

Project Report

Planetary Health Initiatives in Rural Education at a Riverside School in Southern Amazonas, Brazil

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Abstract: Planetary Health is an expanding scientific field around the world, and actions in different areas are essential to minimize the environmental damage that compromises the future of humanity. This project report aims to describe the development of Planetary Health actions in a rural school in the Brazilian Amazon, to understand and raise awareness of themes related to Planetary Health. To implement the educational activities, a booklet entitled “Planetary Health: Guide for Rural Education” was created. Subsequently, didactic sequences were applied to 37 ninth-grade students in the first semester of 2023. The activities were diversified, including: (1) investigative activities (pre-tests, interviews with family members, ecological footprint adapted to the Amazonian riverside context), (2) interpretative activities (image reading, identification and problem-solving for Planetary Health stories in the Amazon, educational cartoons, and graphs of the sectors with the highest pollution in Brazil and diseases associated with climate change), (3) audiovisual activities (educational videos), (4) playful activities (educational games), (5) practical and field activities (forest tracking, planting seedlings, sanitation trail, construction of a school garden, preparation of a healthy school snack, greenhouse effect simulation, and basic analysis of lake water with a probe). The results of the educational actions allowed students to undergo new experiences on Planetary Health themes, as well as understand the centrality of the Amazon for the planet and how the environmental impacts in this biome are compromising the future of humanity. The experiences during the educational actions showed that young riverside residents are concerned about the future of the Amazon, especially given the environmental destruction that is frequently evident, such as deforestation, fires, illegal mining, and land grabbing. Inserting these themes into riverside education makes it possible to look at the Amazon in a resilient, responsible way and to discuss scientific and local knowledge so that students can develop initiatives to face environmental challenges in their community. We conclude that Planetary Health education needs to be an effective part of the school curriculum, prioritizing reviewing the documents that guide education to prioritize transdisciplinary actions with children and young people, as they are the voices of the future and future leaders in emerging causes. Educational actions in Planetary Health in the Amazon region are an example that can inspire actions in other places with similar characteristics.

Keywords: Amazon region; education; planetary health; riverside students



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1. Introduction

Planetary Health is a scientific field that is expanding worldwide, gaining notoriety in several areas of activity. It is dedicated to understanding the environmental impacts resulting from anthropogenic actions, aiming to develop strategies to mitigate harm and ensure the future of humanity [1]. In basic education, Planetary Health is still in its infancy, but it holds great potential for engaging the public, especially children and youth, in raising awareness about environmental impacts. Moreover, it encourages them to take actions

towards understanding the severe consequences of environmental damage on health, both at a local and global scale.

UNESCO emphasizes education as a powerful force in building peace and driving sustainable development. Considering the essentiality of urgent actions throughout life and across various cultural and social spaces, it is crucial for these actions to be taken collectively to change course and redefine the future [2].

Among scientific knowledge, allied with Planetary Health education, sustainability education stands out. This approach presents a perspective focused on understanding environmental, social, and economic issues, involving the development of knowledge, skills, and attitudes that promote sustainable actions for an equitable and healthy future for all [3].

Sustainability education and Planetary Health education have objectives centered on the planet's well-being and humanity. However, sustainability education encompasses various topics concerning the planet's sustainability, considering natural and social systems. On the other hand, Planetary Health education encompasses diverse areas focused on sustainability studies, emphasizing the health issues of all forms of life and natural systems. Awareness of sustainability and Planetary Health not only has a positive impact on the environment but can also be crucial for the development of skills and values that students will apply in their daily lives and in their future jobs and roles in society [4].

Research on Planetary Health education in Brazilian schools has gained prominence in events within several fields, such as the Annual Planetary Health Meeting, Latin American Congress on Planetary Health, Brazilian Program of Planetary Health Ambassadors, and National Meeting of Researchers in Science Education. However, it is vital that initiatives in this new field be effective in Brazilian schools, considering the specificities of each region of the country.

