



Mix Sustentável

Playing at caring: games as design experiments in building a Biocentric Socio-Environmental Education.

Brincando de cuidar: jogos como experimentos de design na construção de uma Educação Socioambiental Biocentrada.

Jugando a cuidar: juegos como experimentos de diseño en la construcción de una educación socioambiental biocéntrica.

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Abstract: The Maracanã territory, part of the Amazon region of Maranhão, faces intense land speculation that threatens the juçara¹ (*Euterpe oleracea* Mart.), the basis of the local economy (tourism and extractivism). This requires actions to strengthen the socio- environmental situation. We propose the concept of Biocentric Socio-Environmental Education, combined with Design, to co-create educational games based on the confluence of decolonizing pedagogies² to stimulate reflections on territorial conservation. The initiative brought together academia, schools, and the local Environmental Council, using play as a dialogical tool to discuss the maintenance of life in the community.

Keywords: Socio-Environmental Education; Design Experiments; Decolonizing Pedagogies; Board Games.

Resumo: O território Maracanã, porção da Amazônia Maranhense, enfrenta forte especulação fundiária que ameaça a juçara (*Euterpe oleracea* Mart.) base da economia local (turismo e extrativismo). Isso exige ações de fortalecimento socioambiental. Propomos o conceito de Educação Socioambiental Biocentrada, aliada ao Design, para cocriar jogos pedagógicos a partir da confluência de pedagogias decolonizantes para estimular reflexões sobre conservação territorial. A iniciativa aproximou academia, escolas e o Conselho Ambiental local, usando o brincar como ferramenta dialógica para discutir a manutenção da vida na comunidade.

Palavras-chave: Educação Socioambiental; Experimentos de Design; Pedagogias decolonizantes; Jogos de tabuleiro.

Resumen: El territorio de Maracanã, parte de la Amazonia maranhense, se enfrenta a una fuerte especulación inmobiliaria que amenaza a la juçara (*Euterpe oleracea* Mart.), base de la economía local (turismo y extractivismo). Esto exige medidas de fortalecimiento socioambiental. Proponemos el concepto de Educación Socioambiental Biocéntrica, aliada al Diseño, para co-crear juegos pedagógicos a partir de la confluencia de pedagogías descolonizadoras para estimular reflexiones sobre la conservación territorial. La iniciativa acercó a la academia, las escuelas y el Consejo Ambiental local, utilizando el juego como herramienta dialógica para discutir el mantenimiento de la vida en la comunidad.

Author Contributions

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Conflict Declaration

Nothing to declare.

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¹ Juçara is the name given to the açaí fruit in Maranhão.

² Pedagogies that help in the process of constructing counter-hegemonic thinking.

Pedagogies that seek to put education at the service of those who struggle to transform the existing order

Palabras clave: Educación socioambiental; Experimentos de diseño; Pedagogías descolonizadoras; Juegos de mesa.

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1 INTRODUCTION

Concerns about the environment, unsustainability, and related issues have become increasingly prevalent in contemporary society. The growing environmental impacts resulting from the exploitation and unrestrained pollution of natural and non-renewable resources by the socioeconomic sector's production machinery have significantly affected the planet, raising concerns about the need for urgent action beyond the much-touted sustainability.

Every day, media platforms trumpet data on the progressive depletion of resources such as oil and the deforestation of plant life systems. In Brazil, anthropogenic actions have triggered negative changes in the landscapes of regions with Amazon Rainforest, Cerrado, and Atlantic Forest biomes, with the creation of desert areas, climate change, and the depletion of water resources.

The state of Maranhão, geographically located in the northeast, has striking characteristics of the northern region, as it is in the transition zone between the two regions (Legal Amazon). This unique fact contributes to the state having a diverse ecosystem, where the Amazon Rainforest, coastline, savannas, and mangroves can be found. It is in this setting that Maracanã is located, a rural and traditional community on the island of São Luís, the state capital, also known for its strong representation of ancestral traditions and cultural identity. Maracanã is located in a Conservation Unit, APA (Environmental Protection Area), with rich biodiversity in plant species that provide raw materials that characterize the identity of the territory, such as palm trees, among them, the juçara/açaí palm, which provides the natural resources that add the most socioeconomic value to the locality, from food production to other purposes, as every part of the Juçara palm is used (Correa, 2019; Santos, 2020).

Figure 1 – Representation of the geographical location of the village of Alegria/Maracanã



Source: Prepared by the authors.

