

An integrated proposal for a rural school curriculum and physical infrastructure reform on Ataúro Island, Timor-Leste: a case report

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Abstract

This report presents a case study on an integrated proposal that aims to empower youth through a reform of the rural school curriculum and physical infrastructure on Ataúro Island, Timor-Leste. One of the poorest nations in the world, Timor-Leste has a predominantly young population, with 64.6% of its inhabitants under age 30 years and 35% under age 15 years. To capitalize on this demographic dividend, prompt and comprehensive education reforms are needed to enhance the quality of education and the productive capacity of the population. This paper focuses on Ataúro, an island in Timor-Leste with 10,295 inhabitants. In 2022, 44% of youths not attending school and 21% of the adults were either unemployed or economically inactive. This study presents a pilot project aimed to identify the major challenges faced by students and educators on Ataúro Island. Using a qualitative design and a convenience sample method, data were gathered through field research and analysis of official documents. The findings of this research contribute to a proposal for a concept zoning design intervention for the school aligned with a curriculum review for the local school. The project suggests that creating innovative learning environments can facilitate the transformation of school practices in a community-centered approach. This approach empowers students to address their villages' main hurdles and develop new perspectives, skills, and ways of living in their communities.

Keywords: Education reform, Learning spaces, Community education, Sustainable architecture, Bio-based design

Introduction

After centuries of Portuguese colonialism and nearly two and a half decades of Indonesian domination, Timor-Leste transitioned to a sovereign state in 2002 through a courageous struggle for self-determination. Over these last 20 years of independence, the country has remarkably improved, rebuilding institutions and promoting human development. However, despite receiving substantial oil revenues, it remains one of the poorest nations in the world. Therefore, Timor-Leste still faces tremendous difficulties to provide health, water, sanitation, and education for its citizens.

Timor-Leste has a population of 1.34 million people and is the second youngest country in the Asia-Pacific region. Approximately 64.6% of the inhabitants are under age 30 years, and nearly 35% are children under age 15 years (Timor-Leste National Institute of Statistics, 2023). Consequently, the nation is now presented with a demographic window of opportunity that will only last for a few decades. It happens when the labor force exceeds the population dependent on it, namely children and elderly. Consequently, the way the nation drives its projects on human development in the present will determine a 'youth bulge' shift into a 'youth dividend' and promote economic growth (United Nations Development Programme, 2018). One of the preconditions to promote human development and grasp this potential demographic dividend is to invest in child and youth health and education. Based on this understanding, Timor-Leste has been seeking to reduce child malnutrition and food insecurity rates, improve access to clean water and sanitation, enhance essential services, promote quality education, and generate opportunities for youth employment.

According to a recent report, East Timorese children have one of the worst nutrition levels in the entire South-East Asia and Pacific region (Food and Agriculture Organization of the United Nations, 2021). More than 63% of the families in Timor-Leste

cannot afford a nutritious diet. Across the country, intakes are commonly based on starchy staple foods such as rice and tubers, with low inclusion of vegetables and animal-source foods. Although agriculture is a vital sector and the population's primary occupation, crop yield is low (United Nations Development Programme, 2018; World Food Programme, 2019) and the country still relies on considerable imports of rice and other cereals (World Bank Group, 2020). As a result, one-third of the population suffers from recurring food insecurity (Government of Timor-Leste, 2019b). On average, urban households experience a shortage of rice and maize for two months a year. The situation is even more severe in rural areas, where this deficit can last for 3.8 months (Government of Timor-Leste, 2012). Tackling the high child malnutrition rates can improve learning outcomes, increase crop yield to support a growing economy, and nurture a healthy population (Government of Timor-Leste, 2019b).

Due to the Indonesian retreat and the militia riot during the independence process, most of the country's essential services and infrastructure (water supply systems, sewage treatment plants, electricity, and communications) were purposefully destroyed. Since then, Timor-Leste has been working to rebuild the urban water infrastructure. Nonetheless, these developments have not been evenly distributed across the country, and much remains to be done. Today, only around a third of all households have a toilet facility where wastewater is securely disposed of, and this number is significantly lower in rural areas (Government of Timor-Leste, 2019a). Moreover, approximately a third of all rural homes use unimproved drinking water sources. In 2016, about 98% of urban houses had electricity, yet only 66% of the rural houses had this service (Government of Timor-Leste, 2019a). In Dili, the capital, nearly half of the households still use firewood for cooking, whereas in rural areas, almost every house relies on the open fire method to prepare food. More than 70%/Almost a million of East Timorese live in rural areas, with limited access to information and media (Timor-Leste National Institute of Statistics, 2023).

The Indonesian eviction also had a major impact on the education system since many schools were destroyed. In addition to the degradation of the physical structures, the teaching staff also experienced a loss, because most teachers were Indonesian professionals removed from the country (Todescatto et al., 2015). Since then, the East Timorese government has made substantial progress in education, rebuilding schools, recruiting teachers, and increasing children's attendance. Nevertheless, it still strives to tackle disparities between municipalities and improve the quality of primary and secondary education (Government of Timor-Leste, 2019a). The youngsters in Timor-Leste are extremely unsuccessful in literacy, twenty-first-century knowledge and skills, and awareness of good hygiene, nutrition, and health practices. Children born in Timor-Leste today would only develop to be half as productive as possible if they enjoyed complete high-quality education and health (Government of Timor-Leste, 2019a).

Most young people are unemployed and remain idle as not enough jobs are available to those entering the labor market. Even though they complete formal education, they face considerable barriers to successfully transitioning from school to work. The Population and Housing Census 2022, revealed that 73.5% of people between 15 and 34 years of age were unemployed or outside the labour force, and just 32.1% were studying or undertaking a training course (Timor-Leste National Institute of Statistics, 2023). These numbers confirm the findings of a survey on youth well-being indicating that many young people are not involved in education, employment, or training, remaining idle (United Nations Development Programme, 2018). This situation poses a risk for the country given that discouraged and socio-economically marginalized youths keep a vicious circle of poverty and exclusion. The government acknowledges that investments in human capital and economic diversification are priorities for sustainable development and economic growth and has been working to create jobs in productive sectors such as labor-intensive manufacturing, tourism, and agriculture (Government of Timor-Leste, 2019a).

Enhancing human capital is critical to generate inclusive growth, reduce poverty, and create a more productive and healthy society. Investing in people through quality education, health care, and nutrition can lead to higher individual earnings and a more productive economy. Education is crucial in interrupting generational poverty and disease and provides the foundations for sustainable development. The rare opportunity opened by the current demographic dividend requires prompt and comprehensive education reforms to enhance the quality of primary and secondary education, as well as the productive capacity of the East Timorese population to develop the local economy, increase household incomes, and improve the conditions of the active population (United Nations Development Programme, 2018).

Community education and social innovation

To achieve the Sustainable Development Goals by 2030, countries are expected to expand and transform their education systems, providing universal access to basic education from primary to upper secondary education, improving quality, and reducing inequalities in learning outcomes (Sachs et al., 2021). Delivering inclusive and equitable quality education and lifelong learning opportunities requires skills beyond literacy and numeracy, including those needed to promote global citizenship and sustainable development (United Nations, 2015). These goals emphasize the range of skills required to comprehensively prepare children, youths, and adults to exercise citizenship and promote life in the twenty-first century. For that, the United Nations Educational, Scientific, and Cultural Organization (1990, 2015) advocated for a competency-based curriculum model, deepening the focus on the skills of learning to know, learning to do, learning to be, and learning to live together, the well-known four pillars of education (Delors et al., 1996).