The São Paulo Declaration on Planetary Health consolidates the proposal to integrate Planetary Health education at all educational levels, adopting multidisciplinary and participatory approaches involving schools, teachers, students, parents, and communities. This approach particularly emphasizes the need to promote lifestyle changes, aiming to protect both human health and the environment [5]. Additionally, it is believed that Planetary Health education with an emphasis on nature-based learning and decolonial approaches not only provides access to knowledge but also disseminates information inclusively, considering the specific context of women and girls. This not only empowers young people to become current and future leaders in pressing issues but also prepares them to take active roles as decision-makers [5].

Given the undeniable importance of the subject, this work discusses the matter with a focus on the Brazilian Amazon, the largest tropical forest on the planet. This biome plays a central role in Planetary Health discussions due to its multiple potentialities, such as its extensive participation in the carbon cycle, its status as the home of the largest hydrographic basin, its rich biodiversity, its influence on climate stability, and the socio-cultural diversity it hosts. Unfortunately, the Amazon has been under intense pressure that compromises its functional integrity, dangerously approaching a point of no return, which increases the possibility of transforming this lush and valuable forest into a savanna [6–9].

The combined effect of deforestation and anthropogenic degradation undermines the resilience of the forest, leading to biodiversity loss, reduced carbon storage, and an intensification of climate change, with direct repercussions on human health [10]. Consequently, the point of no return for the Amazon implies a true collapse and regression for the whole humanity. Studies are already discussing the possibility of a sixth mass extinction event of mankind [11,12].

It is crucial to address the guardians of the Amazon Rainforest, including indigenous peoples, Afro-descendant communities, and mixed-heritage extractivists such as mestizos, caboclos, and riverines [13]. These communities play a significant role in biome protection, exemplified by their traditional knowledge of the forest, care for the land, sustainable practices, forest management, and their crucial role as climate guardians. However, faced with

numerous challenges confronting the Amazon, these people, referred to as the guardians of the Amazon, are also under threat.

Among the diversity of communities inhabiting the Amazon, this work highlights the riverine people. These individuals are singled out as representatives of traditional groups in the Amazon region, residing near rivers and their tributaries. They are characterized by a strong connection to nature, relying on the natural resources of the forest and rivers for their subsistence [14]. Riverine communities have a limited impact on the deforestation in the Amazon; however, they hold the potential to preserve the region's health [15].

In this context, it is of utmost importance to educate the riverside communities of the Amazon about the impacts resulting from human activities on the environment. This aligns with the process of mitigating environmental damage that has been exacerbated in recent years. Such knowledge is especially vital for children and youth, enabling them not only to develop but also to strengthen their awareness and practices focused on preserving the forest and their communities.

This present work results from a doctoral research project entitled “Planetary Health: Necessary Dialogues for Scientific Education in a Riverside School in Southern Amazonas.” The proposed thesis aimed to foster discussions on the subject within the context of rural education, emphasizing environmental impacts, their connection to health, and traditional knowledge related to the topic. However, throughout this journey, a decision was made to implement initiatives with the students in response to various locally experienced challenges. This encompasses issues such as wildfires, deforestation, illegal mining, the impacts on health, and the absence of discussions on Planetary Health topics in the school.

Therefore, this study represents a pioneering initiative in the southern Amazonas state, aimed at fostering essential discussions with students in rural education, adopting a focus tailored to the Amazonian context—a demographic area that often experiences fragmented education. The central objective was to disseminate information and inspire the new generation to engage in the development and strengthening of actions for the protection of this biome. The shared experiences were developed in partnership with riverside students, seeking to establish connections between Planetary Health topics and the Amazon, in a participatory and transdisciplinary manner.