Through contact with the territory in previous research, a series of problems affecting the natural landscape were observed, which have corroborated the negative impacts on the community, directly influencing the economy and symbolic aspects of the region. Impacts such as the acceleration of the process of reduction of native vegetation and fauna, due to the demographic growth of the Minha Casa Minha Vida Program (PMCMV) and irregular occupations in the surrounding area; the extraction of juçara at inappropriate times, before the appropriate harvest period; and the "theft" of juçara has led to the loss of juçara forests and other endemic species. In addition to deforestation, the irregular disposal of solid waste on the banks of the Maracanã and Ambude rivers and in the vegetation along the access roads to the Rosa Mochel and Joca Guimarães ecological trails (which still exist) that cross the rivers further compromises water resources. The illegal extraction of sand

and stone (laterite) deposits and inadequate public preservation policies, among other problems, reveal the imminent loss of the natural resources that the community still maintains.

In informal conversations with locals, it became clear that few socio-educational actions had been carried out that could bring the school and community together, designed with the community in mind.

Given this scenario, amidst the conflicts, an opportunity was identified to stimulate socio-environmental education through the collective development of socio-educational activities in elementary schools with the involvement of the community (Local Environmental Council) for children, adolescents, and young people (children of people who cultivate *juçara*, *buriti*, *babassu*, and other native flora) within the scope of design.

To this end, it was necessary to analyze the territory in question, recognize the diversity and plurality of this space, the worldviews, know-how, and collective struggles of its people, in order to enable socio-environmental actions that are critical, profound, and emancipatory, based on the value of life. Following these premises, in conversations with members of the Environmental Council (CONAM) and the Sagrados Corações School (CESCO) (the school that hosted this study), the practice of educational board games was suggested as an initial mechanism to bring the community and territory closer together.

In this way, through a holistic and participatory approach, we were able to configure educational board games as a teaching tool, associated with the principles of eco-pedagogy (Dickmann; Liotti, 2022; Guimarães, 2016; Loureiro; Layrargues, 2013; Reigota, 2014), biocentric education (Cavalcante, 2015; Toro, 2009), and indigenous education (Freire, 1967; 2019; Queiroz, 2019) aligned with counter-hegemonic perspectives in education (Oliveira, 2014; Santos, 2015) and design (Escobar, 2014; 2016; Fry; Tlostanova, 2022;). We conceptualize this confluence (Santos, 2015; 2023) of pedagogical knowledge in favor of a socio-environmental reality situated and supported by the “Designantropology” approach (Noronha *et al.*, 2023) as Biocentric Socio- Environmental Education.

2 BIOCENTERED SOCIO-ENVIRONMENTAL EDUCATION, BUILDING THE CONCEPT

The foundation of this speculation is biocentric thinking, a theory whose main premise is that all forms of life are important, connecting all beings on the planet, creating the deep and complex “web of life” (Capra, 1997), because life and consciousness are fundamental to the existence of the universe, and not the other way around. According to this thinking, nature is one, and each species is an autonomous agent that relates to other species in a natural and direct way. In this model, science should be an instrument to help species self-organize (Chalfun, 2010; Thomé, 2021). To this end, it is understood that there is a need for critical, extensive, and exhaustive reflection, allowing room for complex discussions.

Our worldview (still colonized) has been questioned by this philosophy, and in order to combat it, it is necessary to make changes in our relationships with others, with future generations, and with the web of life of which we are a part. To this end, “it is essential that we change our values, which have always been based on domination and hierarchy” (Oliveira, 2014, p. 279). In an attempt to awaken human consciousness, scholars from various fields of knowledge have debated the foundations of the new environmental epistemology, and design has proven to be a favorable field for

strengthening and materializing this thinking. In this sense, design sees the practical-reflective process of socio-environmental education as a of possible paths.

For Soler (2019), the field of socio-environmental education, an extension of environmental education, represents the demands of an entire organized movement (schools, social groups, governments, etc.) that mobilizes education on various fronts of society in favor of life. Tracana *et al.* (2014) emphasize that over time, the concept of SE has undergone significant evolution. Initially, it took on a naturalistic character, shifting its attention to the balance between the natural environment and human intervention, with a view to building a future conceived and lived in a sustainable logic. Currently, it is based on "postponing the end of the world" as a "return to Mother Earth" (Krenak, 2020), linked to environmental justice, land rights, cognitive justice, autonomy, and the defense of worlds (Escobar, 2016).