However, most countries still have curricula organized around the content to be taught rather than on competencies and skills to be developed by the students. Introducing a curriculum focused on competencies requires significant changes in education systems, from curricular reforms to a shift in the pedagogical approach involving teaching methods, assessment concepts, and strategies. It is essential to rethink the teaching model based on transmission, in which teachers transmit factual knowledge to their students but not necessarily the latter understand and apply it (Comfort & Timms, 2018). Consequently, schools and teachers need to be prepared for this new challenge.

Thus, teaching practices must shift from mere transmission models to knowledge construction. This transition approach should enable students to learn from their mental models and real-world experiences to apply their knowledge meaningfully. For this new approach to achieve its purposes, students must discuss, justify, or prove a possible evidence-based position. To implement this, students must learn to ask questions, recognize problems, analyze, and interpret data, as well as obtain, evaluate, and communicate information. The practice of asking questions can lead to the planning and execution of a team investigation, which, in turn, may require the interpretation of data and discourses. These activities include highly demanded language, science, technology, engineering, and mathematics skills. Furthermore, these competencies require good collaboration and communication skills to strengthen teamwork.

Since young people are the agents of change, empowering them to implement the Sustainable Development Goals is essential. To foster youths as those who will bring lasting changes to the good of the people and the planet, they must be educated to identify the needs of their communities, get their hands on, and find innovative solutions to their communities' main hurdles. Students must be prepared to understand the complexities of today's challenges and cooperate in providing creative and innovative solutions.

Many of the persistent social and environmental issues that developing nations face may be best solved by local social enterprises that may discover better and more sustainable solutions than external experts. Thus, countries must educate and prepare young people to be invested in the resources, support, and space to deliver solutions.

Paulo Freire, a Brazilian philosopher and educator, developed the foundations of what we currently know as community education for social and structural changes from a critical approach. He introduced the idea that learning should be integrated into its context, resulting from not only being in it, but with it, and not from simple adaptation, accommodation, or adjustment. 'Integration results from the ability to adjust to reality plus that of transforming it' (Freire, 1967, p. 41, translation by the authors). Therefore, all spaces are potentially educational, reflecting our reality and daily life. Currently, a movement to recontextualize educational action based on the revaluation of the school territory is gaining momentum to bring the school closer to the productive dynamics of its region. Education for local development is directly linked to the understanding that education should not only serve as a springboard for people to escape their region but also give them the knowledge needed to help transform it (Dowbor, 2006). For this reason, we need to educate people who can actively participate in initiatives capable of changing their surroundings and generating constructive dynamics.

Thus, the educational process in contemporary social life cannot support the certainty that learning is restricted to school buildings and timetables. It is also no longer possible to believe that the success of education lies in a homogeneous curriculum proposal out of the student's life context. Learning is flexible in location and occurs inside or outside the institutional physical space. It may occur anywhere and increasingly needs a community-centered approach that enhances students' collaborative construction of meaning via different perspectives on shared experiences. Students must know and understand the reality of where they live and where they will be called to participate as citizens and professionals. Considering this, pedagogical proposals must be based on academic and community knowledge dialogue, viewing the community as a potentially educating place.

When education systems promote such innovations through curricular reforms, the implications for pedagogical practices must be considered. Embedding twenty-first-century skills in the curriculum demands a school environment fostering collaboration, problem-solving skills, critical thinking, creativity, and mastery of information and communication technologies. The teacher is no longer the central actor in the process, who holds all the knowledge and transmits it to students who, theoretically, absorb it passively. Instead, the learning processes are meant to be organized so that students can work in groups and learn actively and interactively under the supervision and support of teachers. For that, schools and classrooms must be transformed.

Practice changes involve an overall change in every aspect of the school (Kokko & Hirsto, 2021). A discussion of education that does not include the physical spaces where it occurs cannot be complete. Since the physical school environment is, in essence, the place for developing the teaching-learning process, the architecture of schools is also part of the education system (Scarpato et al., 2020). Schools are designed spaces that project a system of values in their materiality. Halls, corridors, playgrounds, classrooms, and furniture items indicate prevalent worldviews and notions of pedagogy. Simultaneously, they represent technical solutions related to contemporary views of how teachers and learners should act and interact in designed spaces. Additionally, the ways school buildings are used and experienced by the educational community give them meaning and change over time and with use (Burke & Grosvenor, 2008). To practice citizenship education, it is necessary to reorganize school spaces to be participatory and inclusive.

The study

The principles presented in this report are implemented as part of a pilot project in the study area of Vila Maumeta high school, on Ataúro Island, in Timor-Leste. The main challenges of this study are redesigning a foundational structure of an existing environment through architectural interventions and sustainable engineering that considers curriculum and learning beyond school grounds. The project assumes that innovative learning spaces can support the reconfiguration of school practices in a

community-centered approach that will enable students to understand the main problems of their villages and construct new ways of thinking, working, and living in their communities.

The study adopted a qualitative design with a convenience sample method. Data were gathered through field research and involved three main areas:

1. Analysis of official documents, stakeholders' reports, and general secondary education curricula;
2. Semi-structured interviews with government officials, school leaders, teachers, and students, and analysis of the physical infrastructure of a rural secondary school;
3. Proposal of a concept zoning design intervention for an Ataúro high school by architecture students as part of an accredited Master of Architecture Design studio project.

School context

Ataúro Island is located 25 km from the capital Dili and is surrounded by the Indonesian islands of Alor and Wetar. The area is approximately 140.5 km², and 10,302 inhabitants spread over 19 small hamlets that makeup five villages: Beloi, Biqueli, Macadade, Maquili, and Vila Maumeta (Direcção Geral de Estatística, 2018; Timor-Leste National Institute of Statistics, 2023). Surrounded by a virgin reef with incredible biodiversity, the island has unique marine beauty and great ecotourism potential. Beloi, Biequeli, and Vila Maumeta, located on the right side of the island and closer to the port, have the best infrastructure and the highest prevalence of tourism.

However, the poor road infrastructure undermines access to the other villages and, in some of them, it is possible to arrive only on foot or by boat. Furthermore, the electricity distribution grid through all these villages is still challenging. Therefore, renewable energy projects are considered a priority on the island to minimize its dependence on diesel-fueled generators and imports from the main territory of Timor-Leste. Similarly to the reality in the other rural areas of the country, but exacerbated by its isolation, the population of Ataúro suffers from periods of low food consumption. In addition, the effects of climate change such as frequent and torrential heavy rainfalls resulting in flooding and landslides continue to significantly affect agricultural production, communication, movement through the island, storage of crops, and produce, amongst other issues. Also, as in other parts of the country, 97% of households still use firewood for cooking (Government of Timor-Leste, 2012).

