



The role of the Environmental Education in tackling the Climate Emergency and biodiversity decline: articulating Brazilian experiences

O papel da Educação Ambiental no enfrentamento da Emergência Climática e do declínio da biodiversidade: articulando experiências brasileiras

Rosana Louro Ferreira Silva¹

<https://orcid.org/0000-0002-5787-2331>

Edson Grandisoli²

<https://orcid.org/0000-0002-1524-9074>

Pedro Roberto Jacobi³

<https://orcid.org/0000-0001-6143-3019>

Abstract: The transition to more sustainable societies is permeated by interests, conflicts, and predatory use of natural resources, generating vulnerability, socio-environmental injustice, and poverty. Considering that we are living in an era of uncertainty and multiplication of complex and wicked issues due to the prevailing logic of society, there is an urgent and unquestionable need to re-think educational paradigms, considering the need to redesign actions within transitional and transformational perspectives. This work describes and analyzes two educational experiences related to central and connected socio-environmental challenges: biodiversity loss and climate emergency. Both experiences encompass ways created to empower teachers to understand the complexity and create paths for action, highlighting the crucial role of participation and cooperation among different social institutions such as Governmental, Universities and NGOs. The challenge is to build communities as territory transformative agents in the use of active learning methodologies that promote meaningful knowledge from a perspective of the global South.

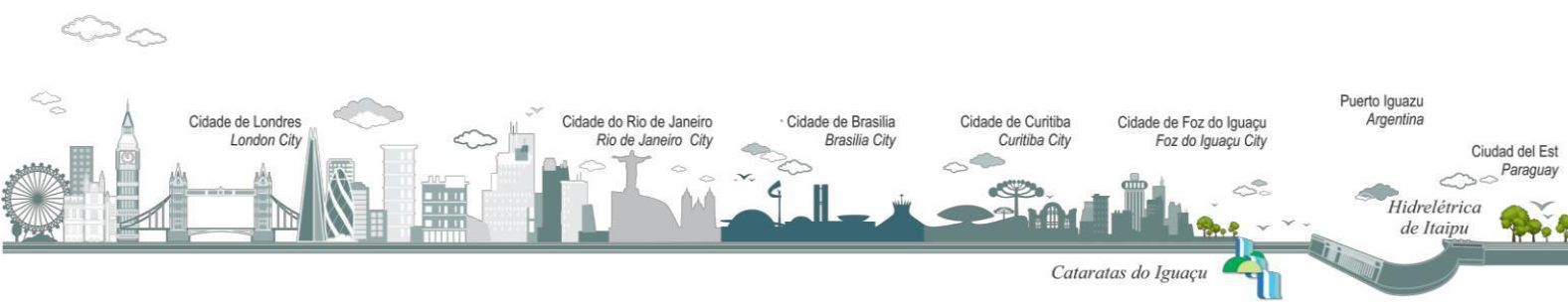
Key Words: Social learning. Sustainable societies. Climate schools. Teacher training.

Resumo: A transição para sociedades sustentáveis é ainda dificultada por interesses, conflitos e uso predatório dos recursos naturais, gerando vulnerabilidade, injustiça socioambiental e pobreza. Considerando que estamos vivendo uma era de incertezas e multiplicação de questões complexas e perversas devido à lógica predominante da sociedade, há uma necessidade urgente e inquestionável de repensar os paradigmas educacionais, considerando a necessidade de redesenhar ações dentro de perspectivas transicionais e transformadoras. Este trabalho descreve e analisa duas experiências educativas relacionadas a desafios socioambientais centrais e conectados: a perda da biodiversidade e a emergência climática. Ambas as experiências englobam formas criadas para capacitar os

¹ Instituto de Biociências da USP – Departamento de Zoologia – Programa Interunidades em Ensino de Ciências – rosanas@usp.br

² Instituto de Estudos Avançados da USP - Reconecta e Movimento Escolas pelo Clima - edsongrandisoli@gmail.com

³ Instituto de Energia e Ambiente da USP- prjacobi@gmail.com





professores a compreender a complexidade e criar caminhos para a ação, destacando o papel crucial da participação e cooperação entre diferentes instituições sociais, como o Governo, as Universidades e as ONGs. O desafio é construir comunidades escolares como agentes transformadoras de território no uso de metodologias ativas de aprendizagem social que promovam o conhecimento significativo a partir de uma perspectiva do Sul global.

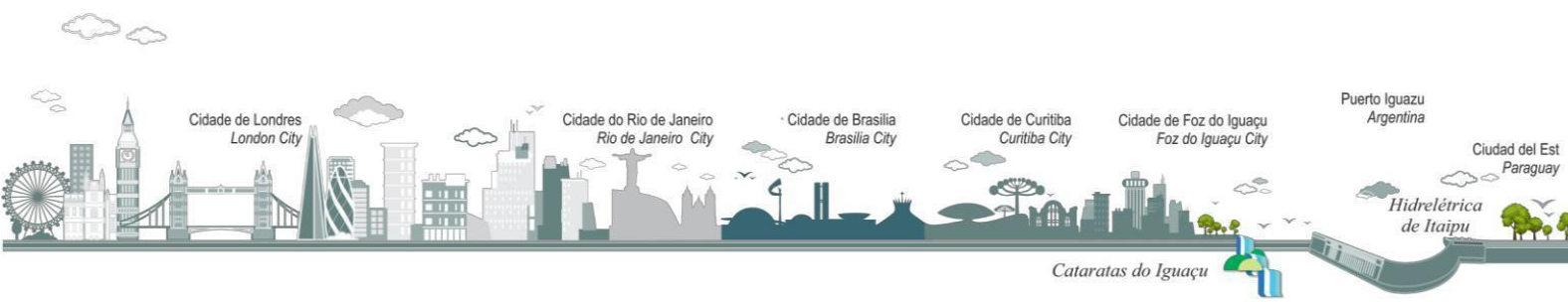
Palavras-chave: Aprendizagem social. Sociedades sustentáveis. Escolas pelo clima. Formação de professores.

INTRODUCTION

The transition to more sustainable societies is permeated by interests and conflicts. Social institutions are constantly charged with the predatory use of natural resources, generating vulnerability, socio-environmental injustice, and poverty, promoting unsustainability. Considering that we are living in an era of uncertainty and multiplication of complex and wicked issues due to the prevailing logic of society, there is an urgent and unquestionable need to re-think paradigms considering new paths of development that need to redesign actions within transitional and transformational perspectives. In this direction, the proposal of reflexive and engaged education centered on knowledge and doings built with, and not for the "learning and teaching" subjects, is in congruence with an Education for Sustainability (JACOBI; GIATTI & AMBRIZZI, 2015).

Our framework is based on research in the field of environmental education and education for sustainability, both approaches being supported by the idea of "sustainable societies", as set out in the "Treaty on Environmental Education for Sustainable Societies and Global Responsibility" (FÓRUM DAS ONGS, 1992), as we understand that this is linked to a broader vision of sustainability, with a focus on social and environmental justice and collective engagement in tackling current environmental problems.

We believe that **environmental education for sustainability** is an ongoing learning process based on respect for all forms of life. Such education affirms values and actions that contribute to human and social transformation and ecological preservation. It encourages the formation socially just and ecologically balanced societies, which maintain a relationship of interdependence and relationship of interdependence and diversity. This requires individual and collective responsibility at local, national and global levels. We believe that preparing for the necessary changes depends on

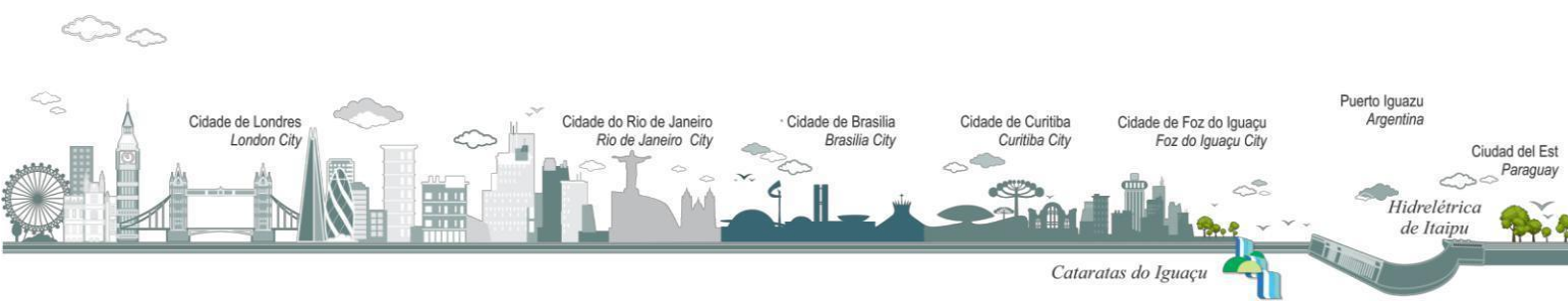




collective understanding of the systemic nature of the crises that threaten the future of the planet (Fórum das ONGs, 1992, p. 1).

