviors, practices and knowledge, from the idea of learning for not only biological but also social survival. It is also clear to assume the relevance of biological, social, existential, aesthetic and conceptual aspects in the lives of children, adolescents and young people (Castaño, 2020, p. 231).

## CONCLUSIONS

The value of ancestral knowledge is recognized, given its importance for the care of life, which is relevant in the critical social and political conditions of Colombia today, to which the teaching of biology cannot be indifferent.

In this sense, it is proposed to approach the teaching of biology from an epistemological pluralism approach, from non-essentialist ontologies and with an intercultural and contextualized view, through which the different pedagogical and didactic aspects are reconfigured, contributing to configure the field of biology teaching, as a way to understand different visions of the world, of life, of the living and to appropriate reciprocal relationships between human beings and nature.

This is how we understand the urgency of making room for other knowledge, not just scientific knowledge, when constructing interpretations and explanations of the country's diverse realities. From this perspective, the relevance of addressing absolute truths (as has been the case in the teaching of biology and the natural sciences in general from the modern perspective) is re-evaluated, and the aim is instead to build truths in context, based on dialogue and exchange of different knowledge and openness to different worldviews.

Among the aspects to take into account, historical and bio-cultural memory is recognized as important, as well as cultural practices of ancestral peoples, as is the case of the Muruy and Okaina, through which life is valued and assigned a sacred character, which implies protection and care; as well as relationships with elements of life such as education, territory, nature and the strengthening of identity and valuation of their own.

Another aspect to take into account is the existence of a diversity of learning scenarios, such as the house of indigenous knowledge (maloca), the chagra, the river and the jungle; as spaces from which we can experience and understand the meaning of life, which implies a direct relationship with the experiences of life in a territory, with a collective and historical character, and that also allow the cultural and identity empowerment, for the defense of life in the particular territories.

Taking into account the above, it is necessary to think of a biology teaching that is re-signified from the dialogues of knowledge and that becomes concrete in practices that are experienced in different contexts, according to local ways of inhabiting the territories and in constant interaction with

those other views of the world that circulate and with which the educational processes can be enriched through the recognition of differences. Likewise, outlining didactics of biology with an intercultural character that is configured from plural dialogues, in the same way, can contribute to constituting alternative views of biology, which allow recognizing the diversity of ways of understanding the relationships with nature.

To sum up, the teaching of biology can be considered as a cultural practice, which places in the debate the place of biology as a science of life and the living, its relationship with the contexts of students and the possibilities of empowering knowledge for the defense of territories and life itself. This implies stating that as human beings we are built in relation to other organisms, hence the importance of understanding the living from life, allowing respect for all forms of life and forging a world where there is room for biological and cultural diversity.

In this regard, the teaching of biology can enable the empowerment of knowledge, the strengthening of identity and the recognition of cultural practices (e.g., ethnobotanical). From the teaching of biology, life meanings are configured, ways of appropriating the students' own knowledge, that of their families and communities, of the people with whom they interact, and of their cultural contexts.

In this perspective, the teaching of biology can be considered as "an act of otherness", the classroom and the school in general, as a place of dialogue and encounter with different realities, from the sensations and emotions generated by meeting, debating, sharing, creating and proposing other ways of living, of being part of a culture.

**Author contributions:** All co-authors have involved in all stages of this study while preparing the final version. They all agree with the results and conclusions.

**Funding:** No external funding is received for this article.

**Acknowledgements:** To the Indigenous students and traditional authorities of La Chorrera Amazonas, for allowing us to dream with the possibility of caring for life from the teaching of biology. To the Centro de Investigaciones de la Universidad Pedagógica Nacional (CIUP), for their financial support for the realization of this research.

**Declaration of interest:** The authors declare that they have no competing interests.

**Ethics approval and consent to participate:** Not applicable.

**Availability of data and materials:** All data generated or analyzed during this study are available for sharing when appropriate request is directed to corresponding author.