This population's main revenue sources are fishing, sea transportation, handicrafts, employment in the public service, and pension for those over 60 (Silva & Oliveira, 2020). In the 2022 Census, around 65% of the working-age population aged 15 years and over were unemployed or economically inactive. Fishing is the main activity for women, men, and youngsters. They mainly use traditional fishing gear such as nets and spears, and the fishing fleet is composed of wooden rowing boats. Fish are usually sold in the villages directly to consumers or through small traders. However, because fishers cannot rely upon this activity as the only source of income for their families due to unstable seasons, most of them perform other economic activities such as farming and handicrafts as an alternative source of livelihood that can supplement the family income. The lack of a 24-hour supply of electricity also hinders this industry, which would require refrigeration for the fish products to be commercialized at a larger scale and throughout seasons. Although subsistence agriculture is also essential for men, women, and youths, most young people want to abandon this activity. Handicrafts are another vital source of income sold directly to tourists visiting the island or on the beaches and shops in Dili. The most important initiatives are the women's cooperative *Bonecas de Ataúro* (Ataúro Dolls) in Vila Maumeta and the *estátuas manukokorek* (crowing rooster statues) carved by men from Maquili. Once more, the younger generation does not value the art craft production since they do not see any prestige in this activity (Silva & Oliveira, 2020) or any stability of income and, therefore, value. Most people with paid jobs work for the

government as teachers and health professionals or in the tourist sector (accommodations and restaurants).

Relying on the country's natural beauty, rich history, and cultural heritage, one of the government's strategies is to attract the growing tourist market segment that seeks unique experiences in particular locations. To achieve this goal, they intend to develop offers in niche markets for visitors looking for adventure tourism, scuba diving, marine tourism, hiking, and cultural and historical tourism experiences. Ataúro has excellent ecotourism potential and is one of the leading touristic destinations in the country. Due to its proximity to Dili, the island benefits from relatively easy access and can offer tourists a true tropical island retreat. In addition, it is believed that the traditional culture of rural communities, handicrafts, music, and dance will provide visitors with memorable experiences. Nonetheless, the island still needs further development to explore this potential before embracing tourism as an essential industry for economic growth. Human capital development is undoubtedly one of the most significant challenges moving ahead.

Although approximately 48% of the population of Ataúro is within school age (Direcção Geral de Estatística, 2018), the island has only one general secondary education school and one secondary technical vocational on fishing, which had 381 and 179 students enrolled in 2019, respectively. The population within secondary school age on Ataúro Island is nearly 1,000 today, which shows that approximately only half of them are currently enrolled in schools. On our visit to the island, the technical vocational school was located in a newly refurbished building. However, according to what we heard in the community, it was not in use due to lack of materials. We visited the general secondary school in the morning, but we found primary school activities taking place, because both primary and secondary schools share the same building. These school facilities, the focus of the present study, are located in Vila Maumeta and comprise five pavilions for classrooms, two still in use, constructed during the Indonesian period (Figure 1).



Fig. 1. Overall views with site planning and school surroundings. (A) Site planning of the existing high school in Vila Maumeta (project designed by Master of Architecture Design students). (B) Existing pavilion with solar energy, donated by the Ministry of Education of the Government of Japan. (C) Two pavilions with a central landscaping area for students to sit/rest. (D) The main entrance of the school leads to the main road to the east; two old pavilions currently used as storage areas, library to the left and storage to the right. (E). Students and teachers walk long distances to the school in the morning (up to 3 hours walking) (photos taken by the second author).

The two pavilions that the primary school is using, located on the south side of the site planning (Figure 1a), were built after 1999, and they have recently received funding from the Japanese Government. Nonetheless, the plans for these buildings are not flexible (wall arrangements, heights to accommodate different uses, ventilation, lighting, or acoustics) and continue to repeat the model of mere transmission of knowledge, and not knowledge of construction. Additionally, there is still poor connectivity with the outdoor spaces, which could be expanding the areas for integrated learning through landscaping. These buildings have a small photovoltaic solar system that generates

supplementary classroom energy. Unfortunately, we did not have access to power bills or specific quantitative data about the efficiency and monitoring of the system. Still, based on the interviews, the system was offsetting well the diesel-generated consumption for lights in the classrooms.

Students and teachers' access to school (Figure 1e) is made mainly on foot. In an interview, one teacher told us he walks 3 km daily from his residence in Maquili to the school in Vila Maumeta, which takes him one and a half hours, repeating the same route at the end of the day. According to him, due to the mountainous terrain and rocks, it would be impossible to travel on this route in any other way. Therefore, from the moment this teacher leaves his home, at 6 am, until he is back, at nearly 3 pm, he has no opportunity to have a meal.

The other pavilions, located on the northeast side of the site planning, which have been used by the secondary schools, are highly damaged as they remain from the time of the Indonesian occupation and have not had any maintenance (Figure 2). Both the interior and the exterior spaces are not considered safe structures (Figure 2b), with possible asbestos exposure in the roofing. Concrete structures are exposed and corroded, and floors, walling, and ceiling systems are structurally damaged, with vandalized fenestration (doors and windows). The lack of electricity connection to these pavilions considerably restricts the possibility to develop any activities, not to mention the lack of thermal, acoustic, or visual comfort, essential infrastructure aspects for students' learning in classrooms.



Fig. 2. Northern site views of the school. (A) Rubbish is disposed of near areas of crop cultivation. (B) Existing pavilions built during the Indonesian occupation, located on the northeast side of the site planning. (C) The school administration personnel and teachers use a large, dark, damp room. The room for the library is closed, functioning as a deposit. (D) Existing landscaped gardens are full of established trees, natural seating areas made of stones or tree offcuts, and a concrete area used for sports/recreation (photos taken by the second author).

The illuminance or light levels in the classrooms are dangerously low (100–150 lux at times, Figure 2c). When it rains, the closure of windows would make it worse, with the addition of more thermal discomfort, due to lack of proper ventilation, high humidity levels, and high temperatures. Timor-Leste has a tropical climate, and passive cooling

techniques would be a primary target for any design that aims for sustainable classrooms and infrastructure improvement.

The students' textbooks are piled in a room of a house where a teacher and his family live. Two mothers take turns daily to prepare meals for primary school students (no lunch program is available for secondary school students). They use a room with only a table; no stove, refrigerator, or other kitchen utensils are available. Inside the area of the school, the teacher's family cultivates crops for their own consumption. The bathrooms for students and teachers are the same but currently closed because 'there is never water' to ensure their functioning.

The outside area is spacious and full of trees. A cement area serves as a half sports court in the center of the site (Figure 2d), separating the old and new pavilions. In our interviews, we asked teachers if they use outdoor spaces to promote activities with students. All answered that this was not the case. This is no surprise, since even seating is precariously provided by improvised bamboo benches, made of stripped bamboo that is nailed and placed outside (Figures 3a and 3b).



Fig. 3. Outdoor areas: potential learning spaces. **(A)** Students often sit under trees, and on benches, or just socialise outside. This might be the ideal place to stay in sunny days, but not with heavy rainfalls. **(B)** A precarious bench built out of firewood and bamboo (photos taken by the second author).

The way the benches have been made, using nails rather than any other types of joineries, shows the lack of skills and knowledge of their context and the resources that could be used for their infrastructure improvement (Figures 3a and 3b). Bamboo is an abundant resource in Timor-Leste, not necessarily on Ataúro Island, but it can be easily and fastly grown. Bamboo is a building material that can last for decades if properly treated. It is also cheap and strong and provides opportunities for learning and collaboration, and most importantly, for self-sufficiency in communities.