Environmental Education and Education for Sustainability are excellent fields of knowledge to expand the growing capacity of social entities to perform common tasks related to sustainable initiatives, as it is about providing real-world learning opportunities focusing on a shift of current thinking, practices, and values, and that should be a core concern for all educational institutions and spaces (JACOBI *et al.*, 2016). In this context, we consider that educational practices for sustainability would value participation, co-creation, and co-responsibility as a central framework for transformation. This tripod, which we call here a new "sustainability education tripod (SET)," focuses on the importance of collective, collaborative, and democratic processes. These are interconnected concepts that emphasize social practices that aim to strengthen content and knowledge linked to learning processes aimed at promoting a vision that generates changes in ways of thinking and acting both locally and globally (GRANDISOLI *et al.*, 2020). This demands reflexive and critical thinking processes that consider the deeper values and principles upon which people as individuals and as part of collectives are currently caring for their future (SOUZA; WALSH & JACOBI, 2019).

The cultural transformations and the construction of practices capable of structuring the foundations of a sustainable society warn of the importance of strengthening communities of practice and social learning as processes that promote the production of expanding repertoires and learning processes of individuals and groups, through social interactions. This allows the acquisition of new ways of understanding and acting on reality and as Sterling (2007) points out Social Learning is considered here as a process of cultural change oriented towards facing today's social and environmental problems. For Glasser (2007), the biggest challenge to creating active social learning opportunities is to increase the ability to contextualize and reflect. Active processes, especially collaborative ones (recognized as co-learning), have the potential for the emergence of innovations, collective commitments, and sustainability-oriented citizenship practices.





According to Richardson *et al.* (2023),

[...] anthropogenic perturbations of the global environment are primarily addressed as if they were separate issues, climate change, biodiversity loss, or pollution. This approach, however, ignores these perturbations' nonlinear interactions and resulting aggregate effects on the overall state of Earth system. Planetary boundaries bring a scientific understanding of anthropogenic global environmental impacts into a framework that calls for considering the state of Earth system as a whole (RICHARDSON *et al.*, 2023, p.1)

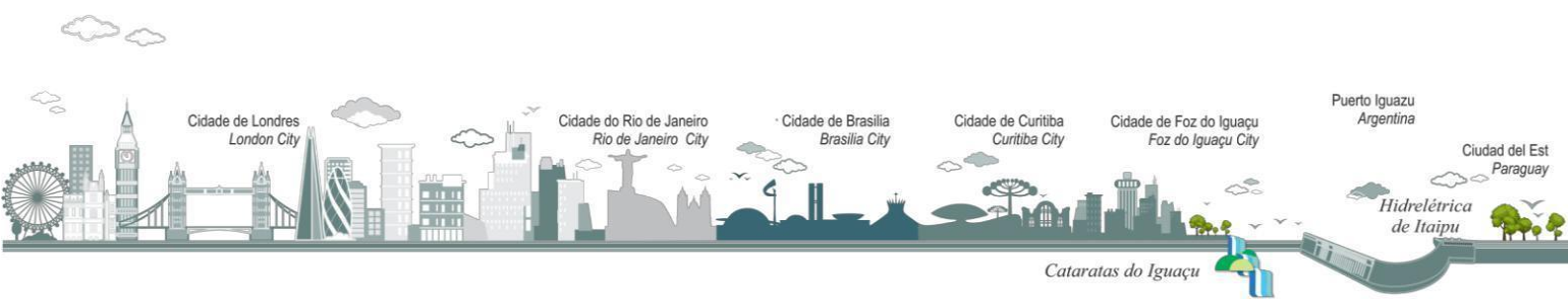
In the same direction, Marques (2023, p.42) affirms that it is crucial to investigate and understand the multiple socio-environmental challenges, their characteristics, and how they reinforce each other. They are the climate emergency, the annihilation of biodiversity, pandemics, and growing inequalities.

Considering that biodiversity loss and climate emergency are two of today's most important socio-environmental challenges because of their complexity and correlations, especially considering trends and historical processes related to deforestation in Brazil, this work points out educational experiences created to empower teachers and communities to understand and create paths for local action. To this end, we consider it imperative to educate for sustainability from a social learning perspective, adding to Paulo Freire's approach to popular education, and adding innovative perspectives and practices from the global south, to empower teachers and communities as territory transformative agents.

COMPLEX AND CONFLICTIVE TIMES DEMAND NEW PEDAGOGICAL RESPONSES

Universities, public research centers, NGOs have a very relevant challenge and provide a privileged locus for an education directed to the demands of complex and conflictive times. It represents an important space for equalizing opportunities and democratizing society, expanding equal opportunities for people.

This implies that lessons learned in the context of the pandemic of COVID-19 expand the need for interdisciplinarity as an educational framework to deal with the complexity of the emergence of new pathological agents and their relationship with the environment-society dynamic. This demands an education that considers the preparation of future professionals suited to a world of constantly accelerating change strengthened by the consolidation of values



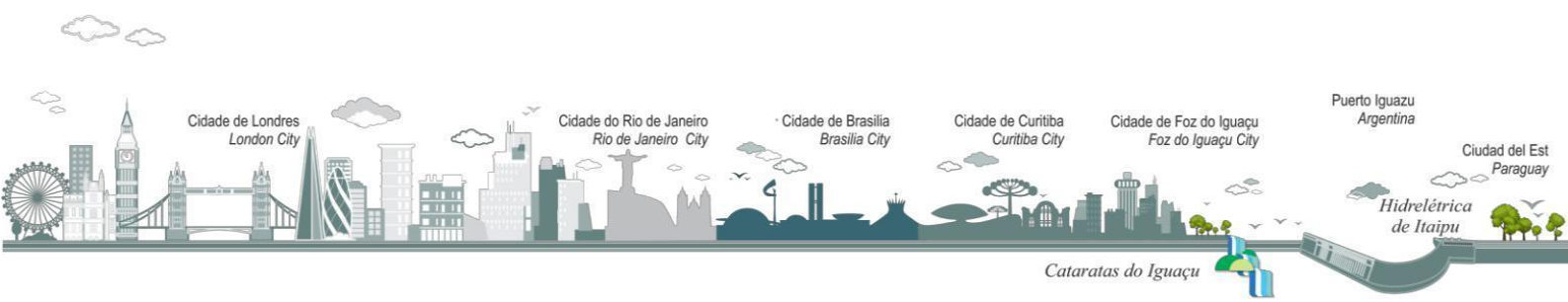


- ethical and personal – in the formation of personalities (JACOBI; ROTONDARO & TORRES 2019).

To this end, there is a need to develop pedagogical models that enable students to have the tools to keep up with the incessant transformations taking place and to increasingly strengthen curricula that emphasize an interdisciplinary approach towards socio-environmental issues. The greater complexity of contemporary knowledge and the appropriate response implies complementarity, mutual enrichment, and conjunction of disciplinary knowledge emphasizing new readings and interpretations (JACOBI *et al.*, 2020)

We can consider that a socio-environmental agenda is part of the development and intertwining of a complex knowledge (MORIN, 2000) that demands advances in disciplinary boundaries, demanding cross-fertilization to educate for change and uncertainty within a reality that demands increasingly an understanding of hybrid scientific objects. There is a challenge of higher education institutions to create spaces to develop transversal and interdisciplinary initiatives to strengthen the understanding of how its role can be part of a process based on cross-hybridization, of a new culture of sustainability strengthening "participation, co-creation, and co-responsibility within a collaborative approach" (GRANDISOLI *et al.*, 2020). An important example of an initiative in this sense was the creation of projects articulated in academic consortiums for undergraduate education, where the authors of this article developed a training experience in environmental education involving teachers and students from different undergraduate courses, with the complete experience being described in Silva & Bacci (2023).