## REFERENCES

- Alarcón Cháires, P. E. (2015). *Otras epistemologías: Conocimientos y saberes locales desde el pensamiento complejo* [Other epistemologies: Knowledge and local wisdom from complex thought] [PhD thesis, Pensamiento Complejo. Multiversidad Mundo Real].
- AZICATCH (2007). *Plan de vida y abundancia de los hijos del tabaco, la coca y la yuca dulce de La Chorrera* [Plan for life and abundance of the children of tobacco, coca and sweet cassava of La Chorrera]. Alta Voz Comunicaciones.
- Beillerot, J., Blanchard-Laville, C., & Mosconi, N. (1998). *Saber y relación con el saber* [Knowledge and relationship with knowledge]. Paidós Educador.
- Blaser, M. (2009). Political ontology. Cultural studies without 'cultures'? *Cultural Studies*, 23(5), 873-896. <https://doi.org/10.1080/09502380903208023>
- Buinaje, A. (2013). *La Maloka Uitoto como espacio educativo de vida desde los principios tradicionales del clan Eimen+ de la etnia Uitoto de la Chorrera Amazonas Colombia* [The Maloka Uitoto as an educational space of life from the traditional principles of the Eimen+ Clan of the Uitoto ethnic group of the Chorrera Amazonas Colombia] [BSc. thesis, National Pedagogical University].
- Castaño, N. C. (2009). Construcción social de universidad para la inclusión: La formación de maestros con pertinencia y en contexto, desde una perspectiva intercultural [Social construction of the university for inclusion: The training of teachers with relevance and in context, from an intercultural perspective]. In D. Mato (Ed.), *Educación superior, colaboración intercultural y desarrollo sostenible/buen vivir* [Higher education, intercultural collaboration and sustainable development/good living] (pp. 183-206). UNESCO-IESALC.
- Castaño, N. C. (2011). Construcción social de Universidad para la inclusión: La formación de licenciados en biología con pertinencia y en contexto, desde una perspectiva intercultural [Social construction of the University for inclusion: The training of biology graduates with relevance and in context, from an intercultural perspective]. In *La Educación Superior en la Amazonia hoy: Inclusión, pertinencia y financiación en los programas de formación. Memorias del seminario internacional* [Proceedings of the International Seminar on Higher Education in the Amazon Today: Inclusion, Relevance and Financing in Training Programs] (141-158). National University of Colombia Amazonia.
- Castaño, N. C. (2012). La enseñanza de la Biología en un país biodiverso, pluriétnico y multicultural. Aproximaciones epistemológicas [The teaching of Biology in a biodiverse, multi-ethnic and multicultural country. Epistemological approaches]. *Revista Bio-Grafía. Escritos Sobre la Biología y su Enseñanza* [Bio-Graphic Magazine. Writings on Biology and its Teaching], 560-586.
- Castaño, N. C. (2020). *Concepciones de vida, cosmogonía Muruy, enseñanza de la biología y diversidad cultural: Perspectivas ontológicas y epistemológicas* [Conceptions of life, Muruy cosmogony, biology teaching and cultural diversity: Ontological and epistemological perspectives] [PhD thesis, Universidad Distrital Francisco José de Caldas].
- Chona, G. D., Castaño Cuéllar, N., & Cabrera, F. (1998). Lo que nos dice la historia de la enseñanza de la biología en Colombia-Una aproximación [What the history of teaching biology in Colombia tells us-An approach]. *Revista Tecné, Episteme y Didaxis* [Tecné, Episteme and Didaxis Magazine], 4, 5-10.
- Cobern, W. (1995). Belief and knowledge: Unnecessary conflicting the science classroom. In F. Finley (Ed.), *Proceedings of the History and Philosophy of Science and Science Teaching* (pp. 222-232). HPSST.