Concerning the resources available to support their work, the teachers claimed that larger classrooms, with up to 60 students, would be desirable to accommodate their groups. They also stated that it is fundamental to have an electricity connection that could be widely available at no cost, so that they could use the Internet, computers, sound equipment, laboratories, and a library. Flexible spaces that are self-sufficient in energy are considered essential for improving the quality of education before anything else.

As part of the brief to the Master of Architecture students involved in the project, we stated that it is important for the interventions in this site to include five basic principles:

1. The school grounds should trigger economic diversification within the community through an integrated curriculum and activities that could enhance livelihoods and promote lifelong learning opportunities, inclusive of the communities of Ataúro (closer and isolated).

2. The spaces should provide opportunities for change and the involvement of the young population in their own education, employment, and training as they become agents of change once they have the tools and spaces to do so.

3. Teaching practices need to reflect a knowledge construction model, with flexible, collaborative, comfortable, creative, affordable, and diverse spaces promoting discussion and sustainable practical solutions, and all spaces are potentially educational.

4. The school should double the number of students now able to attend it, from 400 to 800 students, in two terms, morning and afternoon, provided that the primary school students moved to another location.

5. The design interventions need to happen in stages, and in doing so, they should be flexible in how the architecture and the sustainable engineering solutions can be implemented. This is to give opportunities for the community to learn what is being proposed by experiencing and experimenting it. Based on these experiences, they can develop their own unique solutions and from that create and revalue their school territory and bring the school closer to the productive dynamics of its region.

After all, the goal is to educate people who can actively participate in initiatives capable of changing their surroundings and generating constructive dynamics by sharing community experiences. The pedagogical proposals that could happen at the school grounds, with spaces now fit for purpose, would allow viewing the community as a potentially educating place.

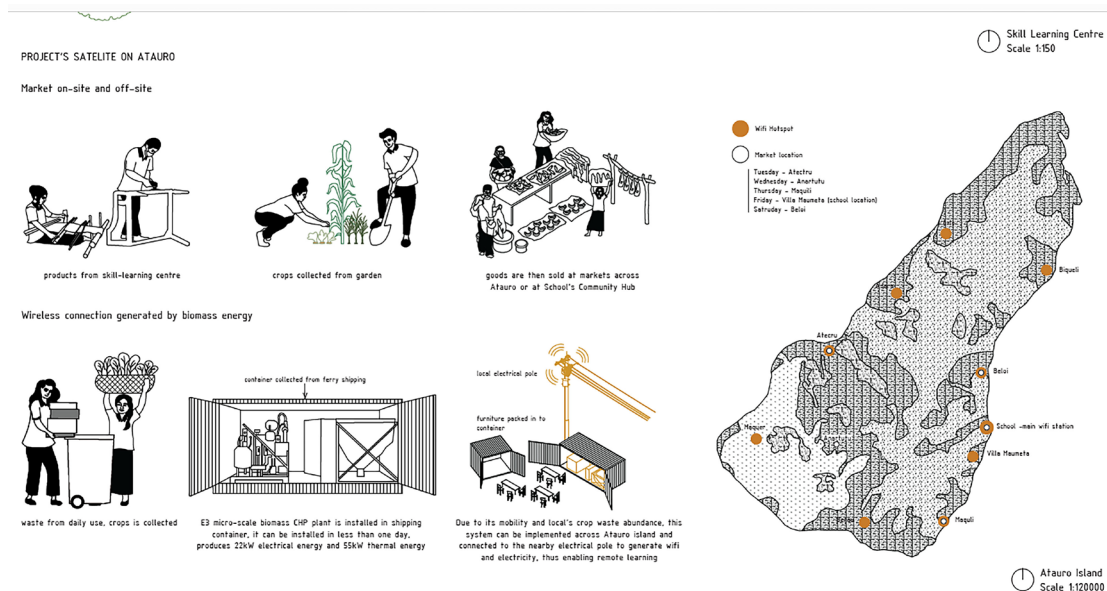


Fig. 4. Mapping of existing marketing locations and future physical spatial interventions led by communities with potential activities to be encouraged (project designed by Master of Architecture Design students).

Results and discussion

The infrastructure problems, or the lack of infrastructure observed during the site visits to the study case on Atauro Island, have been exacerbated by the isolated context of the place. Still, it is not an atypical event throughout Timor-Leste or in Atauro. The difficulties encountered at the school are reflected across the island; therefore, it is possible to consider spatial zoning as an expanded intervention beyond the school boundaries. Trying to replace infrastructure alone, without the involvement of the communities that are served, and without monitoring and support for training and development seems counterproductive.

The first step on the evaluation of the territory was to determine the possible connections that the school could make with the isolated communities, in a physical level, responding to the initial principle of the brief. The Master of Architecture students identified the markets already happening every week across the island, and the different groups that participate in them such as artistic and crafting. People gather on specific days of the week in these areas, coming from different villages. Creating a community hub to support learning and activities could be a first project/step towards connecting

those today isolated and without education and the community. The satellite hubs, or skill learning centers, would be small containers/structures built and designed for disassembly for easy transport as a flat pack at the workshop of the high school on Ataúro Island, out of local materials, and transported to the different sites where existing markets take place every week. The tools and capacity/making of each container/unit would be determined by the activities already in place in each market such as carving, agriculture, fishing, and furniture making. This would enhance the existing characteristics of this particular area. The skill learning centers could be used both by adults and youths. These centers are an opportunity for the school to come to communities, for intensive courses to happen, and for different modes of delivery that can integrate their needs and the school grounds (Figure 4).

The new zoning plan intervention understands the meaning of memory and place and how people relate to such events (Figure 5). It has been determined that it is necessary to demolish the existing pavilions in some areas of the school site, namely central and to the right, where the old classrooms and library are located. These functions (classrooms/learning), however, have remained there. Children tend to relate to views, landscaping, positions of trees, and even the sunset. Complete change of such elements is not always recommended, and this plays an important role in accepting new interventions and spaces.



Fig. 5. New proposed site planning for the school (project designed by Master of Architecture Design students).

The project proposal was designed as a Lego building block set, which can be built individually or connected to other modules. It is a playful combination for the co-existence of internal and external spaces that aims to promote flexibility of a classroom in its multiple pedagogical needs. The larger classrooms are equipped as multi-purpose areas, and the smaller ones can be upgraded in the future. All classrooms are made out of modular materials such as bamboo, timber, clay bricks, and organic mycelium panels that can be made at the school's workshop. Students can be a part of the construction

The bigger classrooms have now been transformed into a digital computer area, a library, and arts classrooms for larger projects such as dance, theatre, music, television, and radio, which can be a place of study inside, as well as for presentations and multimedia use for the students and the community to access the world (Figures 8 and 9). Outside, the spaces can be expanded for presentations, artistic productions, or whatever the community thinks is necessary for their development.