The challenge is to stimulate initiatives that diversity and intertwining that arise from practical experiences, recognizing the reciprocal influence and the mutual transformation that results from the dynamic relationship between individuals and between individuals and the environment (SOUZA; WALS & JACOBI, 2019). And as Wals (2011) points out it can lead to a transformation, both individually and collectively, stimulated by dialogue and cooperation among a diversity of people that share a common goal. The concept of Social Learning (WALS, 2007; SCHOLZ; DEWULF & PAHL-WOSTL, 2014) becomes a valuable approach to develop processes of articulation of actions that promote the importance of acknowledging aspects





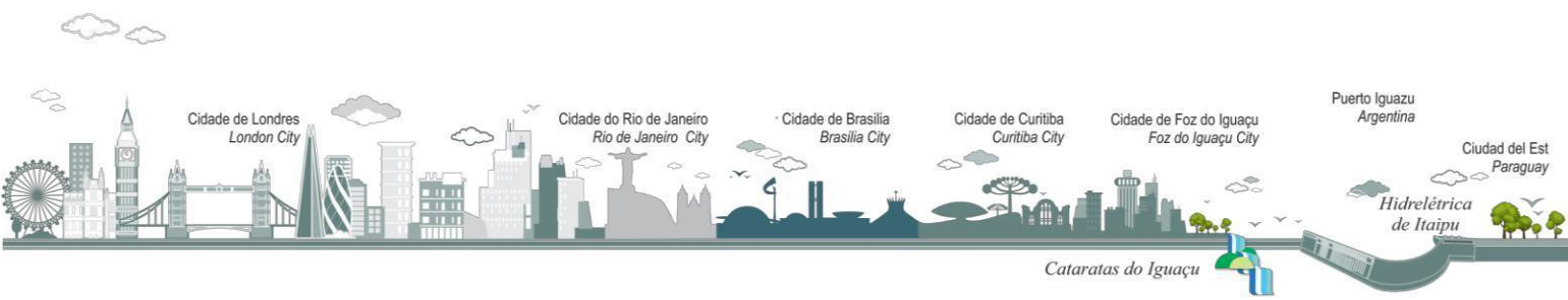
associated with unsustainable patterns of production and consumption and unequal and exclusionary social structures.

This represents the need to emphasize a relational approach that in the context of complex contemporary social and environmental challenges, and according to Tilbury (2007:118), three fundamental aspects underpin the notion of social learning for sustainability: the need to challenge the mental models, to develop new approaches to build skills that promote change and to use pluralism and diversity of views in collaborations in a process that are open to the diversity of views to promote sustainable environments.

It is relevant to stress that education does not act in an isolated dynamic, it represents a process of acquiring knowledge that is necessary to engage and understand the world we live in, and to prepare not only students but also communities for their future involvement in professional activities and initiatives that will be increasingly linked to aspects of sustainability. The fact that we still are living in a world where unsustainable practices prevail, and still very slowly new world views based on transitional stages to promote relevant changes to decarbonize and reduce environmental degradation are essential.

The greater complexity of the contemporary knowledge structure demands that interdisciplinarity be the appropriate response, as it implies complementarity, mutual enrichment, and conjunction of disciplinary knowledge. The traditional logic that presides over the way knowledge is developed demands new readings and interpretations, and this implies reorganizing the cut of scientific knowledge, which does not presuppose the disappearance of disciplines, but new ways of organizing knowledge (JACOBI; GIATTI & AMBRIZZI, 2015).

Chankseliani & McCowan (2020:3) address the issue arguing that when approaching higher education it is far more than a tool to acquire skills, knowledge, and credentials and that Universities, institutions, and social organizations have the challenge to stimulate and promote a holistic human development that takes into account that individuals have values and rights to pursue as well as their agency freedom, encompassing issues of identities, values, social change within an approach that emphasizes other actions for sustainability. However, it is important to emphasize that there is a need to consider specificities and social and institutional dynamics in a wider and consider the challenge to address issues and actions in a broader context that takes into account the Global North and South different realities.





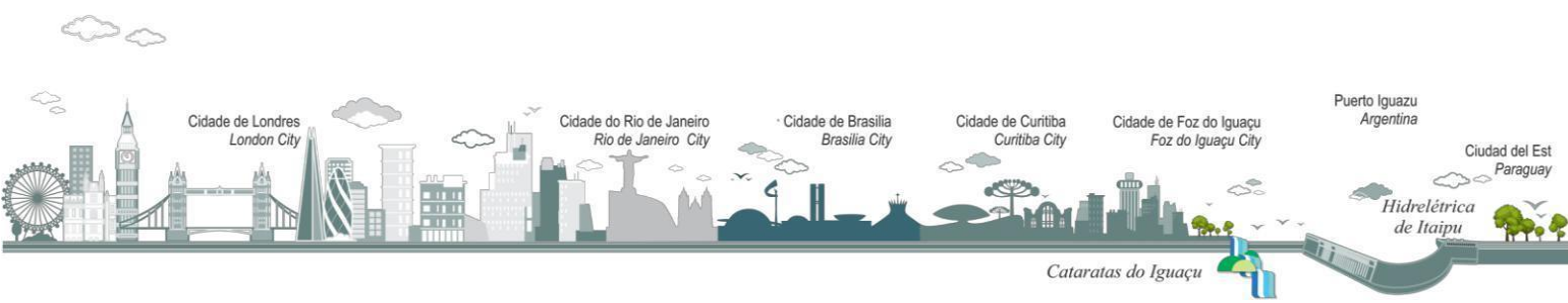
Its purpose is transformative, in the sense that it should widen the world views, Silva *et al.* (2018) consider the socio-environmental training process is necessary and that the implementation of transdisciplinary practices is a great challenge. Extramural activities and socio-environmental attitudes in classes were also presented as important formative aspects and it was identified that the dimensions of knowledge, values, and participation still were not in equilibrium on the formation.

A CHALLENGING EDUCATIONAL ACTION AGENDA

There is a need to stimulate dialogue and more active societal participation in the recognition of the complex nature of these contemporary socio-environmental problems and their consequences. This implies also including human health issues and establishing common goals and shared solutions. Within a paradigm, sustainability, articulates complexity, diversity, and social practices coverage and represents the consolidation of a new paradigm (JACOBI; TOLEDO & GRANDISOLI, 2016).

Education constitutes a major challenge in the face of the diversity, complexity, and uncertainties of the many processes that exist in contemporary societies. Its goals indicate fundamental pathways towards more inclusive education, at different levels, to train citizens capable of understanding the main collective challenges and acting responsibly in the search for solutions. This implies, among several other challenges, the improvement of the capacity building and empowerment of the professionals' engagement for a more active and participatory teaching-learning process towards the formation of critical citizens and, at the same time, proactive and co-responsible concerning their future and their community (SILVA & GRANDISOLI, 2020), and need to deal with a multiplicity of barriers and limitations, creating paths to new approaches and answers within the Global South reality. The challenge is in renewing methodologies that promote autonomy and proactivity that stimulate collaborative educational processes and interdisciplinarity focused on problem resolution.

This approach aims to empower teachers, practitioners, and students to contribute actively to their community with their knowledge and experiences and engage in a social learning process where they can share their narratives, raise new questions, and co-create within the different socio-economic and environmental realities. One challenge is to add value





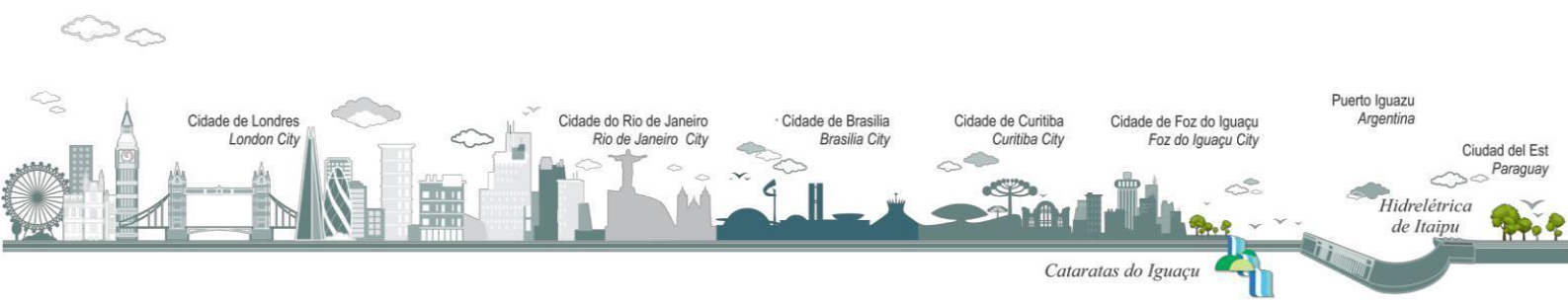
to share and promote cross-fertilization, new learnings, and skills and because of that, it is important to advance in methodologies, to network and promote interaction within a legitimate and symmetrical approach and strengthen new forms of social inclusion and openness in science and education to new collaborative knowledge creation, democratizing research and leading into the emergence of new disciplines and connections (PETERS & BESLEY, 2019).

Moments of uncertainty and risks like the current ones demand continuous formation processes for the recognition of forms of work for the cognitive, socio-emotional and attitudinal fields, as well as the mobilization of competencies for educational action integrated and articulated to the different realities.

