

INSPIRATIONAL CASES |  FINALIST 2023 |  BRAZIL

#ENVIRONMENT

Students create biodegradable and economical diapers

A more sustainable solution was designed to benefit the rural community and had as its starting point a subject on the STEM approach.

TEACHER

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COMMUNITY/CITY

Carnaíba, Pernambuco

STEM AREAS

Science

STUDENTS

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SCHOOL

Escola Estadual Professor Paulo Freire”

OTHER AREAS OF KNOWLEDGE

Environmental education and Sociology

PROJECT NAME

EKOfralda

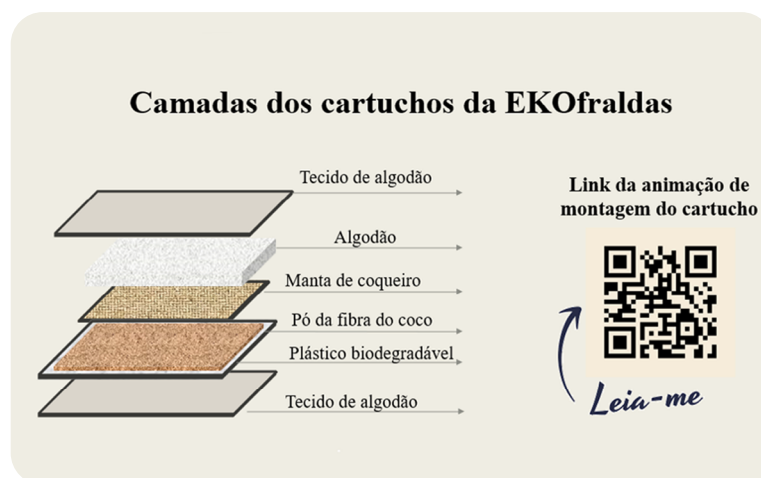
Despite the facility of use, disposable diapers have environmental and financial impacts. With frequent use, buying diapers takes a toll on the budget. Furthermore, they can remain in the environment for up to 450 years after disposal. To improve this situation, a group of five students from the Brazilian semi-arid region (known as “sertão nordestino”) developed reusable diapers using a common material locally: coconut shell fibers that would otherwise be discarded by industries. The project was among the 10 finalists of the Solve for Tomorrow program in 2023, in Brazil.

Chemistry teacher Gustavo Bezerra, [mediator](#) of the “EKOfraldas” project at the Paulo Freire State Technical School, in the municipality of Carnaíba, in the backlands of Pernambuco, remembers that the idea arose in an elective course called “STEM in practice”, with 28 students from the 2nd year of High School (second to last year of compulsory schooling). At the institution, regular education is offered along with full-time technical courses in computer networks or administration. “There were many young people interested in developing scientific projects, but they were not aware of the methodological basis required for fairs and programs like Solve for Tomorrow. So, in this discipline, we saw a bit about the research method, how these approaches are covered in different programs”, he reports.

The class was divided into groups of 3 to 5 students, and each of them worked on different projects. The “EKOfraldas” were the result of research and experimentation by a group of five

students. They had as starting point the Sustainable Development Goals (SDGs), which are 17 ambitious and interconnected plans proposed by the United Nations, to end poverty and to protect the environment and climate, among other actions.

Provoked by discussions in the classroom, the students observed that spending on disposable diapers weighed on their own families' budgets and in addition, harmed the environment. Therefore, they thought that a way to solve both problems would be to create a more affordable ecological diaper, as those available on the market were beyond the reach of the majority of the population. "The students found a kit of eight ecological diapers online for R\$330 (approximately 64 US dollars). A low-income family here in the interior of Pernambuco state, no matter how much they wanted, would not be able to buy it", reports the teacher.



Coconut shell and cotton fabrics take part of the sustainable solution

The initial project, due to the pandemic context, was to reuse fabrics from used masks. But throughout the experiments, the students discovered that these products also have a long decomposition time. So, they started looking for other absorbent materials, until they came up with a combination of cotton fabrics and coconut shells.

The EKOfraldas [prototype](#) consists of reusable elastic fabric pants, accompanied by adsorbent cartridges, which must be changed after use. These cartridges are made from an outer layer of biodegradable plastic, which prevents liquids and odors from leaking. Inside, there is cotton combined with coconut fiber, which is capable of absorbing liquids up to 25 times its initial volume. To avoid direct contact of the fibers with the baby's skin, the cartridge is finished with another layer of fabric. "For the next stage, we intend to carry out more elaborate allergy and physiological tests, which are essential before testing on people", adds the educator.

