Open Schooling in the Amazon for Community Empowerment

A Case Study in the TUPÉ Sustainable Development Reserve

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The CONNECT PROJECT
distributed by the European Commission no. 872814.
To cite:


The Open University UK. ISBN: 978-1-4730-3923-0. 
https://doi.org/10.21954/rtn-pb82
English: https://oro.open.ac.uk/93143
Portuguese: https://oro.open.ac.uk/93144

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“We, indigenous peoples,
live in sensitive zones
where effects of climate change
are most devastating.”

(source: Roerig & al, 2012).
CARE KNOW DO for Sustainable Development

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PREFACE

In the vast expanse of the Amazon rainforest lies a story of profound significance. It's a story that underscores the interconnectedness of our world and the collective responsibility we bear for preserving one of Earth's most vital ecosystems. Conserving the Amazon is essential for a sustainable and just future, and has an urgency that transcends borders and generations. It calls upon us to take action, to protect this natural wonder, and to forge a path toward a harmonious and sustainable future.

Schools have a key role to play. Through environmental education, students can be equipped to become responsible global citizens, with a deep understanding of the Amazon's significance in our world and the challenges it faces. These challenges, such as the exploitation of natural resources and deforestation, have consequences at local and global levels. The search for solutions to these issues lies in education, empowerment, and fostering innovative thinking.

This book embarks on a journey, a scientific exploration that takes us to the Tupé Sustainable Development Reserve, nestled along the banks of the Negro River. This resilient community, located in the heart of the Amazon, can be seen as a living laboratory for responsible citizenship and open schooling. Open schooling is an approach that empowers students to collaborate with key stakeholders to engage with real world issues, such as climate disruption, that are impacting the local São João do Tupé community.

This journey offers a powerful portrait of a community deeply connected to its environment implementing the CARE-KNOW DO pedagogy to drive research and innovation. Through this approach students address real-life challenges and generate knowledge that is both relevant and transformative, able to [re]frame our understanding of vital issues.
This portrait reveals the challenges faced by the Tupé community, the profound impacts of climate change, and the mitigation strategies they develop and implement. At the heart of these responses is a vibrant collaboration between community members, students, educators, and researchers. These draw on principles of ‘reflective conversations with the situation’ to forge collaborative designs. This methodology recognises the individual nature and uniqueness of all contributors and helps build bridges of understanding between collaborators.

The journey outlined within these pages is a remarkable one. The experience of open schooling, embraced by participants of all ages, unfolds as a story of enrichment and innovation. It is evidence-based research of engagement, meaning, and empowerment—a pathway toward community transformation. This book is not just a chronicle of the Amazon; it is a roadmap for a better future. The three recommendations shared here—to integrate environmental education, to advance open schooling, and to ensure equitable access to knowledge—are the pillars of positive change. These have value beyond the Amazon and illustrate the potential of education to have a powerful impact, beyond the local, on global issues.

This book is an embodiment of knowledge, community, and responsibility—an evidence-based study of the Amazon's enduring spirit and the global commitment to protect it.

Prof Dr Kieron Sheehy
Professor of Education
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OU-UK, 2023
Open School initiatives supported by the CARE-KNOW-DO framework
Students, scientists and communities for sustainability
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The Vitória Régia is one of the main aquatic plants found in the rivers and lagoons of the Amazon. It is a living symbol of biodiversity.
Introduction

Thinking about the Amazon necessitates reflection on its multiple contexts within the sustainability debate. This involves considering how it generates value and spurs action for people, while also recognizing its integration of environmental, social, cultural, economic, historical, and political dimensions. Education for sustainability becomes crucial in empowering both the current and future generations — in the Amazonian region and around the world — to collectively address the challenges affecting global and local contexts.

Agenda 2030 [1] highlights 17 sustainable development goals, requiring urgent, effective, and collaborative responses in a short space of time. One of the essential requirements is the cooperation of all representatives of local, national, and global society, as well as people of all generations and backgrounds. Success with the 17 goals will mean that today’s young people and future generations will have a better quality of life and better conditions to deal with adversity, difficulties, and unexpected challenges. Our understanding of the 2030 Agenda is the importance of considering the achievement of the goals, together with the most vulnerable communities in situations of risk and adversity. Thus, innovative education approaches, such as open schooling [2], need to consider the least privileged regions and actors. The priority should be to reach those who need access to quality education, including indigenous, riverine, and other communities that experience precarious conditions of health, transportation, basic sanitation, drinking water, situations of instability, exclusion, lack of information technology and employment, fragility in job opportunities and qualifications.
Climate change is affecting biodiversity. In some regions, the leaves of the Vitória Régia do not reach the optimum size because of the long dry period in the river’s tributaries.
The global movement for climate action

It is crucial to prioritize the enhancement of climate science literacy among teachers, students, and community members within underserved or underrepresentative communities. This effort empowers individuals and groups to participate as both researchers and informed citizens with skills to support their communities to sustain people’s lives and the planet.\[3\]

The 2030 Agenda and the Paris Agreement are two distinct global milestones promoted by the United Nations in 2015. The Paris Agreement aims to address climate change by limiting global warming. Meanwhile, the 2030 Agenda (Sustainable Development Goals) consists of 17 targets adopted by the UN to address broad challenges such as poverty and inequality.

Despite different focuses, both seek a more just and sustainable future.\[4\] These two benchmarks recognize collaboration between countries with different capacities and backgrounds.\[5\] Although the two are different, these efforts intersect. Acting for the climate contributes to several goals, such as Climate Action (Goal 13), clean energy (Goal 7), and marine and terrestrial life (Goals 14 and 15). Addressing the climate often yields social benefits. For example, renewable energy improves the environment and creates jobs by supporting various goals.

Climate change and sustainable development are connected challenges, requiring coordinated global action to tackle the causes of environmental degradation and inequality. In addition, principles such as equity and accountability highlighted in the Paris Agreement are also relevant to the 2030 Agenda.
Protecting the Amazon and the planet

The Amazon region plays a vital role in global environmental balance\(^6\), and its preservation is key to meeting the objectives set by the two international frameworks.

The Amazon is intrinsically linked to the 2030 Agenda and the Paris Agreement due to its implications for environmental conservation, climate change and sustainable development.

The preservation of natural ecosystems is seen as a crucial measure to tackle climate change due to three factors.

Firstly, the conservation of the Amazon is vital to achieving the goals of the 2030 Agenda, especially those linked to climate action and the preservation of biodiversity\(^7\).

Secondly, as defined by the Paris Agreement, the region plays a crucial role as a carbon sink, contributing to climate change mitigation\(^8\).

Thirdly, the Amazon is also related to sustainable development goals, such as fighting poverty, promoting sustainable societies, and guaranteeing natural resources for future generations\(^9\).

Conserving the Amazon is essential for a sustainable and just future.

Schools play a vital role in raising students’ awareness through environmental education, so that they can exercise responsible citizenship. This is vital for tackling Amazonian challenges such as the inadequate exploitation of natural resources and the unbalanced expansion of agriculture and forest clearing. These threats both have a local and global impact.
The meeting of the Amazon and Negro rivers
(Image by Ale Okada, 2023)
The community of São João do Tupé

Our research focuses on a study based on the open schooling approach in one of the six communities of the Tupé sustainable development reserve, on the banks of the Negro River, located in the countryside 25 km as the crow flies from the city of Manaus in the state of Amazonas, Brazil.

The Tupé region, a rural area in the municipality of Manaus, is one of the territories affected by climate change, both in terms of worsening droughts and floods, exacerbating socio-economic and environmental challenges [10]. According to studies by Borges, Silva and Muller (2021), the community experiences many difficulties in relation to public policies, since there is a lack of public sanitation, health centres and public transportation. The citizens have a low income and survive on small-scale farming, fishing, tourism, and commerce [11].

The Sustainable Development Reserve's education system is supported by three types of learning: informal, which refers to the appreciation of local and community knowledge, present in the Amazonian way of life; non-formal, which relates to community projects, organized by external or internal agents and which has an organized cycle and objectives; and formal education linked to the systematized knowledge of the school and its regular training. This triad of the training process enables different critical contexts in which communities come to recognize their place in protecting the culture and heritage of traditional communities [12]. This report investigates the factors affecting the livelihoods of the São João do Tupé community.