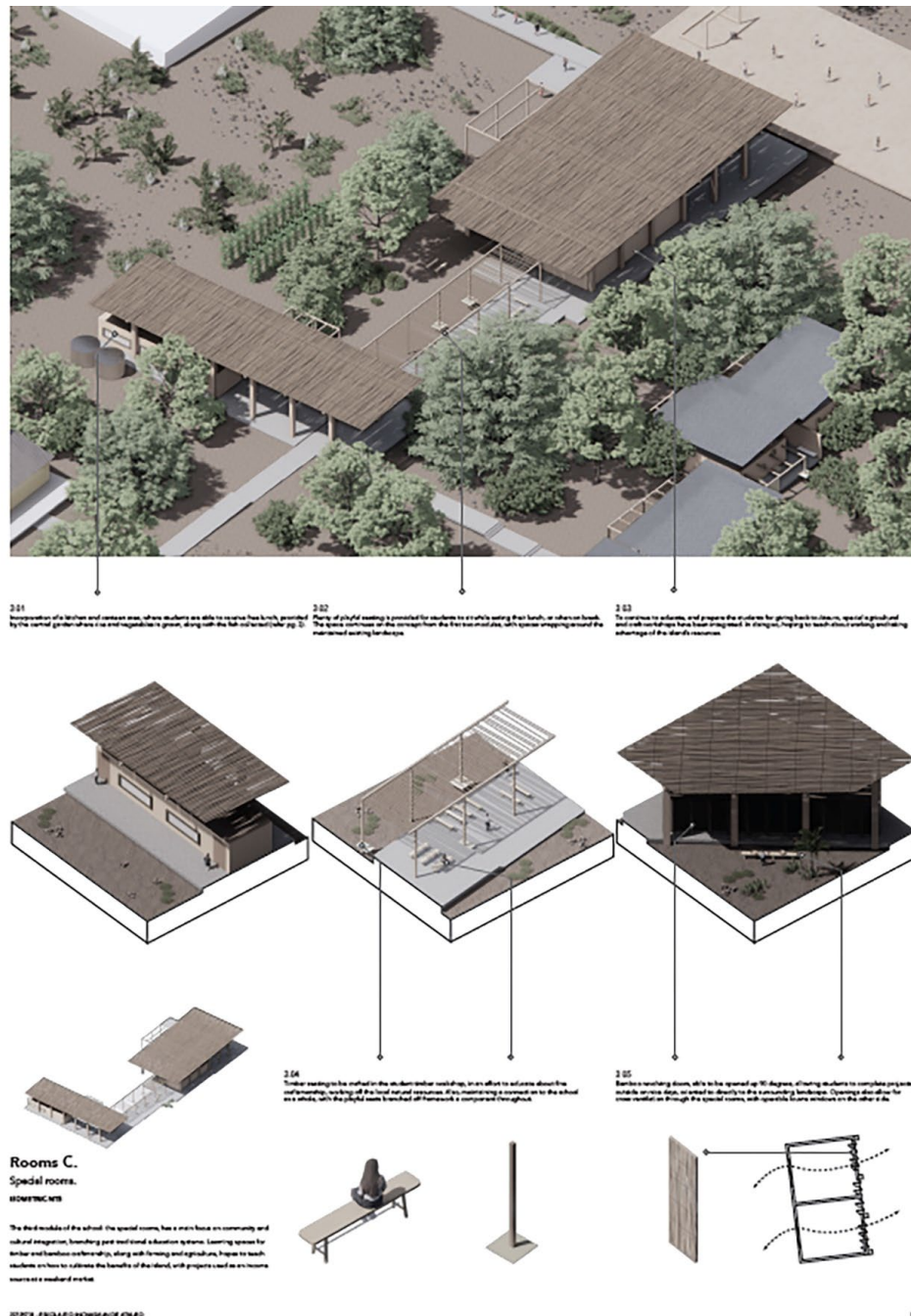


Fig. 7. Potential combination of materials and components for classrooms and furniture (project designed by Master of Architecture Design students).

Near this larger congregation area, the administrative block has been moved and placed at a central position to support such activities and help those who are arriving and are new to the school as well as to students. Blocks of toilets have been created near this area (south of the site) and equipped with a rainwater collection system that has storage under the elevated slab, pumped to the toilets by the solar photovoltaic system throughout the day. Another block of toilets has been placed near the courts at north of the site, where the kitchen, agricultural area, and workshop facilities are also located.

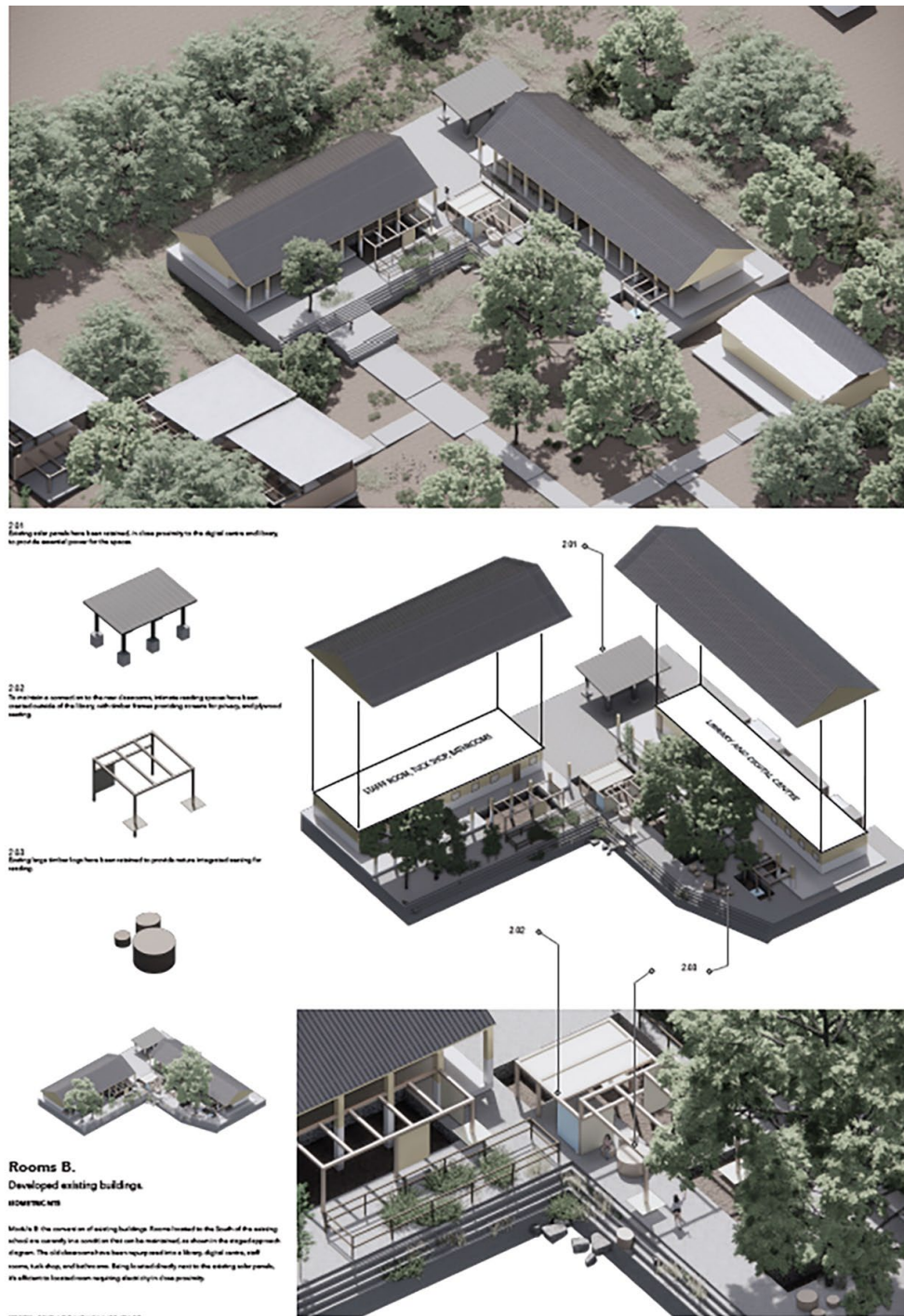


Fig. 8. Existing classrooms refurbished for integrated learning and indoor/outdoor activities (project designed by Master of Architecture Design students).