From a methodological perspective, we stress the need to stimulate inclusive and participatory processes between different actors, the development of critical thinking, and the creation of connections and networks in the search for answers for the future, based on a process of vision transformation, focused on sustainability (JACOBI *et al.*, 2016; SOUZA *et al.*, 2019; GRANDISOLI *et al.*, 2020). The emphasis of social learning approach as learning practices that address environmental and socio-ecological concerns while leading to transformation — both individually and collectively is to be stimulated by dialogue and cooperation among diverse groups of people within a context of emancipatory action, the creation of common knowledge, critical thinking, and collective agency, and when cultivated leads to the questioning and disrupting of features of society that have become normalized over time and which pose barriers for a broad sustainability transition (SOUZA, 2019). In this way, we present recent experiences in the constitutions of the learning communities to address the main civilizational challenges: climate emergency and biodiversity decline.

SCHOOLS FOR THE CLIMATE MOVEMENT: CLIMATE EDUCATION AND ACTION

The AR6 Climate Change 2023: Synthesis Report, produced by the IPCC (IPCC, 2023) provides new critical information and insights about the chances of crossing the global warming level of 1.5°C in the next decades while it remembers the urgency of taking immediate and large-scale reductions in greenhouse gas emissions.





The report highlights that:

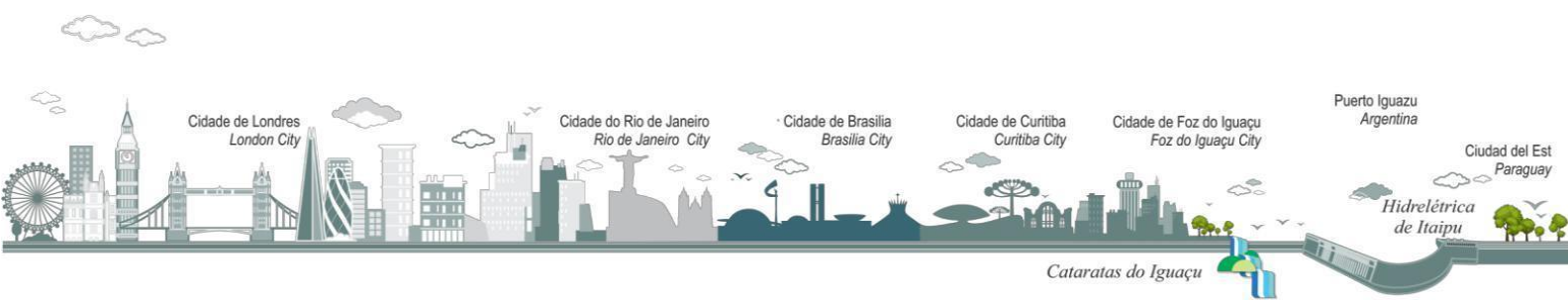
Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles, and patterns of consumption and production across regions, between and within countries, and among individuals. (IPCC, 2023, p.4)

Climate change, as well as the current major social-environmental crisis, can be considered as "wicked problems" once they have some features in common: (i) being poorly defined; (ii) complex and systemic connections to other problems; (iii) solutions are not readily apparent; (iv) are linked with different actors who are the cause of the problems and; (v) being almost impossible to know, *ex-ante*, what would be a good solution (PETERS & TARPEY, 2019; TERMEER; DEWULF & BIESBROECK, 2019). Wicked problems are a combination of complexity, diversity, and uncertainty (HEAD & ALFORD, 2013).

Climate emergency has been considered the most important wicked problem on our planet (FUERTES *et al.*, 2020) because it directly determines the impacts of other major global risks such as the emergence of infectious diseases and biodiversity loss (WEF, 2021). Thus, collective mobilization and action are crucial for present and future generations considering that the human civilization model is directly related to those crises.

Thus, considering wicked problems as a reflection of human-nature and human-human relationships, Education plays a central role in forming citizens capable of understanding the complexity of the major current crisis - considering both cognitive and emotional components - and developing skills and competencies to collectively prevent and tackle different local, regional and global socio-environmental challenges. Considering the complexity and urgency related to climate change, new and specific educational strategies related to climate education must be created and implemented.

Climate education can be formal, non-formal, or informal. Non-formal and informal education can engage people of all ages, while formal education engages a mostly young generation (MILÉR & SLÁDEK, 2011). Considering the extent and complexity of climate





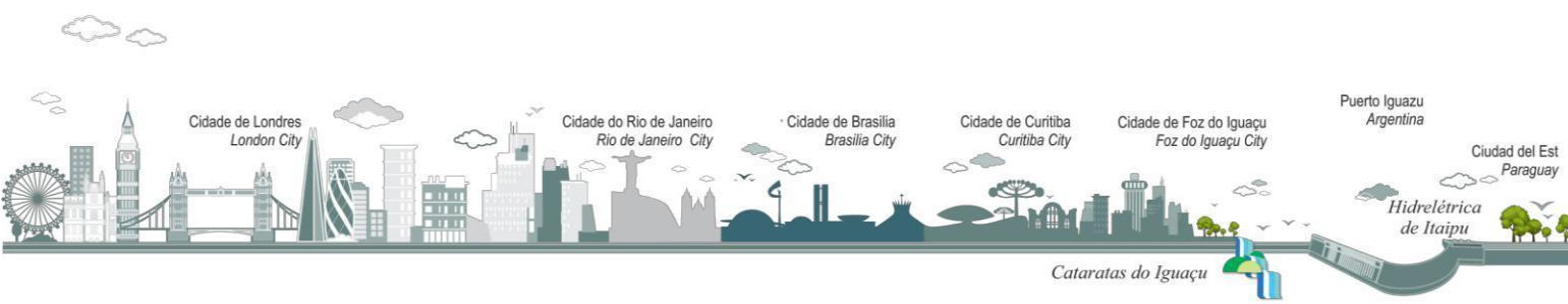
change and its associated challenges, the combination of all three education categories is crucial to involve different actors and create a sense of co-responsibility.

According to Anderson (2012), education for the climate must integrate the core principles of quality learning and disaster risk reduction considering four components that can build the capacity of educational systems to provide its community with relevant content knowledge, critical thinking skills, safe and adaptive schools and the construction of green schools. So, education is one of the key factors in preparing societies to handle climate change (UNESCO, 2017) and considering the current scenario related to global climate change and the urgent need for information, mobilization, and effort integration.

Despite the urgency of the climate change debate and the central role of education in tackling it, there are only initial efforts in the direction of determining the legal, conceptual, and practical basis of climate action and education considering the history and tradition of environmental education in Brazil. Just recently, the FUNBEA (Environmental Education Brazilian Fund) in partnership with different institutions and collaborators, produced the very first official document entitled "Guidelines for Climate Environmental Education". It is important to highlight that the first guideline suggests the structuring of a climate environmental educational national program, "that helps to provide scale, continuity, synergy, access to resources and quality to transformative processes" (FUNBEA, 2023), which points out the importance of permanent and continuous actions related to climate environmental education.

Following the importance of climate environmental education, we will present *The Schools for the Climate Movement*, launched in October 2020, which intends to bring to basic education (teachers and students) the core concepts, ideas, and findings related to climate change and its impacts on the environment and peoples, besides stimulating collective and creative construction of educational and technical solutions to cope climate change.

The Schools for the Climate (SfC) is a Brazilian initiative dedicated to climate education, and is led by Reconecta (a social enterprise) in partnership with the National Center for Natural Disaster Monitoring and Alerts - Cemaden (governmental organization), The Climate Reality Project, and Ecofalante (non-profit organizations). At this moment, the initiative has more than 700 signatory institutions (including basic and high education institutions in all Brazilian





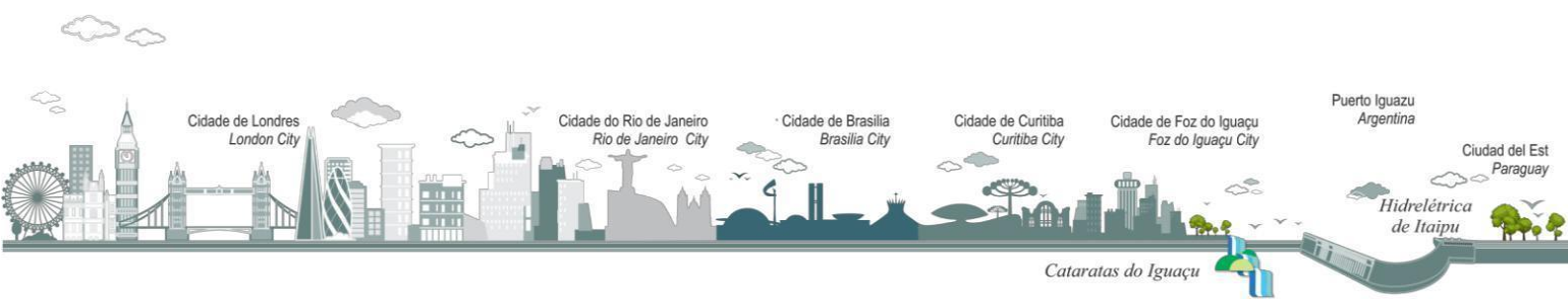
regions, Paraguay, and Portugal) which encompass around 50,000 teachers and professors and more than 350,000 students.