2. Proposals and Development of Educational Initiatives

2.1. Location and Target Audience of Planetary Health Educational Initiatives

The Planetary Health educational initiatives were conducted at a riverside school in the Brazilian Amazonas state, located at Uruapiara Lake, in the southern mesoregion of Amazonas (6°20'25" S and 62°1'19" W), approximately 172 km from the urban area of the municipality of Humaitá. The estimated travel time to reach the community is approximately 20 h by medium-sized boats.

The word “Uruapiara” (“Urua” and “peara”) has indigenous origins from the *Parintintin* ethnicity, meaning “Big Snail”. The lake displays dark waters and an imposing reflection, being formed by the Ipixuna River, a tributary of the Madeira River. The communities around the lake accommodate both indigenous and non-indigenous inhabitants, whose traditions are interconnected. The lake is considered an environment with traditional communities due to the cultural characteristics that endure through generations.

Cristo Rei School is situated at Uruapiara Lake. It was established by Ordinance No. 031/96 on 25 October 1996, to serve students in basic education at the elementary and junior high school levels who live in the traditional community of Cristo Rei and surrounding communities.

The target audience consisted of 37 students from two 9th-grade classes in elementary school, ranging in age from 14 to 17 years old. They reside in riverside communities that surround the lake. The selection of these classes was based on criteria such as being in their final year of elementary school and the potential knowledge they may have acquired about environmental topics across different subjects.

2.2. Strategy for the Development of Planetary Health Initiatives

During the second semester of 2022, the creation of an educational resource for the students was undertaken, encompassing all the activities conducted at the school. This resource, entitled “Planetary Health: Guide for Rural Education”, was developed as part of a larger project entitled “Planetary Health in the Amazon: Education, Health, and Sustainability”, intended for teachers in the Amazon region.

The educational initiatives at the riverside school were carried out in the first semester of 2023, involving 37 9th-grade students. Over the course of one week, the students engaged in various simultaneous activities to comprehensively understand Planetary Health topics in a participatory and transdisciplinary manner. This approach incorporated a decolonial perspective, considering other forms of knowledge [16,17].

To develop the themes of Planetary Health in the school, we have chosen participatory and transdisciplinary approaches, as proposed in the framework for Planetary Health education [18]. Various methodologies, including playful teaching, have also been incorporated.

These proposals are relevant due to the complexity and multidisciplinary integration of the involved themes, as environmental issues are complex and interconnected with various areas. Therefore, transdisciplinary and participatory approaches integrate diverse knowledge. In the case of riverside communities, these approaches can contribute to decision-making. Students can play a significant role in this process, as awareness and understanding promote greater responsibility towards planetary health issues.

The proposed activities encompassed diverse methodologies, such as educational videos, image reading, didactic games, an ecological footprint adapted to the Amazonian riverside context, practical lessons, interviews with family members, investigative pre-tests, problem-solving related to Planetary Health in the Amazon, forest tracking, readings on diseases associated with climate change, interpretation of graphs depicting the most polluting sectors, seed planting, establishment of school gardens, sanitation trail, and the development of a healthy and sustainable school diet meal (Figure 1A–G).



Figure 1. (A)—Students participating in Planetary Health educational activities; (B)—Collection of water from Lake Uruapiara; (C)—Practical lesson: simulating the greenhouse effect; (D)—Forest tracking; (E)—School garden; (F)—School meal; (G)—Classroom activity.

Teachers from various disciplines, including Portuguese Language, Mathematics, Natural Sciences, Geography, History, Arts, and Physical Education, contributed to the educational activities. This was necessary because the activities were interconnected with different forms of knowledge, whether being of scientific or local traditional knowledge.

To conclude the activities, a questionnaire was applied to allow students to evaluate the activities, asking: “What did you enjoy the most about the activities conducted during the week at school?”.

3. Implementation of Educational Initiatives

3.1. Riverside Youth

A total of 37 riverine students actively participated in the activities, demonstrating a keen interest in the topics and all the proposed initiatives. They all showed enthusiasm for how the activities were conducted. Additionally, it was evident that the participants had a limited understanding of the environmental impacts and the crucial role of the Amazon Rainforest in Planetary Health.