At the north end are the agricultural land production, the workshop, and the courts at the very end (Figure 10). In this area, more community activity is meant to happen by creating a new access road at the top left side. The spaces are flexible in their use and, again, made of sustainable materials that can be produced and manufactured on the site, requiring low skilled labor. The modularity of the design makes it easy to assemble and yet appropriate for its functions and use in a tropical climate.

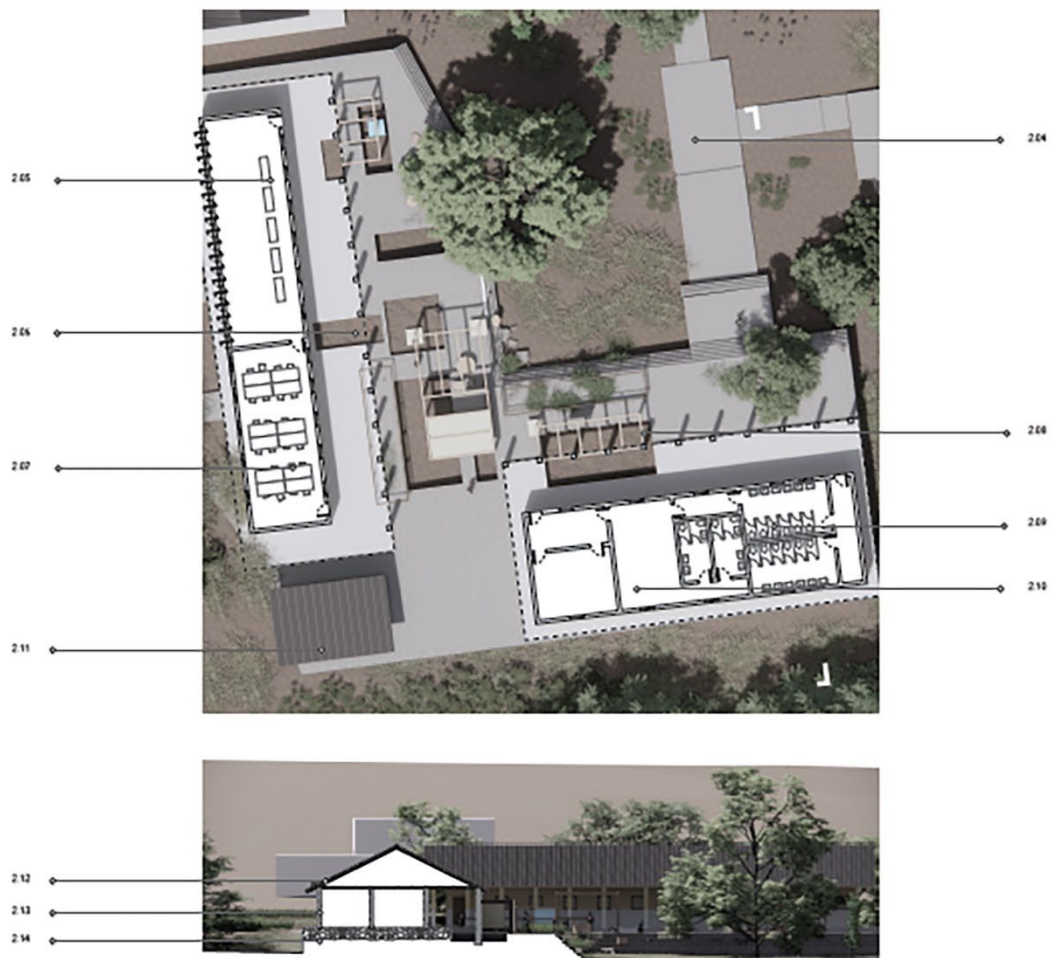
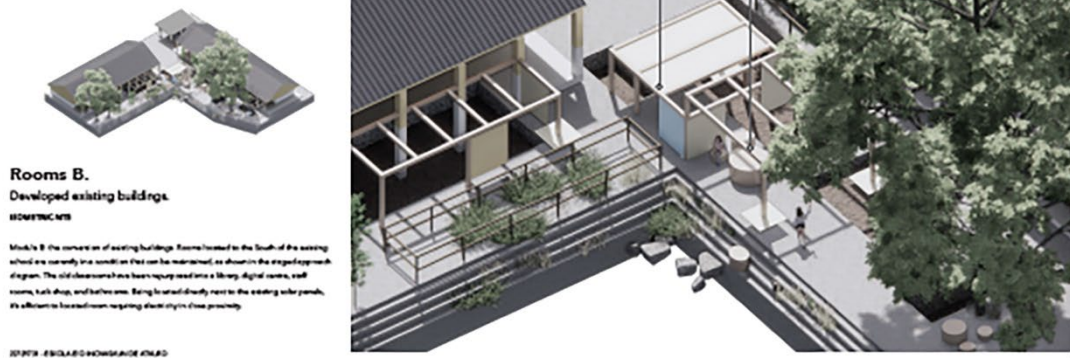


Fig. 9. Internal layout of refurbished classrooms with library, arts classroom, and digital classroom (project designed by Master of Architecture Design students).

The permaculture gardens proposed find support in local community groups already well established throughout Timor-Leste. Additionally, they are essential for implementing a meal program for secondary school students and teachers. The opportunity to link with local specialists, who could come to the school and connect with the students, to set up such a project would be a source of knowledge to all involved, from teachers, to students, to community members. The higher added value to permaculture products, the opportunities for economic diversification on the island, and the use of the workshop to create their own environments allow for the building of self-sufficient community and rely on the collaborative power of construction.