According to the student's calculations, the reusable diaper costs 1 BRL (about 0,18 USD) and each biodegradable cartridge would cost 40% of this amount. "To develop the prototype, part of the cost came from the school; other, from the teacher and some materials, such as cotton, were obtained by the students with their parent's collaboration. On top of that, they did a financial

SAMSUNG

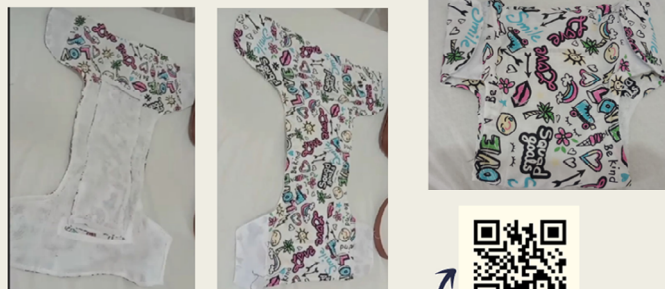
study. Of course, if the diapers were produced on a commercial scale, other expenses would have to be added, such as labor. Even so, they would not be as high and exorbitant as on the market”, highlights the mediator of the project.



Eureka Moment!

In the first tests, the team found that the adsorbent cartridges were too large, consuming more material than necessary. “There is no point in producing a good result but spending a lot of material. So we took the larger cartridges and divided them into a size of 5 by 5 centimeters, and tested on a small scale how much liquid it could absorb. Therefore, we adjusted the amount of coconut fiber so that it did not overflow and so that it performed similarly to traditional diapers”, details Bezerra. On a smaller scale, the tests made it possible to try not only the functioning, but the degradability of the products in different disposal scenarios. The team found that the “EKOfraldas” begin to decompose after seven days in contact with soil or water.

1º protótipo físico da fralda produzido



Veja mais sobre a fralda no vídeo no Qrcode ao lado



Leia-me



“I believe that the project changed the lives of the students a lot. Many surprised us, because normally, they weren’t very committed in the classroom. But, when they got involved in the projects, they started to dedicate themselves so much that they became straight-A students in that aspect, in terms of research and laboratory techniques”,

says the teacher.

From an experiment to a scientific career

The prototype was successfully tested on dolls. Even in the year of studies for the entrance exam, the team has already started the patent process and intends to continue working on product development. With the visibility given by Solve for Tomorrow, the school has already received contacts from private companies and research institutions, such as the Federal Institute of Pará (IFPA), which offered the structure of their laboratories to continue testing sustainable diapers.

But, in addition to the results of the prototype, [project-based learning](#) also enabled new perspectives for young people in the region, who see in science the opportunity to contribute to their communities, visit new places and think about career possibilities that they were not aware of before. The experience of the students who developed the diapers became a reference for other students and for the population of the semi-arid region of Pernambuco.

According to the teacher, the mentoring offered by Solve for Tomorrow showed research paths, gave advice and contributed to showing answers to difficulties that appeared on the scientific path. “Mentoring really comes with ideas of what students can do. Their role in our research was essential. Now, other teachers and teams at the school also want to join the program,” he says.





Explaining!

The Paulo Freire State Technical School is located in the Sertão do Alto Pajeú region, in the interior of Pernambuco. The students' families, for the most part, depend on rural production and are beneficiaries of Bolsa Família, the Brazilian government's income transfer program. The sectors that employ the most are public administration and small businesses, but, according to the 2022 Census of the Brazilian Institute of Geography and Statistics (IBGE), more than half of the population of Carnaíba lives on around R\$700 per month (approximately 137 US dollars).



Focus on practice!

Take a look at the teacher's recommendations on how to create diapers with sustainable materials.



Empathy

✦ "EKOfraldas" emerged from the observation of students in their homes. They noticed how much spending on disposable diapers weighed on families' budgets. From then on, they thought of cheaper alternatives, with less impact on the environment.




Definition

🌊 Stimulated by a subject focused on the STEM approach (Science, Technology, Engineering and Mathematics), 2nd year Computer Networks students discovered that coconut fiber has a great capacity to absorb liquids. They then thought of adding this material to the fabric used in masks to create low-cost biodegradable diapers.




Ideation

 The team sought to generate as little waste as possible during the development of eco-friendly diapers. The idea of reusing masks was discarded due to the long decomposition time of this material. Coconut fiber was kept, combined with cotton and fabrics to avoid direct contact with the skin.




Prototype

 “EKOfraldas” works with two pieces. The first is fabric pants with elastics, reusable and costing just 1 real (0,18 american dollar). The second is an adsorbent cartridge, which must be discarded after use. These cartridges contain a layer of biodegradable plastic made in the school’s own laboratory, coconut fiber, cotton and a strip of fabric, which is in contact with the baby’s skin. [Find out more here](#) (in portuguese).



Testing

 Tested on dolls, “EKOfraldas” have an adsorption capacity similar to those of brands available on the market, at a lower cost. The plastic layer, which was not initially part of the project, helps contain liquid and odors. Furthermore, it is estimated that the material decomposes completely within one year after disposal in soil or water. The expectation now is to complete the patent and advance the research to reach the testing stage in people.