By highlighting the opinions of young people and adults in the community, through open schooling for responsible citizenship [13], our research presents a vivid collective picture of the climate disruptions affecting the community. In order to intervene, it is necessary to invest in education and reflect, research, and innovate collectively using the basis of responsible research and innovation [14].
Tupé Dunes
(Image by Ale Okada, 2023)
Care-Know-Do

In order to operationalize the process of open schooling at all levels of education, involving school, university and society, a pedagogical model was created called CARE-KNOW-DO\textsuperscript{[15]} to foster collaborative learning between students, teachers, scientists, and families. This model introduces new aspects that include personal value connected to experience ("I care," "This is important to me") and learning that leads to action, such as decision-making and problem-solving.

CARE: refers to informal learning with professionals and family members, which engages students with challenges related to real-life and future-oriented issues, stimulating questions of interest to students, and creating a "need to know".

KNOW: refers to formal learning, focused on scientific knowledge and skills for research and discussion, with a view to greater understanding.

DO: refers to the result of informal and formal learning with an action/intervention or decision-making. Students apply the skills and knowledge acquired in participatory scientific actions. CARE-KNOW-DO was proposed as a pedagogical foundation to enable authentic learning based on students' deep engagement with real-life issues and partnerships with representatives of society, such as homes, schools, universities, businesses, and policy departments.

This model supports problem-solving and research-based learning, situating knowledge content based on learners' interests.
Envisioning CARE-KNOW-DO actions
(Image by Ale Okada, 2023)
The CARE-KNOW-DO pedagogical model makes the learning experience more meaningful, engaging, and relevant. Authentic experiences stem from the deep involvement of learners. It is based on active participation and originates from learner's choices, activated by questions of their common interests related to their lives, and involves collaborative learning with teachers, scientists, and families. Based on the interest aroused in learners, scientific concepts are explored and built upon to make decisions and take action.

Learners need to practice critical thinking skills, participate actively in their communities, and make informed decisions based on scientific evidence. Future-oriented real-life problems stimulate participants' curiosity, encouraging discussions and research to discover innovative solutions in line with society's needs and values. Action and reflection enable participants to intervene, transform and innovate in order to collaboratively develop essential skills in their personal and professional lives.
A sustainable development reserve

The Amazon population is extremely diverse and made up of various indigenous, riverside, and quilombola communities including various ethnic groups, as well as migrants and non-indigenous people who live in communities, villages, and environmental reserves.

The Tupé Sustainable Development Reserve in the Amazon has the basic objective of preserving nature and ensuring the conditions and means necessary for the improvement of ways of life and quality of life. This includes the exploitation of natural resources by the native populations for their survival, as well as valuing, conserving, and improving the knowledge and environmental management techniques developed by these traditional communities [16].

Access to the Tupé sustainable development reserve is done exclusively by the Negro River, taking an average of 30 minutes to 1.5 hours from the city of Manaus.

Travelling along the igarapés (waterways) between the different communities in the region is facilitated during the flood season, the Amazonian winter (January to May), but is greatly impaired during the Amazonian summer (June to October).

Valuing the local knowledge, the protection of culture, the heritage of communities and the preservation of forests and rivers are the basic premises for a sustainable territory.
A significant challenge regarding the environmental management of Tupé involves the absence of policy support and professional personnel for monitoring the reserve and safeguarding municipal areas. In addition, these areas, including the Tupé reserve, lack schools and resources from programs and funds.

An important strategy was the 1st Forum of Amazonian Cities to discuss the challenges and potential solutions\textsuperscript{[17]}. SEMMAS, the Municipal Secretary for the Environment and Sustainability, who oversees the management of the Sustainable Development Reserve (RDS), approved a resolution that enables and regulates tourist activities within the reserve by local communities.

The 1st Forum of Amazonian Cities engaged mayors and representatives of municipalities and produced “the Amazon Cities Pact” to identify and address problems within the Legal Brazilian Amazon. Activities such as hunting, fishing, alligator tracking, and logging require rigorous monitoring. Environmental education enhanced by critical thinking is also necessary for raising awareness about these issues and empowering local communities to develop the essential knowledge and skills necessary to actively pursue sustainable solutions in support of their reserves. Local public policies and critical education are crucial for promoting and preserving culture, as well as protecting the environment.
Ethnic groups

The ethnic diversity of the Amazonian population is a striking feature of this region.

There are various indigenous groups with distinct languages, cultures, and traditions. Some of the best-known indigenous ethnic groups in the region include the Yanomami, Kayapó, Tikuna, and Munduruku, among others. However, it is important to note that there are many other smaller, lesser-known ethnic groups in the region, each with their own cultural identities and histories, such as the Tuyuka and Dessana indigenous communities in Tupé.

Tourism is one of the socioeconomic development activities for local communities in the region supported by dancing, singing, and other artistic activities as part of the indigenous culture. For example, the making of musical instruments, such as drums, maracas and flutes as well as handicrafts including bracelets, necklaces, and headdresses.

The cultural customs of the indigenous people in their lands are a way to obtain financial resources from tourists for their survival.
Indigenous culture and biodiversity

Preserving local cultural and environmental heritage is essential for sustainability. Indigenous communities have vast traditional knowledge about the ecosystems in which they live, including their plants, animals, and natural resources. This knowledge is passed down through generations and is fundamental to understanding the dynamics of ecosystems, sustainable management practices and adaptation to climate change. Preserving this knowledge is crucial for conserving natural resources and developing sustainable land-use strategies. Indigenous lands and riverside communities are home to a rich biodiversity. By preserving these lands and the traditional ways of life of indigenous communities, we are also protecting these species and their natural habitats. Biodiversity is essential for the health of ecosystems and for maintaining ecological balance. Traditional practices of natural resource management by local communities are often based on a relationship of respect and harmony with nature. These practices aim at sustainability and conservation of resources in order to avoid overexploitation and their depletion.
Regenerated rainforest
(Image by Ale Okada, 2023)
Livelihood: crafts and agriculture

The riverside population in the Amazon has a diversified livelihood, which includes sustainable fishing and crafts, among other activities. Sustainable fishing is an important source of food and income for riverside communities. These communities depend on fishing resources from rivers and streams in the region to meet their daily needs. They also sell the surplus, an important source of income.

Crafts play a significant role in the local economy. The riverside people produce traditional handicrafts, such as basketry, weaving, ceramics, and objects made from natural materials found in the region. These products are sold both to tourists and to other communities, contributing to the families' income.

Other common activities include subsistence agriculture, extracting non-timber forest products, such as fruits, nuts, and oils, as well as activities related to sustainable tourism, such as boat trips and accommodation for visitors interested in discovering the rich biodiversity of the Amazon.

It is important to note that the livelihood of the riverside population may vary according to the location and the availability of natural resources in each specific region of the Amazon. The sustainable use of natural resources is essential to guarantee the continuity of these activities and the preservation of the environment.

São João Community
(Image by Rodrigues, 2023)
“Indigenous culture and physical activity are very important when educating children and adolescents about taking care of human health and the environment.”

“There are several sectors that require advancements, such as health, education, transportation, energy, and connectivity.”

“The union of people in the community is a priority when seeking improvements.”
Riverside women and indigenous peoples

Women in Tupé play essential and multifaceted roles in communities in the Amazon region. Their roles encompass diverse activities and responsibilities, contributing to the well-being and livelihood of riverside families and communities. Some of the roles of riverside women include:

- **Care for the family**: They play a key role in educating and caring for children, the elderly, and sick family members, ensuring their well-being.

- **Entrepreneurship and income generation**: Some riverside women are also entrepreneurs, being involved in small local businesses, such as selling food, handicrafts, and other products.

- **Fishing and farming activities**: Women actively participate in fishing activities and subsistence agriculture, helping to provide food for their families and communities.

- **Craft production**: Women have valuable traditional knowledge about craft production, such as basketry, weaving, and ceramics.

- **Conservation of traditional knowledge**: They play an important role in transmitting traditional knowledge and cultural practices to younger generations, helping to maintain the cultural identity of riverside communities.

- **Gathering of natural resources**: Women are often responsible for gathering natural resources such as fruits, nuts, oils, and medicinal plants, which are essential for livelihoods and traditional medicine, contributing to health, wellbeing and generating income.

- **Participation in community life**: Women also play active roles in community decision-making and participate in social, religious, and cultural activities.

It is important to value the role of women in preserving local culture, protecting the environment, and strengthening communities.
Indigenous dance
(Image by Rodrigues, 2023)
Challenges with climate change

In the international context, the costs of a world whose average temperature has risen by 3°C will be disproportionately higher than the costs of one with a 1.5°C rise[18]. In the Amazon region, deforestation, followed by agriculture and livestock, contributes to climate change, causing an increase in temperature and a reduction in relative humidity and precipitation in the region[19].