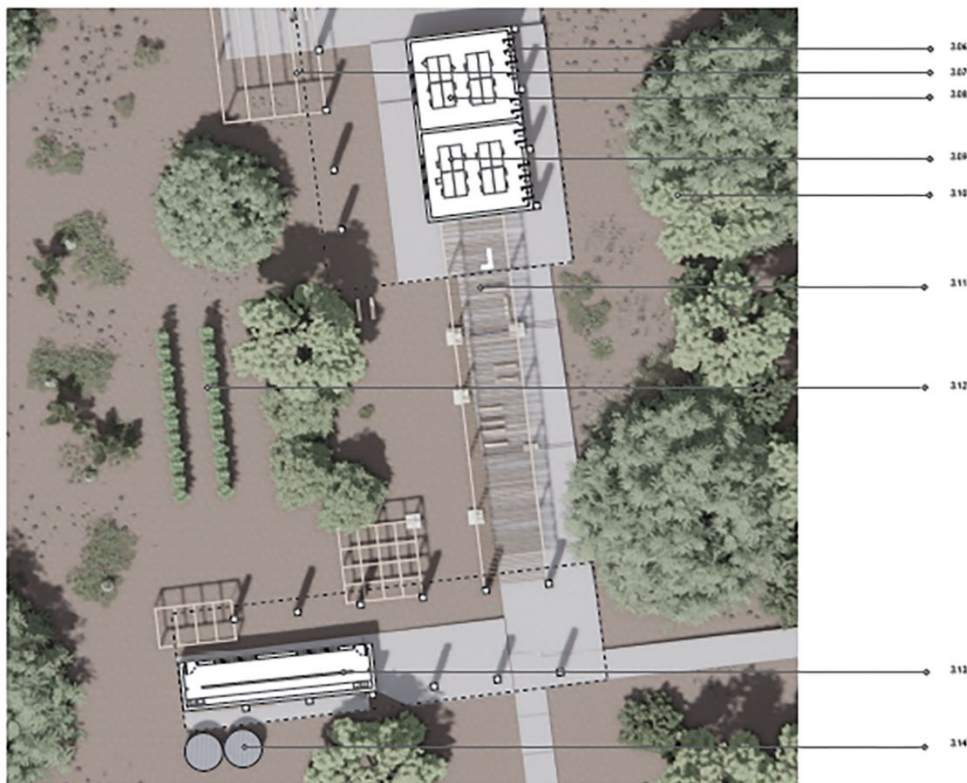


Fig. 10. Workshop and permaculture pathway: open areas allowing making it within the school and with the community (project designed by Master of Architecture Design students).

The sewage and water treatment systems can become effective tools for community learning and prevent extensive waterborne diseases, not only for school grounds but beyond in the communities (Figure 11). The kitchen and the potential use of biomass from the waste products for energy production can become a source of learning for the science classes. This knowledge can be easily transferred to the many homes on Ataúro Island that until today use firewood for cooking.

By creating spaces that align with a pedagogical goal of empowerment for knowledge of construction, students become agents of change and there are no limits to what they can achieve. This can open the possibility of selling products obtained within the school grounds and beyond such as organic foods, bio-based furniture, sustainable buildings, clothing, artistic ventures, and so on, since the potential is enormous.

ROOT ZONE WATER TREATMENT SYSTEM

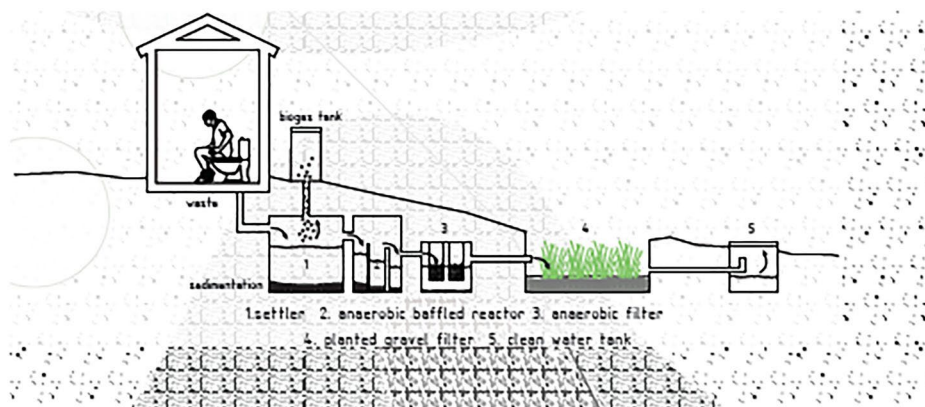


Fig. 11. Schematic section of wastewater treatment system (project designed by Master of Architecture Design students).

Such initiatives as conceptual spatial zoning are hypothetical, based on the observations of technical individuals and counting on their experiences and knowledge. Each initiative would require considerable curriculum planning, support of community members, and involvement of nongovernmental organizations and the government. Without community involvement and consultation such observations are empty and meaningless. Conceptual spatial zoning is essential, though, to generate scenarios, especially in traumatic or post-war contexts as is the case of Timor-Leste. It is also important to refocus those involved into creating teaching practices committed to developing skills aiming to help people transform their environment in connection with their contexts and not just escaping from them.

Conclusions

This pilot project proposes a curricular and physical infrastructure reform of a high school on Ataúro Island, Timor-Leste. The project aimed to address the pressing challenges faced by students and educators to enhance the quality of education and promote youth empowerment in a region with significant socioeconomic constraints.

Given that Timor-Leste is one of the poorest nations in the world and has a predominantly young population, it requires urgent and extensive education reforms to harness the potential of its demographic dividend. To address the challenges faced by this young nation, it is crucial to invest in quality education, healthcare, and nutrition. These investments are essential to empower the younger generations, enhance economic productivity, and promote sustainable development.

This pilot project emphasizes the importance of innovative learning environments and community-centered approaches to reshape educational practices. By integrating a competency-based curriculum model that focuses on the four pillars of education, namely learning to know, learning to do, learning to be, and learning to live together, the proposal seeks to foster critical thinking, problem-solving skills, creativity, and collaboration among students. It recognizes that education plays a vital role in breaking the cycle of poverty and disease, empowering young people as agents of change.

Moreover, it highlights the significance of local solutions to address persistent social and environmental issues. As a result of promoting social enterprises and community

engagement, Timor-Leste can tap into the creativity and resourcefulness of its own population to find sustainable solutions. The proposed curricular and infrastructural reforms aim to prepare young people to actively participate in their communities, identify local needs, and develop innovative solutions.

The integration of physical infrastructure reforms with curriculum changes is of paramount importance to create effective learning environments. The proposed zoning design intervention considers the unique context of Ataúro Island, incorporating elements of memory, place, and community participation. The use of modular materials such as bamboo, timber, clay bricks, and organic mycelium panels not only aligns with sustainability principles, but it also involves students in the construction and ownership of their learning spaces.

Furthermore, the project recognizes the significance of inclusive and participatory school spaces. The new design envisions flexible classrooms, outdoor learning areas, and community hubs that encourage collaboration, knowledge sharing, and engagement with the local environment. The inclusion of permaculture gardens, waste management systems, and sustainable energy solutions provides opportunities for community learning and economic diversification.

However, it is essential to acknowledge that the proposed reforms are hypothetical and require careful planning, community involvement and support from various stakeholders. Collaboration with government agencies, local specialists and school professionals is vital for successful implementation. This proposal highlights the need for ongoing consultation and community engagement to ensure the relevance and effectiveness of the proposed initiatives.

In conclusion, the proposed curricular and infrastructural reforms are structured as a holistic approach to education that prioritizes youth empowerment, community engagement, and sustainable development. Integrating innovative learning environments, competency-based curricula, and participatory design principles aims to equip young people in Timor-Leste with the skills, knowledge, and agency to effectively address the challenges they face and contribute to the betterment of their communities and society as a whole.

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Author contributions

Raquel Scartezini conducted documental research for the project and was responsible for its educational aspects. Both authors carried out fieldwork on Atauro Island. Rosangela Tenorio led the Master of Architecture Design studio project, while Raquel Scartezini served as a guest lecturer in the course and also acted as a judge for the students' projects. The results and discussions were jointly elaborated by both authors.