It is important to highlight that there is still a trend in Brazilian schools, as well as in other countries and educational contexts, to work with climate change in a disciplinary, transmissive, and prescriptive way, creating indifference, paralysis, and hindering teachers and students from creating local solutions to tackle climate change in a more contextualized, integrated and systemic way. Considering this perception, the SfC initiative aims to build a world where all educational institutions and their communities are co-responsible and able to act collaboratively in the search for solutions to the climate crisis. It connects educators and students, provides curated climate education content, and gives visibility to educational institutions committed to the subject.

The SfC acts taking into account the importance of scientific and reliable information related to climate change (climate science) as well as examples of adaptation and mitigation plans and strategies. Besides curating information, movement volunteers' also help to create new and diversified communication strategies to spread the word about SfC and increase the number of signatory institutions.

All the information provided (especially related to climate science and the importance of the development of adaptation and mitigation mechanisms) can inspire and be used to promote effective changes in the curriculum (e.g. building a climate curriculum), management practices (e.g. changing the institution's consumption habits), physical spaces (e.g. reducing energy consumption by installing skylights), and collaboration to community engagement related to climate change (e.g. using hitchhiking apps), among other possible initiatives (Figure 1). Successful climate change adaptation and mitigation requires specific knowledge, skills, attitudes, and behavior change that only appropriate and strategic educational policies can provide (ANDERSON, 2010; MOCHIZUK & BRIAN, 2015; IPCC, 2018; FUERTES *et al.*, 2020).

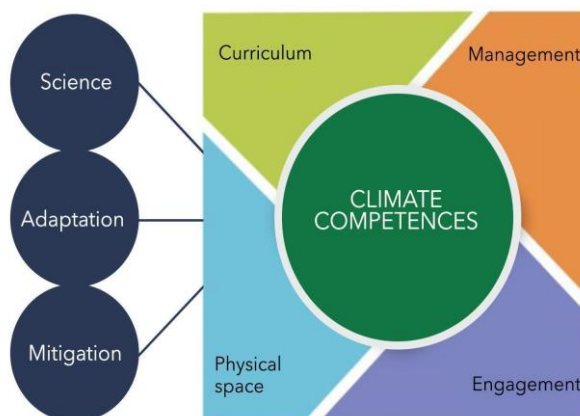
The development of climate competencies is the core objective of SfC actions and strategies considering the schools, once it provides a useful framework to (1) develop an understanding of the complexity of climate change, including the role of the school's community and different stakeholders; (2) stress the importance of climate change science and environmental education; (3) broaden the comprehension about natural and human processes;





(4) better evaluate the risks that climate change poses to economic and human development and; (5) create viable solutions to tackle the climate crisis.

Figure 1 – Schools for the Climate Action Framework

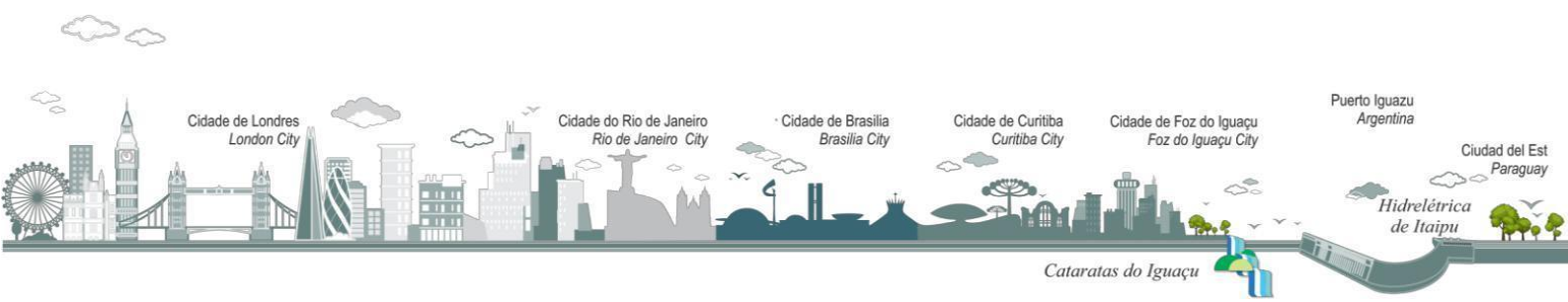


Source: based on UNESCO (2017); Fuertes *et al.* (2020).

Besides providing curated information, SfC organizes exclusive and open online events and seminars for the signatory institutions in partnership with universities. These online events are crucial to increase the number of participant institutions. Increasing the network is fundamental to expanding the exchange of ideas and inspiring practices in climate action. In other opportunities, the signatory schools also have the chance to share teacher's institutional initiatives about climate change communication, educational strategies, and mechanisms of adaptations and mitigation already being developed. The exchange of experiences facilitates contact among people and institutions.

At last, during October and November, the signatory institutions are invited to share their climate actions during an online congress. The projects or programs developed by teachers and students are evaluated by an independent educational commission, and the best initiatives are recognized and awarded by the SfC. Furthermore, they will be part of an e-book freely distributed for the main educational departments and schools, ensuring recognition of proposals and disseminating good practices in climate education.

The creation of a community of practice (ECKERT, 2005), as SfC proposes, is fundamental (1) to spread the word about climate change and other contemporary challenges;





(2) to guarantee continuous formation to formal, non-formal, and informal educators and; (3) to co-responsible social actors in the search for viable solutions for climate crises.

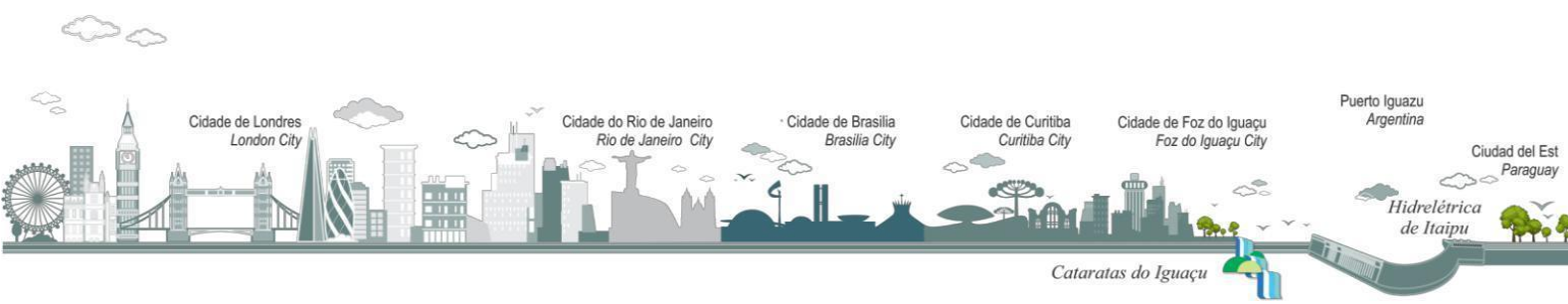
The SfC is a recent initiative, but already the biggest educators and educational institutions network dedicated to the climate emergency. The next steps are to increase the number of signatories and action partners, the amount and periodicity of online and face-to-face events, develop tools to facilitate networking and organize events in which the actions taken by individuals and institutions can be even more recognized, valued, and disseminated.

Addressing the climate crisis through education takes more than science alone. Creating effective mechanisms of mitigation and adaptation will take the concerted action of every social actor and all parts of society (UNESCO, 2010). Considering the schools' community there are several different strategies to inform, raise awareness, engage and ideally create climate action.

The first strategy is often related to expositive classes that introduce students to climate change, its characteristics, its consequences, and ways to reduce its impacts, stimulating or not dialogue, and critical and contextualized thinking. The second involves raising awareness through activities connected to commemorative days such as Earth Day, World Water Day, Earth Overshoot Day, etc., and the third one aims to integrate climate education by building collaborative partnerships and developing integrated and permanent actions involving community and territory.

The establishment of coordinated climate change education networks would help to integrate and synergize these diverse efforts by conducting research on effective methods, and sharing best practices and educational resources (FORREST & FEDER, 2011). UNESCO recommends seeking collaboration and partnerships with ministries, civil society, communities, media, the private sector, etc. In the specific case of African countries, the organization recommends establishing regional centers of excellence and regional climate change education networks (VALENTIN *et al.*, 2015).