Indigenous and riverside communities face challenges resulting from changes, such as prolonged droughts, unexpected floods, and food shortages, especially those who live in remote areas and depend on natural resources for their livelihoods. Knowledge about the environment and its seasonal changes are necessary to predict weather events and adapt agricultural, fishing and hunting activities.

In some situations, communities may be forced to migrate due to extreme weather events, such as prolonged droughts or floods. The São João do Tupé community, including riverside and indigenous people, depend on the water, and in the dry season the boats cannot navigate due to the very low water volume in the rivers. Consequently, the population cannot move from one community to another.

In other communities, indigenous people need to move to floating houses located in areas of easier access to interact with tourists in order to carry out their cultural presentations. For the riverside communities that live on the banks of the rivers, the rivers flood much more, harming the region and affecting the livelihood of the local population.
Problems with housing and health

The wooden houses of riverside dwellers are damaged by prolonged rains, lack of electricity, and basic sanitation. The climate in the Amazon region is characterized by heavy rains and periods of flooding. Wooden houses are vulnerable to damage from moisture and flooding. Because of climate change, floods and landslides have increased, affecting the stability and safety of riverside homes. Many riverside houses do not have access to electricity or face frequent blackouts. This makes it difficult to perform basic activities at night, such as studying, working, and using appliances. In addition, the lack of energy can affect the preservation of food and medicines.

Most riverside communities have limited access to basic sanitation services, such as clean water and sewage systems. This can lead to contamination of drinking water and an increased risk of waterborne diseases. These challenges have significant impacts on the quality of life and health of riverside communities. The lack of adequate infrastructure hinders access to essential services, increasing health problems.

To improve the wooden houses of riverside dwellers in the Amazon, investments are needed to improve infrastructure and basic services, such as rural electrification, drinking water supply, sewage treatment, and actions to prevent and adapt to climate change.
Pollution

The problem of plastic waste, caused mainly by tourists and the urban population, is a worrying reality in the Negro and Amazon rivers, as well as in other parts of the Amazon region. River plastic pollution poses a serious threat to the environment, aquatic life, and human health. Plastic waste is often found on riverbanks, in urban areas close to riverside communities, and also in more remote locations. Improper disposal of plastics by local residents, tourists and boats is one of the main causes of this problem. Plastic waste pollutes the water, harming aquatic fauna and flora, in addition to posing risks to fishing and other sustainable activities in riverside communities.

The ingestion of plastic by marine animals can also be fatal and contributes to the breakdown of the ecosystem. In addition, plastic waste can clog rivers and creeks, aggravating the problem of flooding during the rainy season. Combating the problem of plastic waste in the Negro and Amazon rivers requires joint efforts by governments, local communities, environmental organizations, and research institutions. For example, awareness campaigns on reducing the use of single-use plastics, selective collection, and the correct disposal of waste, including adequate infrastructure for waste treatment.

The preservation of Amazonian rivers, tributaries and lakes is essential for the protection of biodiversity, natural resources, and the way of life of riverside communities that depend on these ecosystems for their subsistence and well-being.
About this report

This report identifies real and current livelihood issues for the community living in Tupé, the impacts of climate change on their lives, and the adaptation and mitigation strategies they have employed to deal with the crisis so far. By highlighting the views of young people in conjunction with community members through open schooling, our research presents a vivid picture of how climate disruption is already affecting all community members. These impacts are set to intensify in the coming decades. Research related to public policies in education in the Amazon context is essential to empower communities[20].

This study is based on community-based participatory research supported by the open schooling approach integrating inquiry mapping with some principles of design thinking adapted to the educational context [21], through group discussions with young people, adults, professionals, citizens, and researchers from the Tupé region itself. This report also highlights insights from the youth-centered multidisciplinary workshop held at São João school "Agenda of Priority Actions of the Tupé Community" – part of the research actions of the CONNECT project of open schooling for sustainability [22].

Connect team arrival (Image by Rodrigues, 2023)
School and society build together an excellent education for Manaus, Amazon (Image by Ale Okada, 2023)
This open schooling initiative focuses on empowering the Tupé Sustainable Development Reserve, located in the Amazon. The project was coordinated by Dr. Okada (The Open University - UK) with the COLEARN network team that includes leading NGO researchers and practitioners, Rossana Moura (CEO of Anjos Digitais and researcher at IBICT – MCTI), Alberto Steimber (Vice President from the Humans Without Borders Institute for Sustainability and for Life and studying for a Master’s degree at UniCEUB), Riuima Ventura Muller (Doctoral Student and Lecturer at UFAM), Dr Thais Castro (Associate Professor at UFAM), and Dr Luciana Ferreira (Associate Professor Factor at UNAMA and member of IRAMA).

The government organization supporting the research: Brazilian Institute of Information in Science and Technology (IBICT), is a research unit linked to the Ministry of Science, Technology, and Innovations (MCTI).
Empty school during dry season
(Image by Rodrigues, 2023)
The NGOs involved in this project were:

- IRAMA (Ribeirinho Institute of the Amazon).
- REDDA (Reduction of Emissions from Deforestation and Degradation of the Amazon).
- Action Against Hunger (poverty eradication and zero hunger).
- DIGITAL ANGELS (digital inclusion and gender equality).
- Human Without Borders Institute for Sustainability and For Life (human rights, environment and health).

The Tupé Sustainable Development Reserve comprises five communities: Livramento, Julião, Agrovila, Tatulândia, Central and São João do Tupé. A single municipal elementary school, located in the São João community, serves these five communities. Participants from the local community were 15 people, including 10 adults and 5 children/adolescents aged 2 to 15 years. There were members of the Dessana and Ribeirinhos indigenous ethnic groups.

The activities were carried out at The São João Municipal and Elementary School.

The Municipal Education Secretary granted authorization for the group’s visit in response to a request from the Federal University of Amazonas (UFAM). The researchers obtained ethical authorization for research from the Municipal Department of Education of the city of Manaus, State of Amazonas. As the study involved participants of different ages: children, adolescents, their mothers and/or grandmothers, teachers and other citizens, the consent form was prepared for the generation of data, photos and audio recording and signed by all. The study was also approved by the international ethics committee of the CONNECT project. Community participants acted in partnership in the research and representatives acted as co-authors, valuing co-learning and co-investigation of knowledge through research.
Dry season with high temperatures
(Image by Rodrigues, 2023)
The São Joao Municipal and Elementary School is located in Tupé, on the banks of a tributary of the Negro River. It offers primary education only. The space is also used by SEDUC (State Department of Education) to offer Youth and Adult Education (EJA). Young people aged 15 to 17 do not have access to face-to-face secondary education in this community, which is only offered in the state capital, Manaus (45 minutes away by speedboat). When students turn 18, they can enter the technology-mediated EJA program in Tupé.

Students from other locations were not present during this open-schooling project, due to intense drought. The river's dry season is longer because of climate change, mainly at the headwaters of the Negro River in the very distant area close to the municipality of São Gabriel da Cachoeira - an important location supported by various indigenous communities. Due to the drought, the school year is shorter than in the urban region, as boats cannot transport students to school. Classes start in February and end in mid-October.
No access for boats during dry season
(Image by Ale Okada, 2023)
The CONNECT CARE-KNOW-DO principles were used to support open schooling actions in Tupé. The community was very receptive and interested in the open schooling proposal. Initially, the participants were introspective, but after the initial dialogue including an engaging activity in the introduction, they felt comfortable interacting with the researchers in an interactive way. The objectives of the open schooling activity were introduced. Mapping activities for collective investigation were discussed to identify the community's challenges and opportunities to face adversity and enhance sustainability.

Open Schooling co-learning and co-investigation objectives were identified before and during activities collaboratively based on the principles of CARE-KNOW-DO.