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Availability of data and materials

The datasets used and/or analyzed during the currently study are available from the corresponding author upon reasonable request.

Declarations

Competing interests

The authors declare no conflict of financial or no-financial interests.

References

- Burke, C., & Grosvenor, I. (2008). *School*. Reaktion Books. (Objekt Series).
- Comfort, K. B. & Timms, M. (2018). A twenty-first century skills lens on the common core state standards and the next generation science standards. In E. Care, P. Griffin, M. Wilson. (Ed.), *Assessment and teaching of 21st century skills: Research and applications* (pp. 131–144). Springer.
- Delors, J., Al Mufti, I., Amagai, I. A., Carneiro, R., Chung, F., Geremek, B., Gorham, W., Kornhauser, A., Manley, M., Quero, M. P., Savané, M. A., Singh, K., Stavenhagen, R., Suhr, M. W., Nanzhao, Z. (1996). *Learning: The treasure within: Report to UNESCO of the International Commission on Education for the Twenty-first Century*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000109590>. Accessed 16 January 2024.
- Direcção Geral de Estatística. (2018). *Dili em números: estatística município de Dili* [Dili in numbers: Dili municipality statistics.]. <https://www.statistics.gov.tl/wp-content/uploads/2020/03/Dili-em-Numeros-2018.pdf>. Accessed 16 January 2024.
- Dowbor, L. (2006). Educação e desenvolvimento local [Education and local development]. *IBAM, Municípios, Revista de Administração Municipal*. <https://dowbor.org/wp-content/uploads/2006/04/06EDUlocal.doc>. Accessed 16 January 2024.
- Food and Agriculture Organization of the United Nations. (2021). *Asia and the Pacific regional overview of food security and nutrition 2020: Maternal and child diets at the heart of improving nutrition*. <https://doi.org/10.4060/cb2895en>.
- Freire, P. (1967). *Educação como prática da liberdade* [Education as the practice of freedom]. Paz e Terra.
- Government of Timor-Leste. (2019a). *Report on the implementation of the sustainable development goals: From ashes to reconciliation, reconstruction and sustainable development: Voluntary National Review of Timor-Leste 2019*. https://sustainabledevelopment.un.org/content/documents/23417TimorLeste_VNR_2019_FINAL.pdf. Accessed 16 January 2024.
- Government of Timor-Leste. (2019b). *The first IPC analysis report on the chronic food insecurity situation in Timor-Leste: Evidence and standards for better food security and nutrition decisions*. https://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/3_IPC_Timor%20Leste_CFI_20182023_English.pdf. Accessed 16 January 2024.
- Government of Timor-Leste. (2012). *Timor-Leste plano estratégico de desenvolvimento 2011–2030* [Timor-Leste strategic development plan 2011–2030]. http://timor-leste.gov.tl/wp-content/uploads/2012/02/Plano-Estrategico-de-Desenvolvimento_PT1.pdf. Accessed 16 January 2024.
- Kokko, A. K., & Hirsto, L. (2021). From physical spaces to learning environments: processes in which physical spaces are transformed into learning environments. *Learning Environments Research* 24, 71–85. <https://doi.org/10.1007/s10984-020-09315-0>.
- Sachs, J., Kroll, C., Lafortune, G., Fuller, G., & Woelm, F. (2021). *Sustainable development report 2021: The decade of action for the Sustainable Development Goals*. Cambridge University Press. <https://s3.amazonaws.com/sustainabledevelopment.report/2021/2021-sustainable-development-report.pdf>. Accessed 16 January 2024.
- Scarpato, M., Branda Junior, N. A., & Silva, S. A. I. (2020). O espaço físico na educação escolar: uma discussão a partir de Michel Foucault e Paulo Freire [Physical space in school education: a discussion based on Michel Foucault and Paulo

- Freire]. *Revista Epistemologia e Práxis Educativa*, 3(2), 1–28. <https://doi.org/10.26694/epeduc.v3i2.11413>.
- Silva, K., & Oliveira, A. C. R. (2020). Managing artifacts: Empresa Di'ak's commodity production practices in Atauro, Timor-Leste. In K. C. Silva (Org.), *Performing modernities: pedagogies and technologies in the making of contemporary Timor-Leste* (pp. 99–126). ABA Publicações, AFIPEA. https://www.academia.edu/45168390/Managing_artifacts_Empreza_Diaks_commodity_production_practices_in_Atatau_Timor_Leste_1. Accessed 16 January 2024.
- Timor-Leste National Institute of Statistics (INETL) (2023). Timor-Leste Population and Housing Census 2022 Main Report. Timor-Leste National Institute of Statistics. https://timor-leste.unfpa.org/sites/default/files/pub-pdf/final-main-report_tlphc-census_2022.pdf
- Todescatto, C., Scartezini, R. A., & Cunha, F. S. R. (2015). A cooperação educacional brasileira no ensino superior em Timor-Leste [Brazilian educational cooperation in higher education in Timor-Leste]. In M. D. Guedes, R. A. Scartezini, A. T. Barbosa, R. T. Canarin, E. Rosalen, A. G. Ramos, & S. S. Carvalho (Org.), *Professores sem fronteiras: pesquisas e práticas pedagógicas em Timor-Leste* [Teachers without borders: pedagogical researches and practices in Timor-Leste] (pp. 171–186). NUP/UFSC. <https://dicite.paginas.ufsc.br/files/2016/08/PROFESSORES-SEM-FRONTIEIRAS.pdf>. Accessed 16 January 2024.
- United Nations. (2015). *Transforming our world: the 2030 agenda for sustainable development*. <https://sdgs.un.org/sites/default/files/publications/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>. Accessed 16 January 2024.
- United Nations Development Programme. (2018). *Timor-Leste National Human Development Report 2018: planning opportunities for a youthful population*. <https://www.undp.org/timor-leste/publications/timor-leste-national-human-development-report-2018-planning-opportunities-youthful-population>. Accessed 16 January 2024.
- United Nations Educational, Scientific, and Cultural Organization. (1990). *World Conference on Education for All: meeting basic learning needs: a vision for the 1990s*. Inter-Agency Commission (UNDO, UNESCO, UNICEF, World Bank). <https://unesdoc.unesco.org/ark:/48223/pf0000097552>. Accessed 16 January 2024.
- United Nations Educational, Scientific, and Cultural Organization. (2015). *Education 2030: Incheon Declaration: towards inclusive and equitable quality education and lifelong learning for all*. UNESCO, UNICEF, World Bank, UNFPA, UNDP, UN Women and UNHCR. <http://uis.unesco.org/en/files/education-2030-incheon-framework-action-implementation-sdg4-2016-en-pdf-1>. Accessed 16 January 2024.
- World Bank Group. (2020). *Timor-Leste economic report: a nation under pressure: April 2020*. <https://openknowledge.worldbank.org/bitstream/handle/10986/33749/Timor-Leste-Economic-Report-A-Nation-Under-Pressure.pdf?sequence=5&isAllowed=y>. Accessed 16 January 2024.
- World Food Programme. (2019). *Fill the nutrient gap Timor-Leste final report*. <https://docs.wfp.org/api/documents/WFP-0000116769/download/>. Accessed 16 January 2024.