Schools are not exempt from promoting an education that produces and reproduces a dominant, hegemonic ideology. However, transformative action in the field of environmental education implies freedom and a critical recognition of reality. Not only threats to human existence arising from the capitalist model, but also risks to nature's metabolisms, equally arising from capitalism (Soler, 2019). Without this material basis coming from local contexts, an effectively liberating transformation will not be possible. "Without environmental protection, social transformation is not feasible" (p. 37).

The process of socio-environmental education is an exercise in citizenship, referring to a new way of looking at the relationship between human beings and nature, based on a new ethic. This implies other values and different ways of seeing and being in the world, valuing diverse forms of life and co-produced knowledge. The process is linked to a different view of the human/nature relationship, as it is understood that this dissemination of environmental practices will only be possible if it is inserted in the context of social values, even if it refers to transformations of habitual and indigenous customs. In view of this, in addition to a critical stance, it is necessary to consider not only ecological needs, but also social relations and subjectivities (Guattari, 1990; Reigota *et al.*, 2021).

Marcos Reigota (2014) emphasizes that environmental education can be a space for teaching and learning about belonging to the environment in which one lives, seeking to raise awareness of behaviors in relation to others, the world, and oneself. This tends to reflect on the economic, cultural, and social impacts of local and global actions, in the present and for future generations.

This articulation can and should be carried out with schools and beyond the school space, in other spaces of the community and with the community, considering the particular knowledge, cosmologies, and predispositions of these territories, which we bring to this work. In this sense, practical-reflective actions need to be dynamically correlated. Thus, it is believed that this emancipatory, critical, and situated process can be guided by design, in this case, by Design Anthropology (DA).

This approach operates amid complex social relationships, seeking answers by bringing design and anthropology closer together. It allows for a deeper understanding of how people inhabit and perceive spaces, construct themselves, and relate to the things they use (Anastassakis, 2014). Furthermore, it helps us, as researchers, to understand reciprocal relationships in the field, imagining possible futures by comparing human knowledge and its various ways of living. These practices materialize during collaborative work with people in the field, motivated by the attention paid, empathy,

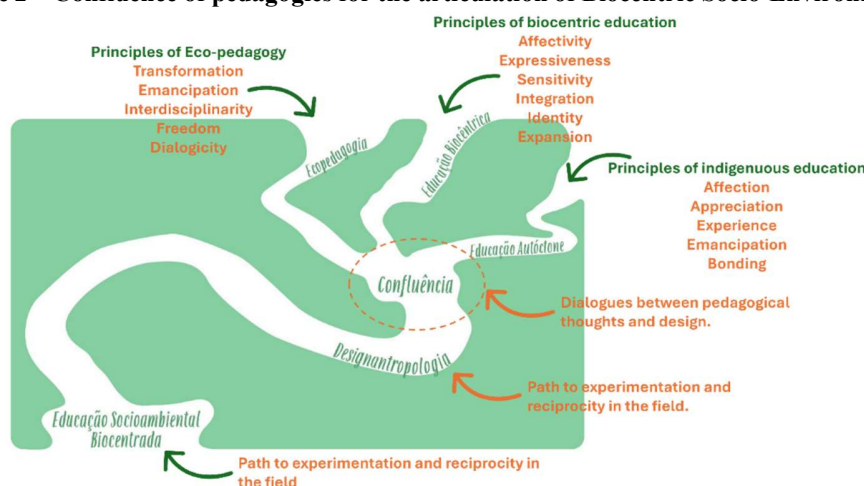
and involvement of the senses in experiments.

In this work, DA is understood as a design philosophy, a "guide" that leads us to understand the process of immersion during contact with interlocutors that goes far beyond participant observation, but rather the experiences built through reciprocity, attentiveness, and care while thinking and doing things together. It is from DA that we build our design path based on the needs perceived with people in the field. This design philosophy dialogues directly with the aspects raised, integrating cultural, social, and environmental perspectives into the creative process. Given this context, this study takes on the prerogative of activating the process of socio-environmental education in the researched territory through design. The term "Biocentric" used here is constituted from the confluence of pedagogical foundations and principles with a critical, biocentric, autochthonous positioning, which we consider to be "decolonizing pedagogies" (Santos and Rezende, 2024, p. 28) or counter-hegemonic, and essentially transgressive, as advocated by educator bell hooks (2021), in a praxis based on purposeful educational insurgency, not merely denunciatory. They relate territorial characteristics, ancestral knowledge and local practices, repertoires of life and experiences, making the process of socio-environmental education less superficial, more active, and immersive.