3.2. Teaching Strategies

The didactic activities used with the students were diverse, allowing a dialogue between Planetary Health themes and local issues in the Amazon region, specifically within the community, taking into account the students’ knowledge.

Teachers from different subjects contributed to discussing the topics in their respective areas, enabling connections between scientific content and the student’s knowledge. For instance, the Portuguese Language teacher worked on readings and interpretations, emphasizing textual genres that allowed students to understand and explain the materialization of the numerous texts we use daily. The Mathematics teacher focused on reading and interpreting graphs about polluting sectors in Brazil. In Geography, the teacher dedicated attention to environmental impacts in the Amazon biome. The History teacher discussed the industrial revolution and climate change. As for Natural Sciences, the teacher participated in all content and activities, contributing to the discussions about the topics in the classroom and in practical field activities. The teachers of Arts and Physical Education contributed to field activities and the creation of a gallery with drawings depicting the environmental changes that have occurred in Uruapiara Lake over the years.

The initial interaction with the students took place through investigative activities. These activities began discussions on Planetary Health themes in the Amazon region, which encompass climate change, air pollution, biodiversity, nutrition, water, and the connections between various types of environmental impacts and health.

The investigative questions about the themes initiated the participatory classes. This allowed an understanding of the participants’ perceptions about the topics and how they relate to the community, global issues, and scientific knowledge. Additionally, for a better understanding of the local issues under discussion, the students brought insights from their research with their families. This enabled us to learn about the changes in the community over the past years and their ways of life through the ecological footprint adapted to the Amazonian riverside context.

Thus, through these investigations, it was possible to learn about the socio-environmental habits of the students and, above all, discuss solutions to potential environmental issues highlighted in the investigation. These issues included climate change, deforestation, wildfires, lake pollution, illegal mining, garbage burning, and decreasing species, as well as significant matters like the prevalence of ultra-processed food in school snacks and strong evidence of the loss of dietary culture.

Yet, audiovisual activities were employed with the presentation of educational videos, providing insights into Planetary Health and local Amazonian issues. Below, we have a summary of each video used:

1. Planetary Health: What is it? [19]—Provides a brief description of planetary health, considering human threats to the planet and their consequences for health;

2. The World Could End in 2100 [20]—Describes the need for changes to prevent the sixth mass extinction;
3. The Time Traveler [21]—Describes the impacts of climate change and extreme events;
4. A Warning for the Future [22]—Discusses the Amazon in 2050 and the effects of global warming;
5. How the Amazon Regulates the Planet’s Climate [23]—Describes the role of the Amazon in the climate of Brazil and the world;
6. Breathe Life: How Air Pollution Affects Your Body [24]—Describes how air pollution causes various types of diseases.

The audiovisual activities had a significant impact on the students, allowing them to visualize issues they had not studied thus far but were relevant to their context. One of the videos prompted thoughtful reflection among the students, particularly regarding the concept of the “Amazonian savannah”, given the extensive destruction already experienced in this century.

In addition to the activities mentioned above, the youth engaged in image reading of the Amazon regarding environmental impacts and future ideals for the biome. They also identified issues related to Planetary Health stories in the Amazon and were encouraged to find solutions to the reported problems. Other initiatives included interpreting educational cartoons and graphs depicting the most polluting sectors in Brazil. These topics were discussed in relation to diseases associated with climate change, and the students worked on creating a gallery with drawings illustrating the changes in their local environment. All of these visual activities made valuable contributions to the students’ understanding of planetary issues.

In addition to the activities already presented, playful activities were also proposed, such as educational games like “Our Waters, Our Life”, “How do you want to see the planet in 2030”, and “Path of Planetary Health Concepts”. The playful teaching method has the potential to make learning more engaging for students, as it allows for the simplification of complex concepts.

These activities sparked an interest in the possibility of learning through plays. Above all, the students demonstrated motivation to engage with the issues presented in the games, considering primarily the need to take action to minimize lake pollution and various other concerns within Planetary Health.