It is important to highlight that integrating the SDGs as part of a learning process - in this experience SDG 13 in particular - demands a critical reflection on values, views, and concepts, and integrated within the concept of Social Learning (WALS, 2007; SCHOLZ, DEWULF & PAHL-WOSTL, 2014) becomes a valuable approach to develop processes of





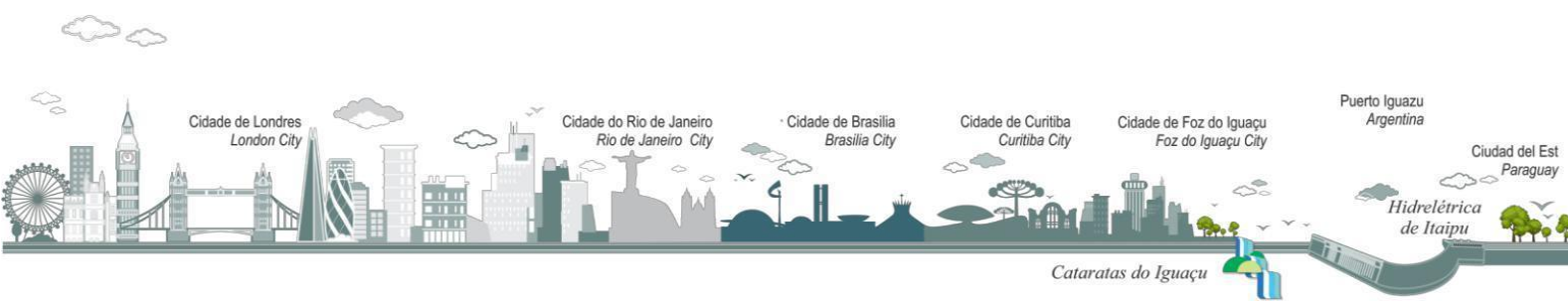
articulation of actions that promote the importance to acknowledge aspects associated to the existing unsustainable patterns of production and consumption and unequal and exclusionary social structures. SDGs create through their diversity and interdependencies the importance of sharing the knowledge that arises from practical experiences, thus observing the mutual transformations of individuals and the environment (SOUZA; WALSH & JACOBI, 2019). This can lead to a relational transformation, stimulated by dialogue and cooperation and SDGs represent innovation within the context of complex contemporary social and environmental challenges (WALSH, 2011).

The dialogue with SDGs responds to the challenges of sustainability and integration of natural resource management interfaces, which presupposes the contribution of different knowledge and interdisciplinarity. This presupposes a sharing of understanding, connecting different views of the problem, and creating intersectoral and interdisciplinary dialogues related to the concept and importance of social learning (JACOBI, 2012; JACOBI, TOLEDO & GRANDISOLI, 2016). Social Learning is closely related to capacity building, and this represents the possibility of developing dynamic processes of participation and collaboration in new ways of thinking and facing problems related to socio-environmental sustainability. The understanding of the role of SDGs and the dialogue with different worldviews through social learning stimulate the development and implementation of responses to different challenges and their global impacts.

ENVIRONMENTAL EDUCATION FOR THE BIODIVERSITY: ARTICULATING CONCEPTS, VALUES, AND FORMS OF PARTICIPATION

Biodiversity is a polysemic, complex, and interdisciplinary theme, permeating international treaties, national documents, legislation, curricula, media, and the daily lives of various social groups. In this sense, we agree with Pedrini (2009) that conserving biodiversity, considered a natural heritage of strategic importance for Brazil, is a matter of national sovereignty.

According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) "Biodiversity – the diversity within species, between species and of ecosystems – is declining faster than at any time in human history". This document points out that the largest global impact has been: changes in land and sea use;





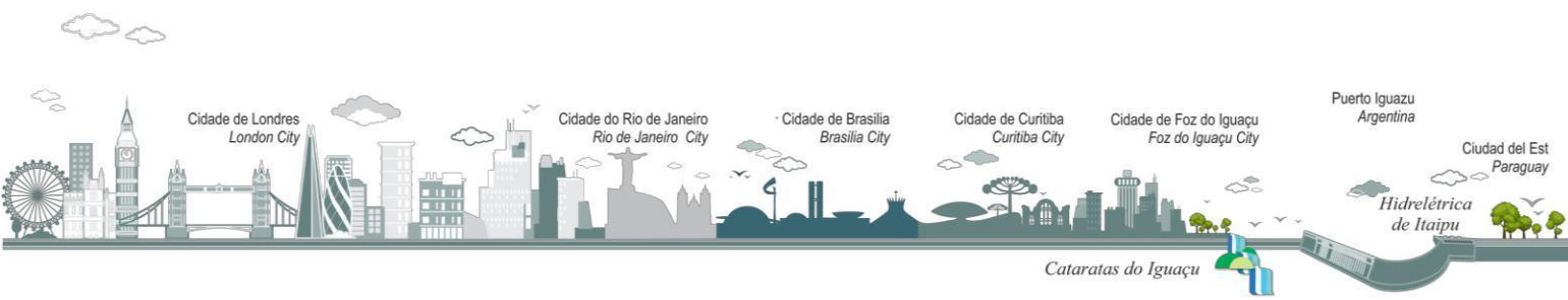
direct exploitation of organisms; climate change; pollution; and invasion of alien species, and the report point that is a necessary change in values and behaviors about production and consumption patterns and in the global governance.

The 1, 17 and 18 of the Aichi Biodiversity Targets⁴ depend, as a priority, on a society that is willing to participate in discussions and decisions regarding biodiversity and socio-environmental sustainability, making it necessary to problematize and dialogue on the relationship between scientific knowledge about biodiversity and the cultural diversity of local communities, and the formation of collaborative groups involving different social actors is strengthened in the appropriation of Environmental Education (EA) through approaches inherent to social learning (MURO & JEFFREY, 2008; JACOBI, 2012).

Dreyfus, Wals, Wheelie (1999) point to biodiversity as an example of a theme for a "post-modern environmental education", for enabling the relationship between concepts of science and social relations. They indicate the need to develop strategies that allow participants to build (knowledge, experiences, and forms of learning), transformation (in the sense of changing, shaping and influencing the world around them), criticism (problematizing the underlying values, assumptions, worldviews, moral, learner and group) and emancipation (in the sense of changing and questioning the power relations that involve the theme).

Gaudiano (2002) points out that environmental education for biodiversity should not only fulfill an instrumental function to help implement technical-scientific decisions but should be an interdependent component that contributes to the construction of decisions on the subject, making it possible to: construct an understanding of the complex nature of biodiversity, showing the impacts of economic, political and social interdependence between countries; providing individuals and communities with the means to understand the interdependence of biodiversity on economic, social, cultural, economic, social, cultural, biological and physical elements in space and time; to develop a sense of responsibility and solidarity between regions

⁴ The Aichi Biodiversity targets is a Strategic plan for biodiversity. Target 1 - people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably; Target 17 - each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan; Target 18 - the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected. (<https://www.cbd.int/sp/targets/>)





and countries; promote the reflective and prudent use of biodiversity and prudent use of biodiversity, encouraging responsible participation in decision-making at all levels of society responsible participation in decision-making.

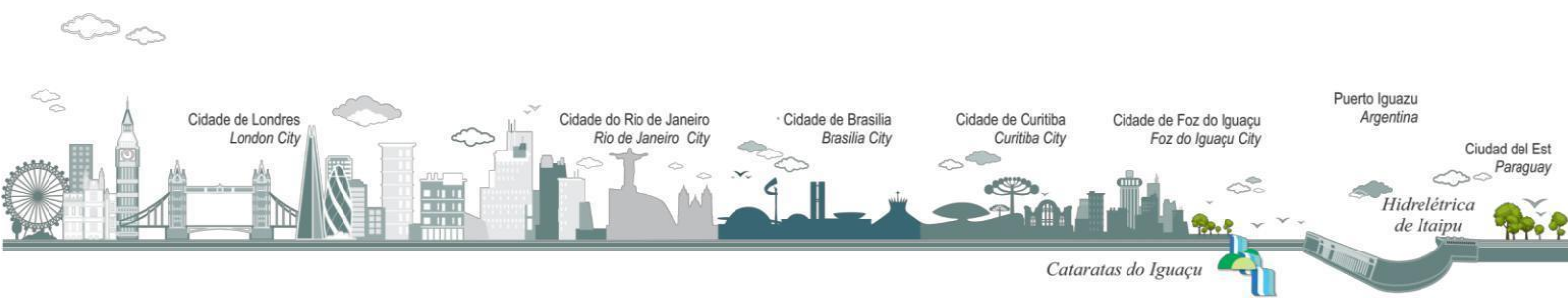
Our proposals consider the assumptions of critical environmental education, which understands the environment as an object of transformation and a place of emancipation (SAUVÉ, 2010) and therefore seeks to offer ways to engage the public with environmental issues through participatory action, investigating the constitution of learning communities - a group of people who are associated around a common goal, in a dynamic dialogue, to solve a problem or build proposals (ORELLANA, 2002). The critical thinking of EE is based on the guiding principles of the Treaty on Environmental Education for Sustainable Societies and Global Responsibility.