Confluence, according to Brazilian quilombola intellectual Antônio Nêgo Bispo dos Santos, is the art of transforming conflicts and differences into diversity. This concept, which governs the relationship between the elements of nature, teaches that "not everything that comes together mixes" - an expression that carries a profound meaning, especially in contexts involving diversity, coexistence, and respect for differences. The author illustrates this idea with the example of a river, stating that "a river does not cease to be a river when it converges with another river"³ reinforcing discussions on topics such as social justice, sustainability, and cultural resistance.

We use this symbolism to characterize both the "gathering" of philosophies and pedagogies that underpin the epistemological formation of this study, as well as the collaboration of diverse people working together on a common plan for Maracanã in terms of the continuity of its biodiversity and ancestry (Fig. 2).

Figure 2 – Confluence of pedagogies for the articulation of Biocentric Socio-Environmental Education



Source: Prepared by the authors.

³ Quotes taken from the exhibition "Poema-rio: por um memorial da confluência Afro-indígena" (Poem-river: for a memorial to the Afro-indigenous confluence); Masters Antonio Bispo dos Santos (Nego Bispo) and Ailton Krenak. Curated by Deborah de Magalhães Lima and Karenina Vieira Andrade, 2024.

2.1 Critical Environmental Education/Ecopedagogy

Critical Environmental Education or *Ecopedagogy* values people's prior knowledge, as it considers that their life repertoire and experiences make the process of environmental awareness much more interesting. According to Queiroz (2019, p.23), "this process is more than just talking about the environment exhaustively; it is about bringing about transformative environmental education." Mauro Guimarães (2005) asserts that conservationist environmental education, from a certain perspective, can be considered yet another instrument of ideological reproduction, as there is no room for questioning, and thus, environmentalism with the intention of combating only the visible consequences of environmental degradation. Ecopedagogy, on the other hand, questions, reflects, and imagines possible solutions to the causes, with the aim of minimizing negative consequences.

2.2 Biocentric Education

Biocentric Education as an experiential epistemic-methodological educational approach. The leading authority on the subject, Chilean teacher, artist, and creator of biocentric education, Rolando Toro Araneda, proposed a new paradigm in the 1970s that he called *the Biocentric Principle*, to problematize and reflect on the current anthropocentric values adopted not only in the economic sphere, but also in the socio-environmental sphere through the educational system.

The biocentric principle proposes placing all forms of life at the center of our existence. In this way, all living beings (human and non-human) and elements of the ecosystem must be respected without hegemony or domination of one over the other (Cavalcante, 2004; 2015; Toro, 2006), based on the assumption that nature and human beings are not separate and are part of the same network. This thinking is in line with the deep ecology described by ecologist Naess (1973), which recognizes the intrinsic value of all living beings and conceives of humans as just one particular thread in the web of life.

2.3 Education based on Indigenous Knowledge or Existence

The teaching-learning process in rural and/or traditional communities (in and out of school) occurs through social practices and knowledge within the everyday contexts of their natives. For example, in this study, the process of environmental education (albeit incipient) was investigated in the experiences of the *juçara* culture, worked on inside and outside the community's school spaces by researchers and companies. These actions contribute to the process of training, raising awareness, and exercising citizenship among the inhabitants of the territory, in which specific skills and competencies are identified (Beillerot, 1985; Freire, 2019 c).

Paulo Freire (2019) argued that the educational process must necessarily start from the appreciation of the local knowledge and culture of the learner. According to the author, this approach allows bridges to be built between students' prior knowledge and formal curriculum content, transforming the act of learning into an active process of awareness and liberation.

In this line of thinking, Brazilian geographer and researcher Milton Santos brings us to reflect on a "pedagogy

of existence" (2003, p.55), a way of reflecting on reality and the place we occupy in the world. For the author, the pedagogy of existence is an invitation to question what is imposed and to learn from everyday life. From this perspective, Milton Santos argues that education should provide conditions for that people can live meaningfully. The author believed that education should serve both the social interest and the interest of individuals based on their living environment.