- Cobern, W., & Loving, C. (2001). Defining "science" in a multicultural world: Implications for science education. *Science Education*, 85, 50-67. [https://doi.org/10.1002/1098-237X\(200101\)85:1<50::AID-SCE5>3.0.CO;2-G](https://doi.org/10.1002/1098-237X(200101)85:1<50::AID-SCE5>3.0.CO;2-G)
- Díaz, C., & Navarro, P. (1998). *Métodos y técnicas cualitativas de investigación en ciencias sociales [Qualitative methods and techniques of social science research]*. Síntesis.
- Eliade, M. (1956). *Lo sagrado y lo profano. La naturaleza de la religión [The sacred and the profane. The nature of religion]* (4ª ed.). Guadarrama.
- Escobar, A. (2013). En el trasfondo de nuestra cultura: la tradición racionalista y el problema del dualismo ontológico [In the background of our culture: the rationalist tradition and the problem of ontological dualism]. *Tabula Rasa*, 18, 15-42. <https://doi.org/10.25058/20112742.137>
- Farekatde, N. (2004). *La cultura del tabaco y coca: Análisis crítico sobre su reconstrucción socio-cultural, después de la explotación cauchera [The culture of tobacco and coca: Critical analysis of its socio-cultural reconstruction, after the rubber exploitation]* [Master's thesis, FlascoAndes].
- Faretkade, G. (2018). Exposición endulzar la palabra. Memorias indígenas para pervivir [Exhibition sweeten the word. Indigenous memories to survive]. *Museo Nacional de Colombia*.
- Iyokina, F. (2013). *El conocimiento tradicional+vuuhza (Okaina), sobre la relación ser humano-naturaleza, un aporte a la enseñanza de la ciencias naturales en la escuela Divina Pastora de la comunidad Okaina [The traditional knowledge+vuuhza (Okaina), on the human-nature relationship, a contribution to the teaching of natural sciences in the Divina Pastora school of the Okaina community]* [BSc. thesis, National Pedagogical University].
- Jiménez, A. (2006). El estado del arte en la investigación en las ciencias sociales [The state of the art in research in the social sciences]. In A. Jiménez, & A. Torres (Eds.), *La práctica investigativa en ciencias sociales [Research practice in the social sciences]* (pp. 29-42).
- Leff, E. (1986). *Los problemas del conocimiento y la perspectiva ambiental del desarrollo [The problems of knowledge and the environmental perspective of development]*. Siglo XXI.
- Martínez, C. (2018). Propuestas de conocimiento escolar en las orientaciones curriculares para la enseñanza de las ciencias de la naturaleza en Bogotá [Proposals of school knowledge in the curricular orientations for the teaching of natural sciences in Bogotá]. *Educação Unisinos [Unisinos Education]*, 22(1), 53-62. <https://doi.org/10.4013/edu.2018.221.06>
- Mendoza, J. (2008). La reposición del sentido desde un concepto ontológico de cultura. Ensayo sobre Merleau-Ponty. [The replacement of meaning from an ontological concept of culture. Essay on Merleau-Ponty]. *A Parte Rei. Revista de Filosofía*, 55, 1-11. <http://serbal.pntic.mec.es/~cmunoz11/mendoza55.pdf>
- Merleau-Ponty, M. (1977). *Fenomenología de la percepción [Phenomenology of perception]*. Península. <https://doi.org/10.14375/NP.9782070293377>
- Ministerio de Educación Nacional. (1998). *Lineamientos curriculares. Ciencias naturales y educación ambiental [Curriculum guidelines. Natural sciences and environmental education]*. MEN.
- Molina, A. (2010). Una relación urgente: Enseñanza de las ciencias y contexto cultural [An urgent relationship: Science education and cultural context]. *Revista EDUCyT [EDUCyT Magazine]*, 1(1), 76-88.
- Olivé, L. (2009). Por una auténtica interculturalidad basada en el reconocimiento de la pluralidad epistemológica [For an authentic interculturality based on the recognition of epistemological plurality]. In S. Boaventura (Ed.), *Pluralismo epistemológico [Epistemological pluralism]* (pp. 19-30). Muela del Diablo.
- Olivé, L., & Pérez, R. (2011). *Temas de ética y epistemología de la ciencia. Diálogos entre un filósofo y un científico [Topics of ethics and epistemology of science. Dialogues between a philosopher and a scientist]*. Fondo de Cultura Económica [Fund of Economic Culture].
- Quintana, A. (2006). Metodología de investigación científica cualitativa [Qualitative scientific research methodology]. In A. Quintana, & Montgomery (Eds.), *Psicología: Tópicos de actualidad [Psychology: Current topics]* (pp. 65-73). UNMSM.
- Ramírez, M. (2004). Bases para una filosofía culturalista. De la ontología a la ética [Bases for a culturalist philosophy. From ontology to ethics]. *Devenires [Becoming]*, 5(10), 7-24.
- Ruíz, D., & Del Cairo, C. (2016). Los debates del giro ontológico en torno al naturalismo moderno [The debates of the ontological turn around modern naturalism]. *Revista de Estudios Sociales*, (55), 193-204.
- Toledo, V., & Barrera-Bassols, N. (2008). *La memoria biocultural. La importancia ecológica de las sabidurías tradicionales [Biocultural memory. The ecological importance of traditional wisdoms]*. Editorial Icaria.
- Tovar-Gálvez, J. (2021). The epistemological bridge as a framework to guide teachers to design culturally inclusive practices. *International Journal of Science Education*, 43(5), 760-776. <https://doi.org/10.1080/09500693.2021.1883203>
- Varela, F. (1996). *Ética y acción [Ethics and action]*. Dolmen.