Other methodological approaches used in this process included practical and field activities. These aimed to pave the way for Planetary Health within the community, strengthening the connection through nature, with activities like forest tracking, sanitation trail, tree planting, creation of a school garden, and preparing a school meal with healthy food, as well as practical proposals simulating the greenhouse effect and basic analysis of lake water with equipment. These activities were the students’ favorites, allowing them to leave the classroom, reflect on the issues already seen in theory, and contemplate how their knowledge is vital in this resilience process with planetary concerns.

3.3. Regarding the Themes of Planetary Health in the Actions Implemented in the Amazon

The employed didactic strategies addressed themes of Planetary Health, such as climate change, biodiversity, air and water pollution, and nutrition. All of these were designed to foster participatory moments and, above all, to delve into the Amazonian context. In addition to presenting the issues, each activity focused on resolving or mitigating local problems specific to the Amazon.

Among the topics, climate change is one of the most prevalent and strongly interconnected with the proposals developed in the context of the Amazon. This is due to the significance of this biome for the planet, encompassing threats to biodiversity and the maintenance of local and global climate. Investigations and discussions on this topic indicated limited knowledge about climate change and its impacts on health. However, comprehending the impacts of damages to the Amazon due to climate change was the most highlighted strategy during the activities related to this theme.

Air pollution, it could be well contextualized in various activities, especially when discussions were concerned about deforestation, wildfires, energy sources in the community and homes, waste burning, and illegal mining extraction. All of this was taken into account considering the students' own habits. However, making connections with health had a significant impact on the participants, especially during the screening of the video "Breathe Life: How Air Pollution Affects Your Body".

One of the characteristics of the Amazon is its rich biodiversity. Therefore, the proposals on this theme were based on investigations within the community, where students and their families raised significant concerns. They considered that there have already been significant changes in the community about plants, fish, and the landscape. Activities related to the theme of biodiversity were mostly carried out in the field, facilitating the students' connection with nature and strengthening their knowledge. During these activities, students often shared the common names of some species and their uses.

Addressing the theme of nutrition and Planetary Health in schools is crucial to reflect on how a healthy and sustainable diet significantly contributes to the planet. In the local school context, it was observed through the proposed activities that the food consumed by the students in the school meals is not the most suitable. In fact, both the students' reports and the menu analysis showed that ultra-processed foods were being provided and consumed in the school snacks. Furthermore, according to observations made during investigative activities, the school snacks offered had a low acceptability among the students.

The proposals also allowed some reflections on how the dietary culture observed through the activities is compromised, as local biodiversity foods are little explored among families.

The students enthusiastically participated in activities that involved planting fruit seedlings, creating a school garden, and preparing and consuming a healthy school snack. In these activities, there was a lot of interaction with the knowledge of the community itself, such as the planting techniques for fruit seedlings and the garden. This allowed some dialogues with local knowledge.

The topic of water in the Amazon led to various discussions, among which we highlight consumption, mercury contamination, basic sanitation, diseases, transportation, and recreation. The students showed curiosity about diseases and struggled to make connections between local impacts and health. On the other hand, when the discussions leaned towards contamination through illegal mining, a very common practice in the community, the students showed more resistance. According to the majority, it is the means of subsistence for many families in the community.

During the activities, the students reported that they had enjoyed the educational activities carried out at the school, expressing concerns about the future of the Amazon and, above all, did not know how much local environmental impacts compromise their health and well-being. Some phrases cited by students are highlighted below:

- "I liked the trail and all the activities that were developed. There could be more activities like these." (Student 2);
- "I liked the activities, the need to take care of nature, and not pollute the lake." (Student 10);
- "We learned more about the Amazon and environmental issues." (Student 21);
- "It was important to understand that the problems are linked to our health." (Student 29);
- "I liked the plantations, knowing about the environment and food." (Student 32);
- "It was a great experience because it allowed us to be more connected with nature." (Student 34).