3 ARTICULATING THE EXPERIMENTATION PROCESS

Through meetings and conversations with people (Approved by the CAAE Ethics Committee No. 55313121.2.0000.5525), it was possible to discuss degraded spaces, preserved spaces, and other places in the community that could host actions with a positive socio-environmental impact. At the last preliminary meeting with community members (counselors, teachers, among others) at the Sagrados Corações Educational Center (CESCO), we deliberated together on some possible actions to which design could contribute, mobilizing the participation of schools and the community, as presented in the following table:

Table 1 – Deliberations with the community on design actions

Regarding schools	Regarding the community	Possibilities for specific design actions
Schools are active, but it was necessary to work in a network to engage followers.	Act in partnership with the local Environmental Council, with researchers who study the region, and with social actors in the community. This initiative can start with design, in actions already developed in the community.	Production of an APA Primer to be used in schools; Adaptation of the APA Primer produced by the Maranhão State Department of the Environment (SEMA) for children.
Proposing a broad program that can cover as many age groups as possible.	Offer workshops, courses, and training on environmental topics	Reopening of the “Joca Guimarães” trail with signage
Resuming activities on nature trails with the participation of schools.		<u>Production of educational games on socio-environmental aspects of the Maracanã territory.</u>
CESCO as the central school for community actions (actions aimed at preserving juçara forests, seedling production, archaic management).		Targeted courses and workshops.

Source: Authors, 2025

As can be seen in the table above, there were many work suggestions arising from the numerous demands presented during the discussions, regarding environmental and socio-environmental aspects, with the potential for the implementation of several projects. However, for the purposes of this study, it was necessary to make some cuts in space and time, leaving the rest for potential future actions.

The idea of collaborating with the resumption of the state of *well-being*⁴ based on environmental and socio-environmental awareness in the community initiated by the school, through board games, arose from correspondence (conversations, exchanges, visits, incursions, collective moments) during meetings with people from the community.

Once again, in conversation with environmental advisor Odelina Ferraz (CONAM) and environmental educator Carminda Guimarães (CESCO), we noted their concerns about children's addiction to mobile games and their questions about how to get children to look away from screens, as well as what other possibilities could be presented to them as ways of playing and having fun that were not only virtual, but could also be done outdoors.

These observations were crucial in enabling the choice of board games as a didactic-pedagogical tool that could contribute to the dialogical process of raising awareness about socio-environmental education *in* and *about* the territory, starting from the school in a non-formal setting, as the ideal would be to transcend this space.

As we are dealing with a territorial context with very specific social, economic, cultural, and environmental characteristics, unique biodiversity, and particular ways of knowing that reflect on the very conduct of the lives of its inhabitants and on the ways of teaching and producing knowledge, the design actions needed to respect this conjecture. Therefore, we understand these practices as biocentric, as they are concerned with bringing the flow of life present in this space into the design project work. For this reason, we understand them as experimental designs.

The design experiment explores a possible program, in a continuous process, constantly constructing the theme or area of action defined in the original research program (Brandt and Binder, 2007). That is, as one moves forward and understands the needs and context, the program (original research) undergoes modifications due to the ongoing experiment. This process stems from the attention given in the field during exchanges.

Furthermore, we reiterate that in this study, the process of biocentric socio-environmental education in the territory in question, guided by design, starts from the perspective of aligning the principles of pedagogies that dialogue with the environmental dimension, essentially critical, biocentric (Toro, 2009), situated, and participatory, which share counter-hegemonic, that is, countercolonial (Bispo, 2015), a kaleidoscopic perspective of design (Noronha *et al* 2023).

With the evolution of technology and electronic devices, board games have proven to be even more valuable and engaging, ensuring learning and many other benefits for people at different stages of life. We emphasize that this is not a study about games, but about their production and use as a pedagogical tool. In this research, games are understood as a collectively generated design experiment in which people, especially children, can be led to the process of environmental and socio-environmental education about the territory, not only by playing, but also by doing, what the Danish Børge Mogensen called a “provotype” (Binder *et al.*, 2011).

“Prototypes” or the design of things (Binder *et al.*, 2011) can be understood as collectively constructed artifacts that provoke discussions during the process (Santos, 2020) amid collaborative design practices. For this reason, in this research, we resorted to the development of educational board games as provotypes, as their manufacturing process allowed for correspondence between designers and non-designers in the field, in spaces we call Biosituated Design Laboratories (LADBios).

⁴ Living well originates from the Andean expression *sumak kawsay*, in *Kichwa*, and refers to an opportunity, as well as a philosophy, to imagine other worlds. ACOSTA, Alberto. **Living well**: an opportunity to imagine other worlds. São Paulo: Autonomia Literária, Elefante, 2016. 264 p.