CARE through priority community issues and needs; KNOW based on local knowledge and new knowledge to be co-constructed and DO providing the development of skills while searching for solutions to challenges.
Open schooling with CARE-KNOW-DO at Tupe
(Image by Ale Okada, 2023)
Interests and goals

Researchers and the community were interested in:

- Understanding what open schooling is in the context of Amazon and how to make their school open supported by partnerships including their communities in the Amazon and universities in the Amazon state.
- Identifying the important elements to continue open schooling in order to improve the quality of education and, in particular, to explore solutions to local problems.
- Experiencing an open schooling practice for the production of an ebook "Reserva Tupé 2030": an agenda of priorities and opportunities.
Design thinking steps & reflection
(Image by Ale Okada, 2023)
The open schooling approach, using inquiry mapping and some principles of design thinking techniques, brought together researchers and professionals in the field of education, computer science and psychology, as well as members of the São João community and neighbouring territories, including students, teachers, parents, and local citizens. One of Design Thinking’s collaborators, Donald Schôn, developed the principle “Reflective conversation with the situation” - an approach to understand and apply the design process based on a pattern of thinking, talking, reflecting, and interacting. This is normally used by different types of professionals identified as designers, for example, architects, urban planners, engineers, psychoanalysts, scientists, and business managers. The conversation process takes place after reflecting on responses from the situation\(^{[23]}\). It provides a continuous multi-step process with footprint recordings, reflections for continuous reflection, and action in the search for solutions.
Primary rainforest tree
(Image by Ale Okada, 2023)
Glossary

**Meaningful learning:** Based on David Ausubel theory's,[24] meaningful learning is based on the premise that individuals, in their cognitive aspects, structure, organize, and hierarchize their knowledge, and are continually incorporating new concepts, propositions, and ideas. Therefore, we contextualize the content, providing the learner with an active relationship between previous knowledge and new knowledge for the construction of knowledge, incorporating new information to the existing ones in their cognitive structure in a collaborative way.

**Open schooling:** An educational approach that promotes learning beyond the physical confines of the school, involving the wider community in the educational process and real-life issues or challenges of participants that they care about, need to know about and do something about, to develop skills in pursuit of solutions.

**CARE-KNOW-DO:** refers to a pedagogical model involving learners in the discussion and solution of real-life issues through Caring, Knowing and Doing. In this process, the school, university, and society interact, involving students, teachers, professionals, researchers, and managers in a process that allows the development of knowledge, skills, attitudes, and values towards sustainability.

**Inclusive design and learning:** Methodological approach that considers students as active and representative individuals in their own reality in the process of designing computational artifacts, which are intended to serve as mediators for their own learning and that of their peers, encompassing students with and without specific needs.
Secondary rainforest trees
(Image by Ale Okada, 2023)
Inquiry mapping: This technique facilitates collaborative visual scientific thinking, wherein participants collectively identify, record, visualize, and interconnect problems, questions, prior knowledge, and potential actions for a collective solution. It constitutes an integral component of CONNECT project to support inquiry-based learning.

Citizen science: a joint construction between specialists (scientists) and community members, in the collection of data for scientific research. In its methodological bias applied to the educational context, it is a means of enabling students to act in their communities in order to find solutions to common problems, using the scientific process\cite{25}.

Community identity:
In the context of community, for Wenger, "identity" refers to something deeper and broader than simply belonging or shared interest \cite{26}.

Wenger suggests that a person's identity in a community is not just about being part of it or sharing common interests. Rather, he emphasizes that one's identity is inextricably linked to one's active involvement and participation in community life and practices.

For Wenger, a person's identity in a community is developed through the interactions, connections, and collaborations that occur within that community. It is shaped by values and learning experiences, individual contributions, and relationships built over time.

Gender equality and equity:
Gender equality seeks equal rights and opportunities between genders, while gender equity recognizes contextual differences and seeks to address historical inequalities, ensuring fair and adequate outcomes for all. Both concepts are essential to promoting a more just and inclusive society where all individuals can thrive regardless of their gender.
Rainforest region affected by a long dry season
(Image by Ale Okada, 2023)
Design thinking: A human-centered methodology that employs a set of processes to address complex problems, creating innovative solutions centered on the real needs of users.

Conversational dynamics: A research tool that facilitates a fluid and spontaneous dialogue, enabling the expression of ideas, perceptions, feelings, and experiences that contribute to the construction of knowledge.

Active methodologies: A set of methods that place learners of all ages and occupations as the main agent of the co-learning process, encouraging reflection, participation, and active engagement.

Subjectivity: In the context of this research, it refers to each individual's own cognitive and affective perception of the problems and solutions related to their community and sustainability.

The theory of subjectivity: A psychological framework that aims to understand the complex and multidimensional nature of individuals' subjective experiences, which are influenced by and shape their social and cultural context. It emphasizes the active role of individuals in constructing meaning from their experiences and highlights the importance of employing qualitative research methods to study subjectivity.

Constructive interpretive method: A research approach that seeks to understand phenomena from the perspective of participants, interpreting their speeches, actions, interactions, and the context in which they are inserted.

Collective empowerment: The process by which communities gain greater control over their lives and their environment, promoting collaboration and solidarity to achieve common goals.

Sustainability: The principle of carrying out development in a way that meets the needs of the present without compromising the ability of future generations to meet their own needs, ensuring the preservation of life and the planet.
Secondary rainforest affected by dry season
(Image by Ale Okada, 2023)
Methodology

The methodological approach for data generation and interpretation focused on the theory of subjectivity, recognizing that each person is unique and that their experiences and emotions shape their actions. The researchers worked side by side with the participants, in an ongoing dialogue, to generate new knowledge from this interaction. Talking was the main way to generate data and share information in this study. However, it wasn’t just an exchange of words, but also of gestures, facial expressions, silences, and other ways of interacting. Dialogue not only served to create a comfortable and joyful environment for the participants, but also became an important tool for producing knowledge.

The research sought to understand the meaning that each participant gave to their own experiences, both those lived individually and in society. For this, it was necessary to create a favourable environment so that different types of communication could occur freely, engaging the youngest to the eldest. The starting point of this study was to carry out an individual conversational dynamic with the participant who represented the school at that time. The meeting began at the school and continued during the visit to the community. On that occasion, the social research scenario was structured, with an invitation to residents, parents, and students to participate in the work as research participants. After an invitation, reading, and obtaining consent to participate in this study, an individual profile-sheet questionnaire was administered. Subsequently, a group dynamic technique inspired by design thinking was employed as a guiding process for reflection, open dialogue, and the expression of subjectivity. Heterogeneous groups were formed to problematize and identify possible solutions in a collective process of co-creation and collaboration. This technique helped identify the needs of the community and think of solutions that could be implemented.

In groups and individually, participants were challenged to think about the school and the community where they live. They were encouraged to imagine how they would like these places to be designed not only in terms of education, but also in other aspects such as health, housing, work, food, technology, respect for culture, and nature.
Community’s Xmas tree
(Image by Ale Okada, 2023)
Children also played an important role in the design thinking process, problematizing and thinking about solutions through practical playful activities. Freedom, proximity, fun, and wonder were key elements for young people to connect with the open schooling activities. Even with an unstable internet connection, they participated actively, switching between digital and paper-based activities.

The place chosen to carry out this group conversation was the São João do Tupé municipal school, being the only teaching establishment in the Tupé Sustainable Development Reserve that also houses students from other communities. This open schooling study brought together different people, such as students, parents, teachers, school workers, merchants, and community representatives. Each person brought a different vision, based on their own experiences and ways of seeing the world. Participants were challenged to imagine and suggest solutions for a sustainable community in the future. For this, group activities were carried out, stimulating reflective and collaborative discussions.

The conversation took place in two sessions, each lasting three hours. During group discussions, participants were guided in co-creation activities with design thinking in order to stimulate collective reflection and suggest technological initiatives for the community of the future. The reason for this approach was the understanding that knowledge is generated from interactions between community, school, and university participants. The diversity of thoughts, knowledge, individual and collective experiences contribute to the learning of the group as a whole.

Inclusivity encompasses diverse knowledge forms, valuing citizens' personal insights and societal experiences. Deliberation promotes shared understanding, enabling discussions, and recommendations. Exposure to diverse perspectives from various sectors enhances comprehensive understanding of complex challenges.
Wooden houses affected by seasonal floods (Image by Ale Okada, 2023)
To guide the group conversation based on the principles of design thinking, an inquiry mapping with four steps was used: "Understanding the challenge", "Observing the current scenario", "Building a point of view" and "Ideation and prototyping - building solutions to the problem", this last step being completed later through the collective writing of this e-book.

For "Understanding the challenge", the objective was to present the situation to the participants and encourage them to understand the problem from different perspectives through an example.

Participants were invited to share ideas about issues or challenges related to sustainability. A collective discussion was held, and the ideas were recorded on an inquiry map supported by a facilitator researcher. The ideas generated themes for groups such as digital education, empowering women for gender equality, and community collaboration and identity.