4. Discussion

Despite the distinct educational approaches, various interconnections were observed between them and the themes, creating a conducive environment towards a solid under-

standing of Planetary Health concepts. This aligns with the five essential domains for Planetary Health education, namely: interconnection through nature, the Anthropocene and health, systemic thinking and complexity, and equity and justice, as well as building movements and system change [18].

Transdisciplinary approaches are favorable for engaging young people as active participants in the process of changing concepts, helping to define the field of Planetary Health education [25]. The inclusion of Anthropocene themes in education at all levels serves as a driving force for students to take action to protect and restore the planet. However, children and young people are still overlooked in approaches considering environmental impacts and their negative effects. It becomes essential to think about an educational transformation that provides substantial benefits, including the promotion of planetary awareness and management [25,26].

The proposals were well-received by the students due to the applied methodologies, the way different themes were connected, and the opportunity to relate to their daily experiences while respecting their indigenous knowledge. It is important to consider that there is no right or wrong methodology for teaching about environmental issues, but rather the active engagement of students is necessary [27], with strategies that empower them to voluntarily participate in actions that promote environmental sustainability [28]. Education needs to be an integrated process involving specific knowledge levels, as well as skills, values, perspectives, and motivations for action, aiming for inclusion and equity for all [29].

The young riverside residents showed concern about the environmental impacts on the Amazon that are already being felt in their communities. Sensitization was undoubtedly a powerful tool in this initiative, as students had little knowledge about the local and global environmental impacts that are compromising the future of humanity. Thus, Planetary Health education needs to be associated with life, especially in contexts that are still quite overlooked, such as rural communities and schools [30].

Planetary Health education goes beyond the simple promotion of scientific content, offering a range of possibilities for disseminating knowledge and developing other actions that can contribute to minimizing environmental damage. The São Paulo Declaration on Planetary Health emphasizes the essential nature of discussing planetary health early in schools, aiming to disseminate information and cultivate future leaders or decision-makers in planetary health initiatives [5].

The proposal presented here was significant for the local context and should be implemented in other regions according to the specific characteristics of each area. It allows a local diagnosis of the experienced issues and proposes alternatives that inspire young voices to take action aimed at contributing to environmental disasters.

5. Recommendations

Schools are educational spaces that contribute significantly to the construction of scientific knowledge, and it is essential that this knowledge is articulated with other students' knowledge, allowing dialogues to be fair in favor of environmental sustainability.

Thinking about educational proposals, such as projects that bring environmental themes and their interconnections with health is extremely relevant, especially in a biome of great significance for humanity. Actions that allow connections through nature are recommended, with initiatives that awaken in students the need for preservation and care.

Developing legislation focused on education adapted to each community is a promising path for Planetary Health education.

Educators also need to incorporate educational actions aimed at environmental sustainability into their educational practices, thinking about environmental impacts and their relationships with health, economics, politics, and culture, with investments being essential in the continued training of educators to address themes in the most diverse educational disciplines.

6. Conclusions

The educational actions in Amazonian schools bring up relevant reflections, such as: (1) young river dwellers can be local representatives of their community; (2) the environmental problems of the Amazon need to be part of the students' curriculum; (3) all knowledge needs to be considered for an education in Planetary Health; (4) participatory and transdisciplinary methodological approaches are effective; and (5) educating for Planetary Health is a step forward in raising awareness and developing actions for a sustainable planet.

With the points presented above, it is crucial to reconsider how environmental themes are integrated and developed in schools, to bring about a transformation in education. Students serve as conduits for disseminating these themes within their families and communities, and they are essential in the process of changing habits and actions that prioritize environmental conservation.

Thus, we concluded that education in Planetary Health is relevant for students in basic education, as it allows future generations to grow up understanding the risks and the importance of continuing to be guardians of the Amazon and engaging in actions to protect this biome.

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