These spaces were built to promote dialogues on the topics discussed in the research (environment, environmental education, biocentric education, children, board games, etc.), using Co-design tools, guided by Design Anthropology (DA). LADBios are spaces for experimentation, collective construction, co-creation, and imagining futures for the Alegria/Maracanã context in terms of the permanence of its biodiversity.

As the host of the first meetings of this research, the CESCO school was chosen as the initial environment for the design laboratories, where we envisioned what practical actions we could develop together, since they could collaborate with the process of socio-environmental education, initially starting in the school environment, but extending to other environments in the community in the future.

The workshops and experiments (games) involved the active participation of students from 2nd to 5th grade and teachers from the CESCO school, local environmental advisors, researchers, and 5th-semester design students from the Product Design II course, accompanied by Professor Gisele Saraiva from the Federal University of Maranhão, through working groups where we worked together.

These labs were not limited to activities carried out at CESCO and its facilities but also included visits to the community and classroom sessions with design students. These sessions included pre-field preparation (planning and studies) and post-field discussions (reflections and analyses). As themes for the games, we chose aspects that best represented the community, such as environmental and cultural aspects: the ‘juçara fruit’, ‘fauna and flora’, ‘nature trails’, ‘local crafts’, and local festivities such as ‘Santos Reis’ and ‘Bumba-meu-boi’.

Figure 3 - Biocentric Design Laboratories: a-Co-creation; b-Field trips; c-Classroom tests.



Source: Authors.

4 LADBIOS: CO-CREATE, PLAY, RECOGNIZE

4.1 From meetings between groups involved

At the first meeting, which aimed to promote integration among participants, we were warmly welcomed by the school administration, teaching staff, and especially by the children involved in the activities. The researcher began the event by mediating presentations among the groups present—designers, children, and environmental advisors—followed

by an explanation of the objectives of the collaborative activity that would be developed.

To contextualize our proposal and stimulate dialogue, we asked the children key questions such as: "What do you understand by design?", "How do you imagine the work of a designer?", "What are your favorite games?" and "What do you like most about your community?"

These questions served as an initial provocation, arousing the children's curiosity about the proposed activity and, at the same time, offering design students valuable insights into children's perceptions of the territory and the concept of design itself. The enthusiastic responses from the children and th s exceeded our expectations, creating an environment conducive to the development of the next stages of the project.

At a certain point, we organized the distribution of the working groups. Each group had the collaboration of three or four children from the second to fifth grades, ensuring a diversity of ages. Once formed, the teams began the activities with presentation dynamics to promote integration. Next, we used co-design tools to engage the children in the proposal, assigning collaborative tasks. All groups chose methods that involved images and drawings, resources that stimulated creativity and participation. In addition, some teams incorporated games, such as "cards" and "checkers," as a playful strategy to facilitate interaction and dialogue among participants.

It was expected that some children, especially the younger ones, would not be familiar with certain community traditions, such as the "Ecological Trails" and the "Feast of the Holy Kings." This lack of knowledge may be related to age, since many still have no direct contact with the origin of these manifestations, or even to social factors, such as cultural and religious differences.

In the case of ecological trails, the children had little or no contact with them, even though they live close to the CESCO Forest, which has a section of trail. For this reason, many did not know what to say about the subject. Most of the children live in neighborhoods adjacent to the village of Alegria, where the CESCO School is located, which may explain their distance from some local traditions and practices.

As for the Feast of the Holy Kings, the transmission of knowledge about this local tradition runs up against issues of a religious nature. Most of the children in the "Festa de Reis" group belonged to evangelical Christian churches, which reject the festival, preventing children from coming into contact with this ancestral tradition, as it is associated with Catholic saints and the Umbanda religious centers in the community.

As a result, these teams needed to talk to community members at a later stage of the meeting. Odelina Ferraz "Deca," Mãe Jô de Iansã (from the São Jorge Tumajamece terreiro, a neighboring site of CESCO), and Adriano Algarves (APA environmental guide), both of whom are deeply knowledgeable about local traditions and both environmental advisors to CONAM, participated with us.

At the end of the first meeting, the students reported on their experiences in contact with the children and guests, observations, and project perspectives, such as the generation of ideas, concepts, and preparation of preliminary proposals for the games.

At the next meeting, the objective was to continue what had already been started by the groups for each game during their first contact with the children and in the classroom, co-creating with them. In this phase, the groups formed (children and academics) were to compose elements such as characters, scenarios, narratives, and game rules through listening, conversation, and visual representation, made possible by co-design tools.