In "Observing the current scenario", participants were invited to share their experiences, needs, emotions, and motivations in relation to sustainability and the chosen sub-themes. The objective was to better understand the experiences of each person and to arouse curiosity for the experience of others in order to enlarge the map.

In "Building a point of view", the objective was to organize and make sense of the information collected in the previous steps. Participants filled out a form with questions about what they think, what they say, what they feel, and what they need.

Finally, in "Ideation and prototyping - building solutions to the problem", participants were encouraged to think of solutions to identified problems. This phase is focused on generating practical and innovative solutions to address the challenges at hand. Participants are prompted to come up with creative ideas and designs for addressing specific issues or problems.
Latex from a rubber tree
(Image by Ale Okada, 2023)
Several rounds of brainstorming were held, with participants suggesting ideas and adding new perspectives during each round. In the end, the ideas were consolidated into a list of possible solutions and recommendations for the problems raised, to be consolidated with the request for goods and services needed by the community from public and private agents.

After carrying out the group dynamics, individual conversations took place along the walk back, between the school and the boat, increasing connections between the participants.

The data generated in the individual conversational dynamics and group dynamics were analysed based on González Rey's theory of subjectivity, qualitative epistemology, and the constructive interpretive method, resulting from the principles of design thinking, inquiry mapping and CARE-KNOW-DO. This analysis showed that the group discussion topics brought interested people together.

The group of six children expressed themselves through digital games available on the school's computers and through drawings, developed on paper, computer, and tablet. Some guiding principles to facilitate the engagement of students of different ages and levels focused on inclusive learning and citizen science.

In the gender and women's appreciation group, six women participated comprising of mothers, grandmothers, and students. The subtopics of interest that stood out were health and education. The principles that facilitated the discussion of gender in the community were based on gender equity that goes beyond equality.

The community and identity group included four people: a street sweeper, a teacher, an educator, and a researcher. They focused their interests on improvements, human and professional development, and recognition of the value that residents contribute to the place where they live. The reflection was based on the principles of collaboration, belonging, and transformation.
Wooden houses affected by seasonal floods (Image by Ale Okada, 2023)
Results of open schooling

R1. CARE: The challenges the community cares about

Several issues that the group community participants cared about and wanted to address were identified, discussed, and shared in the plenary. In this discussion, a resident mother and grandmother of students said, “All students have the right to a complete school education in their community”. The participant was indignant at the fact that secondary school is not offered at the São João municipal school, which only offers basic education up to elementary education II, which corresponds to the ninth school year. Apparently, the low number of graduating students becomes a barrier to getting the state government’s attention to implement secondary education. The Education Secretary agrees: “The number of students who finish basic education is few. Our classrooms have an average of 5 students.” She indicates that the number of new incoming students could be greater if there were better transport logistics. The secretary was concerned with the difficulty of selecting and retaining teachers at the school, as there is a very high turnover. As with the students, keeping quality teachers in the Tupé region who come from the city is a difficult task due to the limited conditions, she adds. “The community is small and the teachers who come from the city do not stay for a long time because of transport, infrastructure, housing, and health limitations.” It was discovered that teaching in a sustainable regional reserve, whose community faces several problems, mainly due to the fact that it is located in a reserve that is difficult to provide for, arouses the interest of teachers who have an interest in collaborating with the development of the region.
Discussion and reflection with CARE-KNOW-DO and technologies (Image by Rodrigues, 2023)
There is a subjective sense present among the participants that studies are important to form citizens who can, in the near future, serve the development of the community.

The health service is very limited, there are no doctors and nurses in the community. In this excerpt from the dialogue, the 13-year-old student says that “When my mother gets sick it is very difficult to get help, I am responsible for her”. The participant felt afraid and insecure about people getting sick, as there is no transport to take the sick to a hospital or health centre in the city of Manaus. According to the participant, it is necessary to ask a favour from those who have a motorized boat and even then, it is necessary to pay for the fuel.

Environmental issues include waste reduction, lack of security, need for clean water, lack of basic sanitation, and insufficient access to energy for all residents of the community. In this excerpt, the teacher says, “The only place with air conditioning and internet is the computer room, but the power is not continuous; and there are many drops affecting the internet and making the room warmer”. The teacher was very disappointed by the bureaucracy and the neglect of the public institutions responsible for solving the problem.

Many challenges were identified in this region, such as limited access to education, school dropout, youth underemployment, food insecurity, poor health, youth mobility, and lack of security and resources for human and environmental protection. Such challenges created a need to share and provide the construction of knowledge for all community members to discuss opportunities for finding solutions.
Discussion and reflection with CARE-KNOW-DO
(Image by Rodrigues, 2023)
Some opportunities for the community were also identified:

- The development of ecotourism, intertwined with environmental and sustainability education in schools and supported by universities.
- Training for community entrepreneurship aiming at local trade of their products, such as handicrafts, natural repellents, regional food, and seed jewellery.
- Open teaching and learning with open schooling providing relevant interdisciplinary projects co-designed by young people with experts and families.
- Enhanced connectivity and multiliteracy supported by more efficient use of computers and critical, contextualized, and meaningful pedagogies.
- Communication and information channels uniting residents, managers, educators, professionals, apprentices, and researchers both locally, nationally, and internationally.
- Working towards greater equity among students, creating inclusive spaces with the aid of computational artifacts.
- The significance of public policy support highlighted by women, especially in relation to health, education, and mobility.
- Alternative energy sources such as solar energy and sustainable fuel for boats and ships.
- Community unity and collaborative action for transformation.
In this part of the discussion, a 15-year-old student mentioned that “In our reservation, we have some tourists from other countries who only communicate in English. I became interested in learning this language on my own. So, I made a booklet with words to help all residents and young people in the community to welcome foreigners.” The student was engaged in creating local solutions that allow tourists from other countries to be welcomed into the community and leverage local tourism. Subjective senses of care and reciprocity are produced, as resources for tourism will help support the community.

The community raised questions about the purpose of the study, what benefit it would bring to them, and what would be offered to the community by partnering with open schooling. It was clarified by residents and members of the school that the São João community receives many visitors for research, diagnosis and promises of partnerships, but nothing happens for them. Co-authoring an agenda to guide the community on research projects and future partnerships was a welcome initiative by all participants.

They have become very interested and engaged in sharing their local issues. Quality education has been prioritized by the secretary. “I have heard many times that young people are the future of the country. However, I want the gift for the young people now. Quality education today. It is today that will make the tomorrow of young people”.

Authentic dialogue about community priorities provided an opportunity for collaboration between participants of various ages and occupations, supported by local and external partners. The discussions and documentary research generated this collective e-book of the community’s challenges and opportunities, resulting in a process of consolidating partnerships with new actions:

1. Teacher training based on the CARE-KNOW-DO pedagogy.
2. Designing projects and inclusive learning for citizen science.
3. Partnerships for public policies and research proposals.
4. A portal including a database, information, assessment of necessary resources and community studies with organizations.
Nature-based art
(Image by Rodrigues, 2023)
All community members and partners also positioned themselves as co-learners-co-researchers, that is, one learning from the other. The activity had the participation of people of different educational levels, from basic to higher education.

Knowledge: Based on issues of concern to the community, four curriculum topics were identified to support the open schooling project. Local university researchers and local school educators found it important to discuss the curriculum for students to develop knowledge through formal, non-formal and informal education with real-life problem solving experienced by the community:

- **Health and well-being:** Malnutrition, especially among children, can be a concern, leading to efforts promoting sustainable farming and fishing practices for a steady food supply. Additionally, these communities are susceptible to diseases like malaria, dengue, and hepatitis, often transmitted by insects like mosquitoes. Prevention measures such as mosquito nets and repellent are essential, with healthcare workers providing vaccines and treatment when possible. Access to dental care is limited, resulting in prevalent dental issues due to dietary habits and limited resources.

- **Basic infrastructure:** includes access to healthcare, river transportation, sanitation facilities, clean drinking water, reliable energy sources, stable internet connections, and a well-functioning high school system.

- **Professional training:** training linked to the production chain and ecotourism with a focus on sustainability, fish farming, family farming, general services for building and maintaining basic infrastructure, vacancies in local public tenders prioritizing community members, and greater incentives and resources for education and health professionals from other communities who work in Tupé.

- **Pollution reduction:** Pollution is a growing concern in the Amazon and Negro River regions, posing significant threats to their ecosystems.
Nature-based art
(Image by Rodrigues, 2023)
Participants, both teachers, administrators, and mothers, highlighted the important role of education in training young people in the community. The current generation is comfortable using mobile resources and the use of the internet. However, critical, and meaningful digital education is needed more than ever.