In this topic, we present examples of collaborative practices developed in academic extramural projects focused on environmental education and biodiversity, which involved participation, co-creation, and co-responsibility, arguing how teachers and educators articulate didactic strategies and participation in teaching plans built in an in-service training about biodiversity.

In our formative approach, we also use the concept of "culture circles" (FREIRE, 1991) considered integral learning, which breaks with fragmentation and requires taking a stand in the face of problems experienced in each context; horizontality in the educator-learner relationship and the appreciation of local cultures, orality, considering the investigation of the universe and choice of "generative themes", its decoding and problematization of reality.

Initially, we will present two experiences of a university extramural course that was offered in 2018; 2022 and 2023, by researchers from the Research Group on Environmental Education and Educator Training (SILVA *et al.*, 2019). In the course, we seek to include the five elements of teacher education exposed by Nóvoa (2009), which can be summarized as follows: i. Have a strong practical component; ii. Valuing the experience of professionals; iii. Include the personal dimension of the teaching profession; iv. Encourage teamwork and; v. Emphasize the principle of social responsibility.

In general terms, the course took place on the internal and external places of the university campus and using didactic strategies focused on collaboration and knowledge



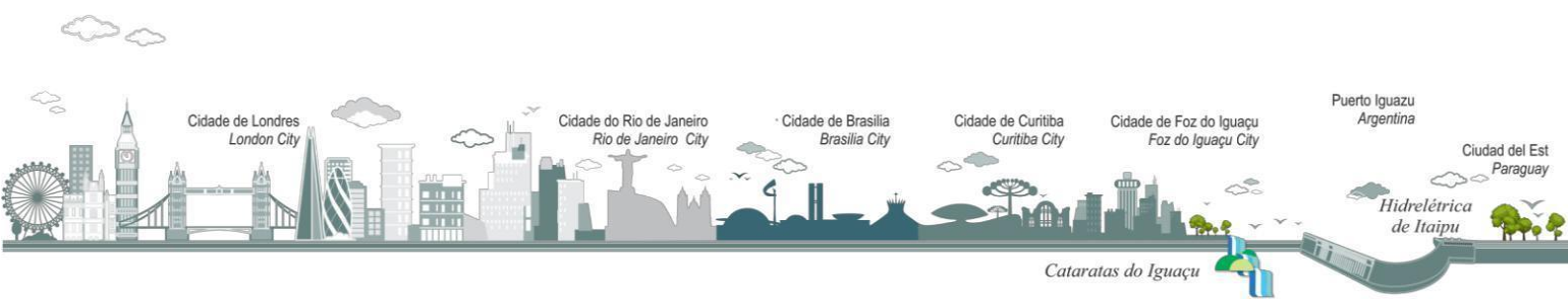


exchange: world coffee (RAYMUNDO; BRIANEZI & SORRENTINO, 2015); use of media (KLOSTERMAN; SADLER & BROWN, 2012); role-play (CHEN & MARTIN, 2015); investigative case studies (HERREID, 1994); socio-environmental mapping (BACCI & SANTOS, 2013); elaboration of projects/didactic sequences.

It's important to show that teachers from different disciplines participated in the course, enabling articulations from the perspective of transversality. Here, we highlight elements of training that materialized in the teaching plans prepared by the teachers as final projects of the course, as well as the contexts for which such actions were planned.

As a starting point for preparing the final projects of the course, the teachers were instructed to problematize a given situation in their daily school life of an environmental nature. Thus, this situation was the motivation to think about the objectives, contents, dynamics, and evaluation of the action plan they would build. When describing the environmental issues in their school realities, the teachers brought up situations specific to the school community, such as waste produced at the school, local political issues, and debate about the transposition of a river in the city. Some projects cited the lack of local belonging as a factor responsible for conflicts within the school, as well as the difficulty of involving students and the community in actions that demand participation in the development of public policies and conservation of local biodiversity.

Considering that the central theme of the course was biodiversity, the words biome and conservation were frequent in the problematizations and, during the projects, direct relationships with the conservation, recognition, and enhancement of local biodiversity can be verified. The five strategies presented and worked on in the course were incorporated into the proposed projects by teachers, mainly socio-environmental mapping, and proposed the use of media and educommunication. Klosterman, Sadler & Brown (2012) propose essential media literacy practices related to - media access, analysis, evaluation, and creation - the latter corresponding to the most advanced levels in the appropriation of media. Most media productions suggested in the projects were intended to disseminate information and knowledge to the local community in a co-creation process. The socio-environmental mapping took place mainly at the beginning of the projects, with a diagnostic sense of biodiversity in the environment, both at the school and in its surroundings.





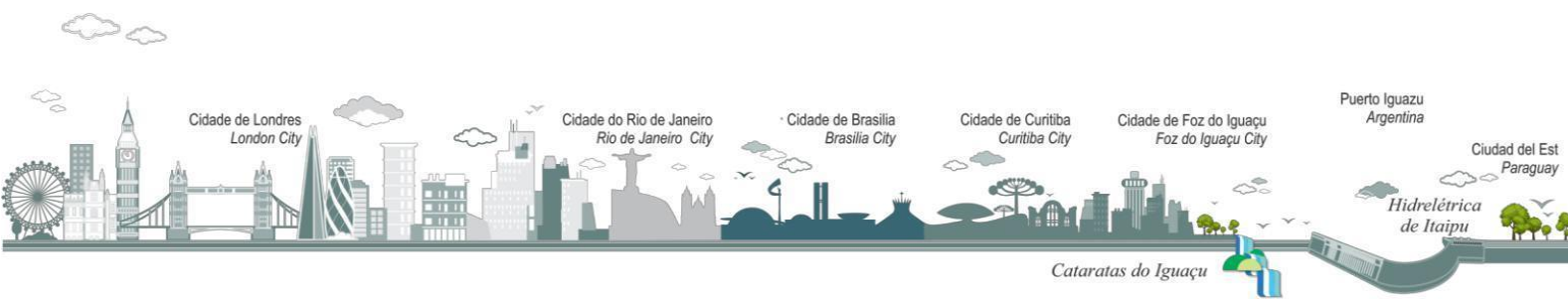
The prevalence of strategies such as socio-environmental mapping demonstrates a reflective and critical look, aimed at a collective process and at the perceptions of the subjects who work in that space. It is also important to highlight that some plans justify the need for belonging as a strategy for biodiversity conservation and for strengthening the local community. According to Bacci; Jacobi & Santos (2013), in addition to the understanding of the social context integrated with the study of the local environment, it is also relevant that there is also a global understanding of the functioning of environmental processes and phenomena for the formation of participative and aware citizens.

In 2022, the projects indicated various levels of education and were designed for the school environment, the community, and various social actors, indicating the power of the school in articulating school knowledge and local knowledge. In the general analysis of the projects, we created a word cloud (Figure 2) in which we can see that the most cited word was "community", showing that most of the projects sought to include various social actors and understood that community participation should be valued in environmental education (SILVA *et al.*, 2023).

Figure 2. Word cloud based on the content of the projects developed using Nvivo.



Source: Silva *et al.* (2023).





We can infer that the dialogic and collective construction approaches used during the course may have awakened the relevance of participation and the resolution of socio-environmental problems, based on the empowerment of these subjects and the rescue of ethical and aesthetic values, as well as the appreciation and dissemination of knowledge. The centrality of the students and the school in the problematizations elaborated by teachers manifest a desire to involve students in overcoming socio-environmental problems based on joint decision-making and points out the importance of the school's partnership with universities in a mutual learning process.