Figure 4 – Children, design academics, and researcher co-creating games



Source: Authors.

The third meeting was dedicated to validating the games, in terms of understanding how each game works and its playability. We understand validation as a process of testing something, with the aim of helping us learn about what is being produced, putting the idea to the test to see if it really makes sense or not.

Thus, by corresponding with the children and observing their dynamics during the games, the design students identified the necessary adjustments to the mockups, taking into account the suggestions presented by the participants. In the field, we realized that, due to the organization of certain groups, some games were already quite advanced—such as those themed around Bumba-meu-boi, APA Crafts, Maracanã Fauna and Flora, and Juçara Festival—with only final refinements and packaging production remaining. After the visit for validation and gameplay testing, the design students turned their attention to finalizing the game design and producing the physical three-dimensional model (printing and assembly), in addition to the technical drawing, so that in the end, we could deliver the games to the school.

The following games were co-produced: "Bumba" about bumba-meu-boi, "Bam" about handicrafts, "Corrida do Maracanã" about fauna and flora, "Caminhos da Mata" about ecological trails, "Três Reis" about the Santos Reis festival, and "Que bagunça é essa?" about the juçara festival.

We were very excited about the finished games, although at that point it was not possible to assess whether the children had assimilated the socio-environmental education content through the games. Despite this caveat, the workshops were successful.

Figure 5 – Teams and three-dimensional models of the games



Source: Prepared by the authors.

The last meeting, called “Let’s Play,” aimed to provide a morning of leisure for the CESCO children through the finished games, as a way of thanking the school and community for their receptiveness and active participation in the project.

To make the gameplay, which the children had been eagerly awaiting, more dynamic, we divided the children into groups of four or five and gave them an estimated 20 minutes to play at their leisure. At the end of that time, the children were to move on to another group, so that there would be a change with each round. This was done so that all children would have the opportunity to explore all the games, assimilating each theme and correlating them with socio-environmental and cultural aspects.

We talked to the teachers present about each game and the themes covered, since they had not actively participated in the previous meetings. Although invited, they limited themselves to observing from afar. This was an indication that we should take a moment to present and work on the games directly with them—it is worth noting that the CESCO teaching staff is mostly composed of women.

The morning of leisure was enjoyable. The children were able to explore all the games, understanding their dynamics and mechanics, but it was still necessary to assess whether all of this made sense to them. Therefore, it was essential to monitor them closely. In the end, we delivered the games to teacher Carminda, who received them with great joy, leaving the doors of the institution open for future opportunities. This meeting represented the culmination of the Design students' very special participation in the project of educational games about Maracaná as a biocentric practice.

Figure 6 – Summary panel of the entire co-creation process at LADBios



Source: Prepared by the authors.

4.2 Responses to the experiments

After the co-creation, prototyping, and validation meetings to adjust the games, it was time to assess whether the co-produced games would indeed function as dialogical devices capable of promoting effective socio- environmental education. To this end, an environment was created in which the children of CESCO could express, spontaneously and freely, their views on the territory, the stories they had experienced in this space, and the importance of keeping it alive.

Based on these premises, we reiterate that, in this study, the game—as a pedagogical tool and design experiment—aims to foster discussions and reflections among children, both during the design and during play, on topics such as the environment, culture, identity, and affection in relation to the Maracanã territory. To this end, it was essential to verify whether the children really recognized the themes addressed in the games and whether they were able to relate them to their daily lives. For this purpose, two Conversation Circle sessions were organized, one before and one after the “Let’s Play” meeting.