The secretary remarked, 'Today, the number of functional illiterates is on the rise. Individuals, including children, young people, and adults, pass through schools without acquiring critical reading, writing, and interpretative skills.' There is growing concern regarding the quality of teaching and learning. The development of critical thinking is paramount for young people to pursue their education and acquire the skills necessary to support their livelihoods.

Young people and children have also expressed their ideas on contributing to problem-solving, emphasizing the need for a broader range of digital resources for learning through computers.

A 12-year-old student stated, 'We would like to have more opportunities to use the computer with a variety of tools, engaging games, and fun activities that help us learn about things important to our lives.'

Participants have expressed concerns about limited internet access, the lack of software tools, and a shortage of engaging activities. School staff members feel neglected by public officials in the context of technology-enhanced learning.

The community members and academic team discussed some key skills for educators and learners to develop:

**Collaboration:** The ability to work effectively with others, including teamwork, and cooperation.

**Communication:** The skill of conveying information, ideas, and thoughts effectively through various means such as verbal, written, and digital communication.

**Critical thinking:** The capacity to analyse, evaluate, solve problems, make decisions, and think creatively.

**Creativity:** The ability to generate innovative ideas, approaches, and solutions, as well as the willingness to explore and experiment with new concepts and possibilities.
Participatory action research supported by children
(Image by Rodrigues, 2023)
The educational packages installed by the Municipal Department of Education (SEMED) must be expanded. Current digital resources are GCOMPRIS game packages on Linux, chess games, a memory game, text and drawing editor, Google for Education package.

- **Scientific thinking for collaborative research** refers to the process of problem solving and innovation based on evidence-based thinking and scientific inquiry-based learning involving all representatives of society: students, teachers, managers, citizens, researchers, and local professionals.

“In 1999, only 1% of the population entered higher education. This number increased a lot in 2022, but we still have people in universities who don’t know how to write a project and do research. Based on this deficit, we ask where is the quality of education? Higher education is now exploding with a high number of universities. But the educational base is essential. From the first to the ninth grade, the teacher needs to be well trained. Many students who finish the ninth year do not master mathematics or the Portuguese language” Education Secretary.
Indigenous school
(Image by Ale Okada, 2023)
The Education Secretary highlighted the slow and ineffective process for requesting resources, preventing the execution of many relevant actions in the school and in the community. “We need resources, but it is necessary to go through the federal and state government and then to the municipal government. The process is very slow, it takes a long time to apply, and the demands are constantly changing.”

The reflective dialogue among all members made it possible to raise awareness of many barriers and the need to develop knowledge and actions.

Participants completed all activities:
- Individual diagnostic interview.
- Discussion and mapping of diagnostic evaluation results.
- Group conversation dynamics using inquiry mapping and design thinking to record the information needed to present the prototype.
- Presentation of the results of each group: challenges and opportunities.
- Final reflection of the process and presentation of the prototype/results, including the next steps.
- Site visits and testimonials.
- Review of the agenda and prioritization of actions.
Indigenous girl.
(Image by Kiana, 2023)
Inclusive design and learning towards citizenship.

After free exploration, following the results of the inquiry mapping conducted by the adult groups, children were prompted to reflect on community challenges and generate potential solutions through drawings. This activity aligns with sketching technique, which is a component of the participatory design approach when applied to creating functional prototypes.

The representations in the form of drawings included common problems that were being discussed, which involved transportation for all, resources for the community such as fruits, incentives for fishing, planting, and housing. Notably, all the drawings by young people were created independently in the same room where the adults discussed the problems and opportunities. Two designs include a heart as a way of showing respect, love and hope for the Tupé community, the place they inhabit. A 6-year-old girl said that the drawing she made represents her wish “that we had a house and fast transport to the riverside community.”
The large image on the left right shows a drawing by a 10-year-old girl. Her community design shows how her priority is protecting the environment, trees, plants and flowers, and transporting children to school.

An 8-year-old boy pointed out that his drawing shows “daddy working as a street sweeper to make the city cleaner, sister fishing to bring home food and I want to be a street sweeper to clean the city just like daddy”. The 6-year-old girl responded with another drawing seen by her classmates, highlighting “I love the landscape where I live, and I want to see improvements for my riverside community”.

Below, a drawing of a 5-year-old girl from another state.

She participated in activities with other children in the community, highlights the priority: “I would like to have transport for all the children to get to school”.

Students aged 7 to 15 had never used a tablet before. They were asked to represent their ideas using an iPad drawing editor and with little explanation.

**Recommendations:** Conducting training workshops with teachers, parents and other school employees would be important for the development of autonomy and social and digital inclusion. These workshops would be through citizen science projects with the use of technological resources, collecting data and designing sustainable solutions for the community. In addition, it is necessary to work with students and teachers to include students with wide neurological diversity and disabilities in the search for solutions. This can be done with co-creation workshops using ‘brain draw’ in the design of spaces and computational tools in an inclusive way, giving everyone a voice.
Indigenous Girl
(Image by Rodrigues, 2023)
Gender equality

In the conversational group about the problems faced by women, participants were asked to express the greatest difficulties and priorities. Emergency diseases such as bullous dermatitis and autoimmune disease of genetic and hereditary origin have been reported. Patients suffer a lot from the summer heat and exposure to the sun. As there is no health centre, patients have to rely on the help of family members and neighbours.

“To help my mother I need help from neighbours to get a boat to go to town.”

The above statement comes from a young woman whose mother suffers from an incurable disease aggravated by the temperature and lack of professional care. The mother has concerns for her daughter, who is constantly missing classes, which is affecting her learning.

Regarding education, another major concern highlighted by the women was the lack of secondary education in the community, as shown in the statement below from a resident of Tupé. “Do not abandon them. Do not let go of the hands that were joined. Fight. Studying is a right...We only have primary education in this school. Young people here need secondary school. Regular high school is not a favour. It is a right”.

In addition to health and education problems, possibilities and solutions were highlighted. For example, tourism and crafts. With regard to tourism, the women make regional foods and sell them at events and in local restaurants and inns. Handicrafts and cooking involve young girls from an early age who need money to help the family, mainly to pay for fuel for local boats and help sick family members.
Artistic expressions shared by young people include crafts in painting and crochet. The example above is a tea towel made by a young woman to help with the family's income and to have savings to help her sick mother. The print came ready-made from the city, and represents a woman outside of the community, it does not represent the people of the Amazonian communities. The crochet was applied by the young woman.

**Recommendations:** In terms of crafts, the girls could learn to paint and value the local culture, highlighting the role of women in various actions and areas of knowledge.

To improve health, in the short term, a riverside health post was suggested for mobile care for routine and emergency appointments. In the medium term, the importance of having a health centre to serve the community population was highlighted.

Internet access is essential for people to access information and healthcare, for training, education, including non-formal learning, supporting the curriculum, and preparing young people for further studies in health and education.

The internet can greatly help the women's community in their subsistence ventures linked to tourism, and the sale of handicrafts including natural products such as locally produced natural repellents.
Community identity

Group discussions in pairs, teams and plenary conversation circles facilitated the active participation of all. Awareness has led to a more united community identity highlighted in the statements of both researchers and residents. “Community members were very receptive. There was a great exchange between residents and researchers and many intelligent productive ideas were shared from the heart. We feel the emotion and affection, not only the pain, but the love and hope for the place where they live” Masters researcher.

The strengthened and co-constructed identity with the voices of all seems to have provided support from the youngest to the eldest residents of the region, producing subjective senses of collaboration. “What I ask for the community is that we be strong, in the sense of union, of wanting, of having the will to join and do things. Because when we really want it, we do it”. Female resident of Tupé.

Identity is constructed by the way someone engages, learns, values, feels, contributes, and becomes valued in the community, making it a meaningful part of who they are. Identity is dynamic and can be classified into different categories, especially when dealing with community identity, because in addition to its personal nature, there is social, ethnic, and cultural identity, among others.
Art and Ethics in research
(Image by Ale Okada, 2023)
The collective identity[28], in constant interaction between peers is formed from a way of life, adding to the experiences and their local and global contexts including digital ones that influence behaviours, cognitions, and emotional interference, which in some way, are also influenced by the shared demands, in the satisfaction of needs and desires.

"Thinking about the Amazon means considering its diverse social and cultural contexts, in which the sustainability debate should generate valuable insights for local communities regarding the integration of economic, social, cultural, and environmental dimensions." - Amazonian academic researcher.