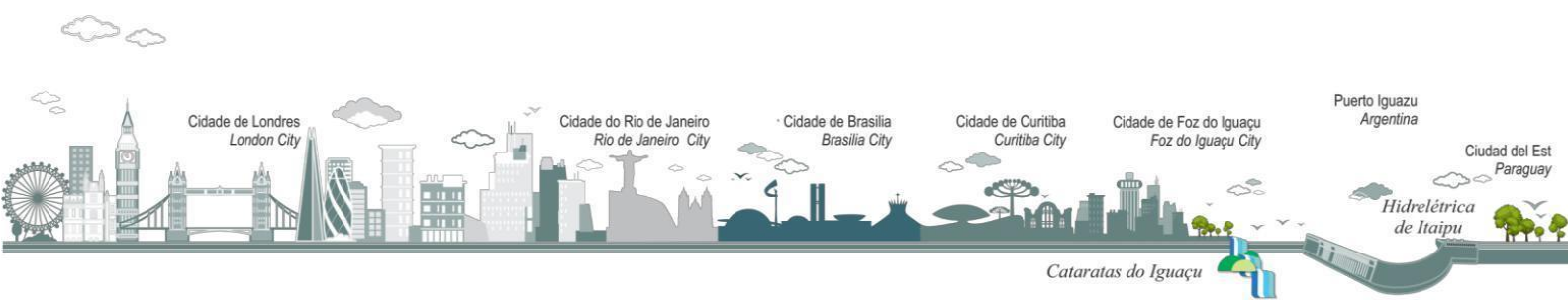
As in teachers' training, we propose the use of communication as a dialogical tool, based on the educommunication approach, which focuses on the management of communicative processes in the educational process, with a set of theoretical-methodological principles guiding a democratic and participatory model of society (SOARES, 2013).

It's worth noting that, as of the 2023 offering, the course began to carry out activities that provided experience with the role of traditional communities in the conservation of biodiversity, where teachers were able to visit an indigenous trail and learn about traditional practices for cultivating native bees. In this way, the importance of traditional communities and interculturality for biodiversity need to be highlighted in teacher training.

The theoretical basis for these practices was decolonial ecology, proposed by Ferdinand (2022), which shows how, throughout history, racism, with its foundations in colonialism and slavery, has been linked to processes of environmental destruction. The author points out that the monoculture plantations that followed colonization destroyed habitats of animal and plant species, causing what he calls biodiversity disruptions, in other words, disruptions in the biological balance of systems. This homogenization of plantations is linked to the homogenization of thought and cultures, proposed by colonial thinking, in a process of destruction of the different forms of existence of the original peoples together with the destruction of biodiversity.

CONCLUDING REMARKS

Marques (2023) presents scientific data showing the relationship between the loss of biodiversity, particularly in the tropical forests of Latin America, and the climate emergency,





The pedagogical practices presented sought to foster communities of practice where subjects can exercise participation that will be capable of analyzing the causes of environmental problems, which cannot be detached from social, political, and economic models (MOREIRA & SILVA, 2022).

The uncertainties that surround the world of tomorrow indicate the need of imaginative and creative methodologies to mobilize students at different levels of education. The complex relationships involving humans and nature must be increasingly understood and emphasized in different educational practices. Pandemics showed the importance of promoting initiatives to avoid negationism in society and the imperative to build capacities and attitudes to deal with the urgency of climate and biodiversity crises.

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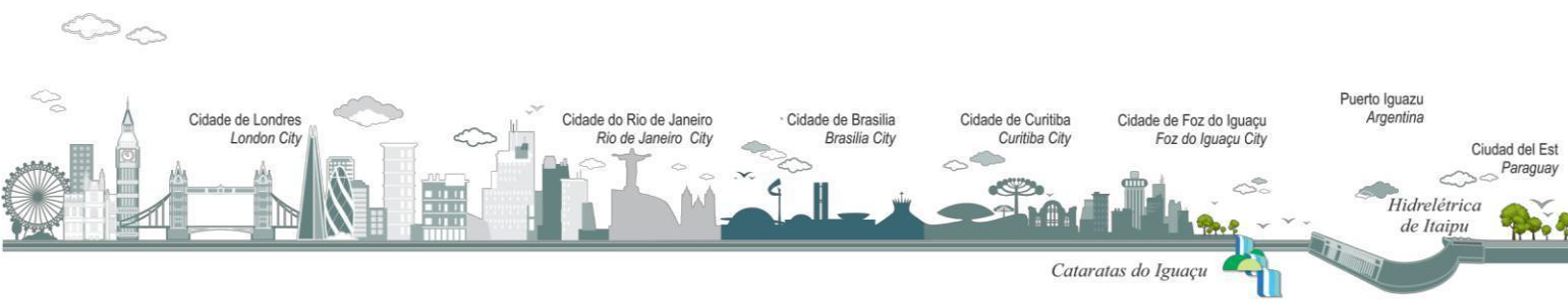
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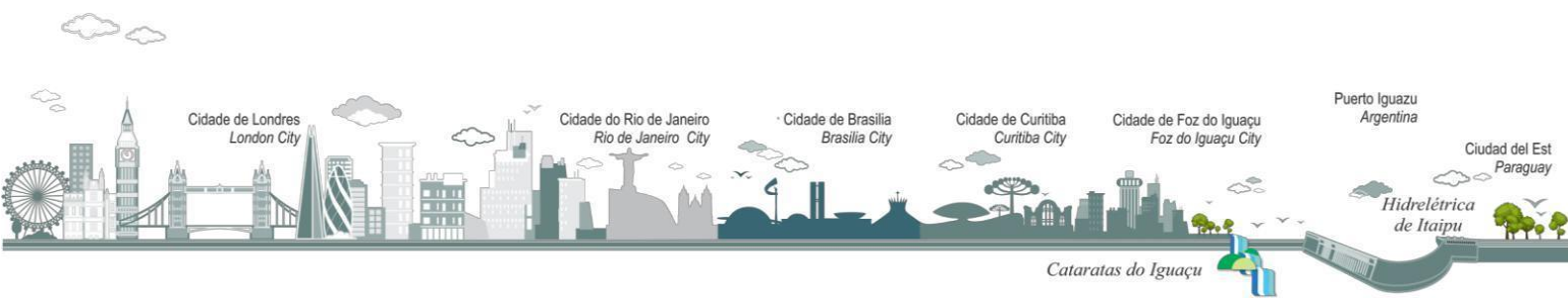
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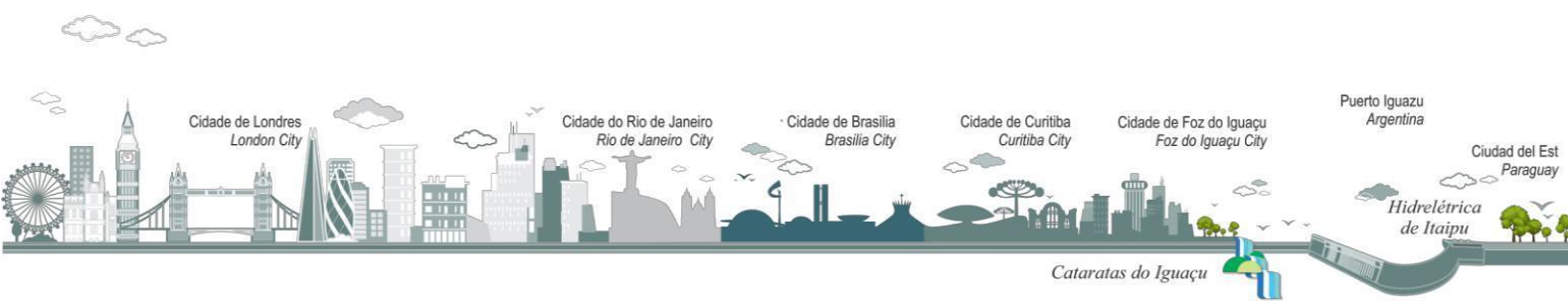
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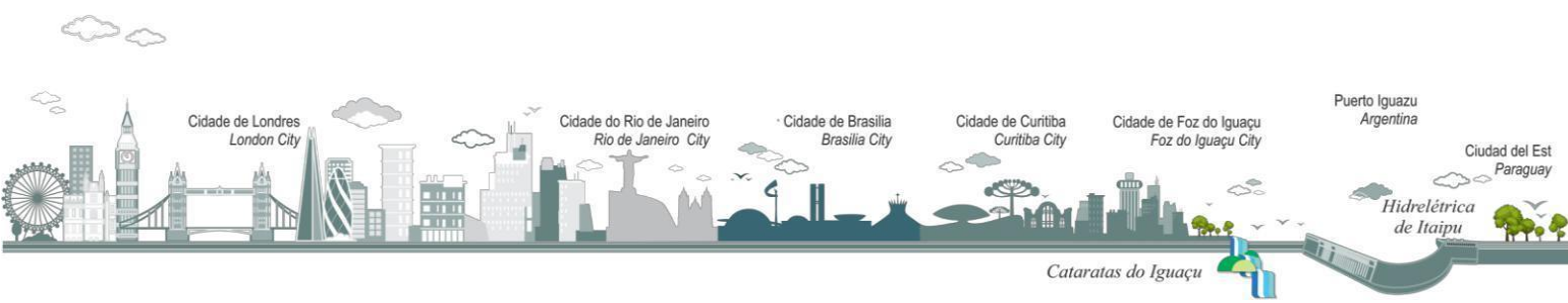
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