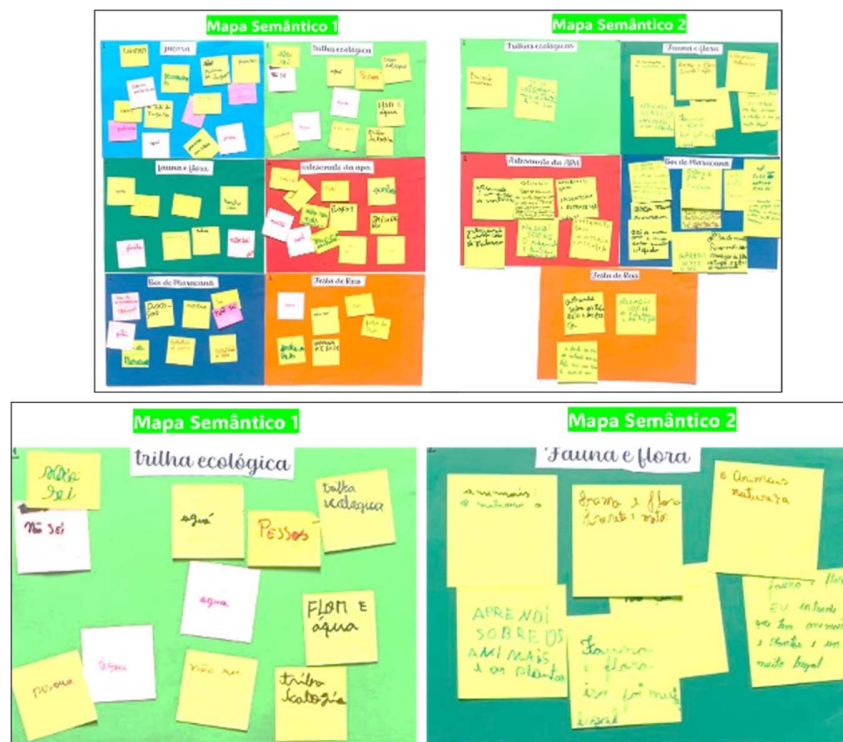
To compare the children's perception of the themes, the Semantic Map tool (Fig. 7) was used in both sessions.

The responses from the first Semantic Map reveal that the children had initial and superficial knowledge about the topics related to the project. There were many generic, disconnected associations or those based on incomplete information, highlighting the need to deepen educational work to help them build a clearer and more contextualized understanding. However, this initial analysis was valuable in identifying gaps in knowledge and directing future activities, such as games and discussions, to fill these gaps and strengthen children's connection with local culture and the environment.

The second Semantic Map, applied after the games were tested, reveals more elaborate and contextualized responses when compared to the first map, showing that the children internalized some concepts and associated the themes with the games they tested. However, the absence of the panel on juçara due to the non-delivery of the corresponding

game within the estimated period limited the evaluation of this specific theme.

Figure 7 – Semantic maps created by children before and after the games



Source: Authors, 2025.

The second Semantic Map, applied after the games were tested, when compared to the first map, reveals more elaborate and contextualized responses, showing that the children internalized some concepts and associated the themes with the games they tested. However, the absence of the panel on *juçara* due to the non-delivery of the corresponding game limited the evaluation of this specific theme.

In summary, the comparison between the two Semantic Maps shows that the project was successful in expanding the children's knowledge and connection with the topics covered. The games and practical activities were fundamental to this evolution, but there are still challenges to be overcome, such as ensuring consistency in learning all topics and deepening reflection on more complex issues.

5 CONCLUSION

The design laboratories (LaDBios) served as spaces for experimentation and co-creation, where traditional and academic knowledge intertwined to develop contextualized solutions. This approach allowed not only for the exchange of knowledge, but also for the construction of a deeper dialogue between the school, the community, and researchers, strengthening community ties and promoting the appreciation of the territory and its socio- environmental particularities.

In addition to their playful function, the games were understood by participants as devices capable of promoting conversation and reflection, even if they needed adjustments. The process of developing the games created a favorable environment for the children of CESCO to express, spontaneously and freely, their views on the place

where they live, the importance of safeguarding the nature present in this territory, and their own experiences. Thus, the games not only served as tools for entertainment, but also as catalysts for dialogue and reflection, both during their creation and when playing. Although these reflections may not be profound at first, they represent a significant step in awakening socio-environmental awareness and strengthening children's connection with their surroundings and their roots.

For design students, the experience provided an opportunity to experience other ways of working in the field, going beyond the creation of artifacts to recognize the social impact of their work through direct involvement with communities and their demands.

For the children, this project created meaningful memories and provided an opportunity to exercise their creativity freely and authentically. In addition, it allowed them to recognize and value the environment in which they live, understanding the influence of this space on their lives and identities.

For the community, the project reactivated the participation of people who, although recognized for their historic struggle for the territory, had been distanced due to the lack of concrete actions and initiatives that would mobilize the collective.

For the researcher, a major challenge faced throughout the journey was the certainty that this project brought significant and transformative results.

In view of the above, we consider that this study has helped children and the community understand the importance of recognizing, reactivating, and reclaiming the territory, reinforcing the relevance of initiatives that promote socio-environmental education in an integrated and participatory manner.

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Conflict Declaration

Nothing to declare.

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