This notion, echoed by the co-authors and integrated from the beginning of this study, highlights that discussions about sustainability in Amazonian scenarios need to promote inclusion, diversity, equality, and equity, valuing authorship among the involved parties. In this study, a consent form based on respect, appreciation, and ethics was emphasized from the outset. The photo on the left features a button with the phrase: 'Nothing about us without us.' This underscores the importance of honouring the choice for inclusion and the recognition of participation and authorship.

**Recommendations:** Education, research, and projects must provide fair, ethical, democratic, and sustainable actions in which members of diverse knowledge unite in the formation of collective and individual identity with their consented and valued participation.

This process can be facilitated by open schooling projects. Identity can be reconstructed with each life experience and in a collaborative way to transform and be transformed by reflections and individual and collective actions in partnership between school, university, and local and international community.

The outputs arising from community actions resulting from co-authorship of research with an open license become a significant part of a scientific sociocultural legacy to inspire other communities and other generations in the personal, social, environmental, and economic values connected with their ways of thinking and living - caring, knowing and doing to transform.
Open schooling
(Image by Rodrigues, 2023)
Discussing the results

1. Originality

In the field of non-formal education focused on learning communities, an original aspect was the open schooling approach as a process of meaningful knowledge construction and participatory research. This new pedagogical approach was well received and implemented by participants from the university, school, and community, enabling co-learning and co-investigation through the principles of CARE-KNOW-DO: caring, knowing, and doing.

The study had a positive impact on education in the Amazonian community of São João do Tupé as it allowed for collaborative and meaningful learning across diverse ages, genders, ethnicities, and fields of expertise. Individuals learned from each other by investigating issues, information, and actions in a contextualized manner.

The process was enriched by multiple dialogued perspectives to:

- Identify, reflect upon, and prioritize individual and collective problems.
- Care about, and want to, address the issues for improvements.
- Share knowledge and seek new contextualized insights.
- Collaboratively engage in relevant joint actions.
- Research solutions for necessary and desired transformations and innovations for all.

Through group and individual conversational dynamics among various participants from schools, universities, and society, including educational management agents, academic researchers, and civil society leaders, a deeper understanding of the challenges faced by the community and the desired vision for transformation could be achieved.
Open schooling
(Image by Rodrigues, 2023)
2. Innovation

An innovative aspect in the field of educational research on open schooling was the qualitative methodology of participatory research based on community support, grounded in the principles of design thinking, inquiry mapping, and theory of subjectivity. The methodological process of this study facilitated open and sincere dialogue among participants from the university, school, and community, contributing to the generation of new insights about individual perceptions and experiences regarding sustainability and the sustainable reserve. These conversational dynamics of open schooling took place within the school space and outside during walks in the reserve, fostering the sharing of local culture and understanding of the community's dynamics. This allowed for on-site discussions of problems, solutions, and knowledge based on the reflections that arose during these moments.

The contextualized discussions yielded valuable insights and innovative ideas for creating sustainable solutions. It was possible to grasp subjectivity and discuss community ideas and challenges through the presentation of proposals and innovative solutions. Following González Rey's theory of subjectivity, it was observed that subjective senses of belonging, and unity emerged among participants in order to achieve common goals aimed at sustainability. Subjectively, at the individual level, personal motivation to learn, innovate, and transform became evident, while at the social level, collective empowerment was manifested in the pursuit of common interests for the sustainable development of the reserve. Valuing the uniqueness of each individual and creating a safe, enjoyable, and stimulating environment facilitated the emergence of innovative ideas and creative strategies for the challenges faced by the community.
3. Relevance

The experience also highlighted the importance of dialogue as an essential tool for critical thinking, the exchange of knowledge, and the collective construction of meaning. The methodology used, inspired by design thinking and inquiry mapping, proved effective in stimulating collaborative scientific thinking in the pursuit of viable solutions based on contextualized information, evidence, and reinterpretations. The participatory research with the community, based on the theory of subjectivity and constructive-interpretive methodology, provided an in-depth investigation of complex and emotional interactions among participants. Group conversational dynamics and individual discussions allowed for the construction of meaningful knowledge and the generation of thoughtful actions for the challenges faced by the community.

The participatory and dialogic approach valued the uniqueness of each individual and promoted collective empowerment in the pursuit of a sustainable future. Through group conversational dynamics and individual discussions, a deeper understanding of the challenges faced by the community and the desired vision for the future was attainable. The participatory dialogic approach created an environment of trust, collaboration, and reflection - promoting critical, creative, and engaging learning.

The research results indicate that the dynamic interaction between researchers and participants, guided by the principles of the theory of subjectivity, was fundamental to the production of meaningful knowledge. It is believed that this practice can be replicated and adapted in other community studies, potentially creating a broader positive impact.
São João Community
(Image by Rodrigues, 2023)
Next steps

The next steps will involve discussing the integrated outputs with key local documents, bibliographic references, and scientific data, which will be available for community access via both internet and offline modes through the computer lab. With the aim of guiding the teaching and learning actions of over 250,000 students in Manaus, the new 'Municipal School Curriculum' was launched in 2021 through SEMED (Municipal Education Department). It underwent linguistic revision, formatting, and adaptation to cater to all, including riverside communities. Results related to the open schooling approach help identify new opportunities with new partnerships via SEMED, which could receive support from two local universities, UFAM and UNAMA, as well as international institutions, utilizing active methodologies (such as creative and critical approaches like consensus dialogue, co-creation, inquiry mapping, design thinking, and theory of subjectivity).

The open schooling approach, based on the principles of “CARE-KNOW-DO' has been deemed valuable and challenging. The agenda began with local issues and concluded with a representative who summarized community opinions and the value of education.
River with low levels during dry season
(Image by Ale Okada, 2023)
Community members became more aware of local priorities and also felt more united. "We have to be grateful. Changing is not easy. We need to be strong to want, know and do. Having regular secondary education in this community is not a favour, it is a right." Grandmother.

The participants recognized that this initiative is challenging, because in order to change it is necessary to have a strong connection with the priorities that concern everyone in the community, as well as knowledge to solve problems and the development of actions to overcome local challenges. Education, better teaching conditions, transportation for children to get to school, access to doctors and medication throughout the year (even during periods of drought), energy, and basic sanitation are some of the community's rights. All these issues were already known. However, one of the main conclusions was that "something must be done from the unity and knowledge of all members supported by partners". This evidence of open schooling can be an approach to increase unity among community members with partnerships to make the change they want and with the necessary knowledge base. Co-creating a collective agenda of priorities, challenges and opportunities was valuable for them to share local wisdom and update/expand their knowledge, including the feedback they needed and received from researchers. This allowed them to find alternatives to reduce barriers, uncertainties and unknown challenges. This shows that open schooling can be a way to increase the confidence of communities to move forward with their own voices and local wisdom collaboratively in and beyond the school with professionals, citizens, educators, learners, and researchers of all ages to identify priorities, improve the quality of education, and change public policies for equality and equity. The results for the participants were: involvement, pleasure, and trust with science and research. Some learning outcomes developed were:

- become aware of the meaning and procedures of open schooling.
- identify new collaborative approaches to explore issues supported by education and democracy, e.g. research mapping with design thinking.
- greater awareness of problems and opportunities for change with new approaches.
River with low levels during dry season
(Image by Ale Okada, 2023)
Some new approaches for bridging formal and non-formal learning for schools-communities empowerment introduced by the CONNECT project are:

**Open-ended scenarios in education:** These are designed to engage students in science through real-world, community-focused challenges. These scenarios encourage students to explore and address local issues by applying scientific knowledge and participatory decision-making. The goal is not just to follow the scientific method but to involve students in problem assessment and decision-making based on both scientific evidence and experiential knowledge. Throughout the process, students interact with experts, family members, and decision-makers to understand the connection between science, community challenges, and decision-making. These scenarios, which can be integrated into regular school lessons or extracurricular activities, offer teachers an innovative way to involve their local community in the learning process.

In open schooling, several key stages are involved in tackling real-world issues collaboratively (see Table 1):

**Agenda setting:** This step involves deciding which issues are important and deserve attention in the policy-making process. It shapes the direction and focus of actions, highlighting priorities.

**Inquiry mapping:** Participants enhance their understanding of real-world issues by formulating queries, reviewing relevant documents, and extracting valuable information. They evaluate evidence, build knowledge, and raise nuanced questions related to the issues.

**Knowledge gathering:** In this phase, students acquire information using various methods, including desktop research (investigating existing data), surveys and interviews (gaining insights from knowledgeable individuals), and stakeholder analysis (evaluating the interests of relevant parties). These methods provide context and depth to the problem.

**Deliberation:** Participants engage in dialogue with experts, scientists, and stakeholders to explore different perspectives. This can be done through methods like system-oriented dialogue model, consensus conferences, juries, or co-creation.

These approaches facilitate a comprehensive understanding of complex challenges.
Recommendation development: Building on the insights gained during deliberation, students develop recommendations independently or in collaboration with experts. These recommendations are then communicated to decision-makers, the media, and stakeholders for consideration and potential action.

Collaborative project-based learning: Students and community members collaborate in teams to create outputs like open letters or articles to disseminate recommendations or innovative solutions. This collaborative approach fosters knowledge construction through brainstorming and design thinking. These stages encourage active participation, knowledge-sharing, and informed decision-making in addressing real-life issues within the open schooling framework for sustainability.

<table>
<thead>
<tr>
<th>Science action stage</th>
<th>Learning objective</th>
<th>Steps</th>
<th>Methods</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care</td>
<td>To develop engagement and interest by framing/finding issues and an approach to solve a community-based challenge</td>
<td>Framing, Questions</td>
<td>1) Agenda setting, 2) Inquiry Mapping</td>
<td>Students, Experts / Scientists, Local community, Families</td>
</tr>
<tr>
<td>Know</td>
<td>To acquire scientific understanding of local issues and problem-solving approaches supported by research and interactions with scientists and citizens. To develop alternative solutions together.</td>
<td>Knowledge &amp; opinions, Deliberation</td>
<td>3) Desktop research, Interviews, Informed survey, 4) Stakeholder analysis</td>
<td>Students, Experts / Scientists, Local community, Teacher, Advisors</td>
</tr>
<tr>
<td>Do</td>
<td>To communicate science actions, projects and findings to the local community</td>
<td>Recommendations, Dissemination</td>
<td>6) System-oriented dialogue model, Consensus format, 7) Jury format, 8) Co-creation, 9) Co-creation, 10) Collaborative project-based learning for policy support</td>
<td>Students, Experts, Decision-makers, Media, Stakeholders</td>
</tr>
</tbody>
</table>

Table 1: Open Scenarios methods. Nerhaus, Malagrida, Torres & Okada (2023)
Through the partnership between the school, the university, and the community, it was identified how and with whom to contact; for example, policy makers and procedures for applying for a secondary school in the São João community that will also serve students from other communities in the Tupé Sustainable Development Reserve.

Awareness of the issues and communication skills to explore the problems and opportunities were revealed by the children who made illustrations of the problems faced and by the adults, who described them in conversations. Using their drawings, they prioritized transportation for everyone to get to school, and also the need for greater opportunities to learn beyond school, for example with family members at home and in their communities. Because of the drought, you have to walk a long distance in hot weather to get to school. Despite the barriers, education is considered the path to change, towards dreams and achievements.

We started this study with two historical marks, the 2030 agenda and the Paris agreement, and ended with another one drawn on the wall of the São João do Tupé community room, in which we started the open schooling actions.

“If you don’t work for your dreams, someone will hire you to work for theirs”.

Principles
(Image by the community, 2023)
Open schooling for sustainability

The experience of open schooling with participants of all ages, something unprecedented for everyone, was highlighted by participants as enriching and innovative. The result was positive, with involvement, meaning, and engagement paving the way for community empowerment. The study allowed reflections documented in publications in the area of education [30].

We highlight three recommendations described below.

R1. The practice of environmental education for residents integrated with local priorities and their surroundings for the preservation of nature, including collaborative knowledge for the conservation of species and ecosystems and environmental monitoring that subsidizes preservation.

R2. Open schooling consolidated and multiplied by practitioners from the Tupé Sustainable Development Reserve, the São João school, the Federal University of Amazonas UFAM and other state, national and international support organizations for the participation of legitimate representations of residents in community management instances; establishing indicators of systematically monitored and evaluated results in order to improve local planning; and the application of resources - strengthening ethical and participatory local management and decision-making.

R3. With regard to improving the quality of life of populations; training processes, internet access and the necessary infrastructure are recommended for all citizens to access. The building and sharing of knowledge available to society and other communities for improvements aimed at the sustainability of the environment and human life.

When students bring their own contexts to school and see them valued, incorporated, and given new meaning, education becomes more meaningful, enabling them to act informed and knowledgeably. This means knowledge in real-world contexts for positive global impact.
A dream that one dreams is only a dream. A dream that is dreamed together is the beginning of a reality.

Colearn network
The inquiry mapping above was developed by the community members with researchers, educators, students, policy makers and community members. The next steps for future research will be monitoring the severe effects of climate changing and key intervention, partnerships and incentives towards solutions.
The Amazon region is facing its most severe drought. In October 2023, one of the world's largest rivers, the Rio Negro, reached a record low, marking the lowest level (13.59 meters) since measurements began in 1902. This unprecedented drought has left hundreds of boats stranded on the river's sandbanks, impacting over 50 municipalities near the city of Manaus, which have been declared in a state of emergency. These distressing images vividly portray the challenges posed by this environmental crisis, exacerbated by climate change.
Dense smoke covered the Rio Negro and the city of Manaus, resulting in severe air quality issues. This had a significant impact on river transportation, with serious consequences for the communities, including Tupé. Fires in the region further worsened this situation, exacerbated by high temperatures. Tragically, more than 130 dolphins were found dead, while researchers collect data along the riverbanks. A significant portion of the population, including children and the elderly, experienced health problems due to air pollution and limited access to hospitals.
All teenagers who have an interest in nature in Brazil and around the world are enthusiastic about learning about the world's largest tropical rainforest and contributing to the conservation efforts in the Amazon.

In the UK, a group of students had the opportunity to explore this book and were amazed by the challenges faced by the people of the Amazon. As a result, they created a poster that incorporates information from the book and online sources, with the support of researchers involved in open education initiatives in both Brazil and the UK.

These British students believe that the Amazon region should receive greater support to address the effects of climate change. They also think that students from around the world should have the opportunity to learn directly from Amazon communities, which possess knowledge beyond what is found in their school textbooks.
PROTECTING LIFE IN AMAZON

we CARE

Amazon took millions of years to evolve into the most biologically diverse place on Earth.

However, humans have radically changed the environment affecting the whole ecosystem.

The aim of this green initiative is to CONNECT open schooling activities in Brazil and in the UK.

Students will discuss issues and actions with researchers and local communities to protect life together.

we KNOW

Researchers with learners will:

1. Examine the challenges and benefits of using science and emerging technology to enhance decision making approaches.
2. Explore the factors that support learners’ independent thinking and affective engagement with learning.

This mixed methods study will use a social learning microblog and the CARE-KNOW-DO reflective tool.

we DO

Students with researchers will:

1. Investigate socio-scientific issues related to Ecosystems, biodiversity and life that they CARE about.
2. Search for reliable sources about what they need to KNOW and examine different perspectives to develop understanding with others.
3. Use different technologies to DO science actions including open AI chat, AR Zapper, VR thinglink, Google Lenses and CONNECT scientist-student platform.

What may happen to Earth without Amazon forest and peoples?

Where can I find the reports about indigenous’ lands?

How the wisdom of natives could be valued?

How students, scientists in Brazil and UK could protect Amazon?

What are the climate problems in Amazon?

Can we protect the forest and animals?

What happened to the Yanomamis?

What are the beings in danger?
Acknowledgements

We are very grateful to all members of the São João do Tupé Community who contributed to the inquiry mapping, to all participants in this study, to the collaborators and organizations that supported this research. Thanks to the Expert Advisory members of the CONNECT project, https://www.connect-science.net/ who contributed to the scientific review, supported by the European Union No.872814

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Timeline of Open Education and Sustainability

1992
- Earth Summit, Brazil
- UNFCCC - UN Framework Convention on Climate Change

1997
- Kyoto Protocol agreement to reduce carbon

2007
- Open Education Declaration, Cape Town

2011
- UNEP Report: Sustainability without poverty

2012
- OER Declaration, Paris

2015
- Agenda 2030
- Paris Agreement
- Open Schooling

2023
- UN SDG2023
- Summit New York
- Open Schooling Declaration

2025
- UN COP30
- Amazon Pará, Brazil

2030

(Source: Ale Okada, 2023)
e-Book in Educational events of Brasil and abroad

(Source: Colearn, 2023)