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#FAIRSOCIETY

Students project guarantees more productivity and safety in coffee washing

Leaving the four walls of the school to the nearby farming communities, the team developed a machine for washing coffee.

TEACHER
James Padilla Guevara

STUDENTS
Angeli Tatiana R. Oyarce
Carlos Leonel Pérez Arbildo
Katty Estefany Vela Trigoso
Merly Regalado Vázquez

COMMUNITY/CITY
Nuevo Chirimoto

SCHOOL
Colegio de Alto Rendimiento de Amazonas

PROJECT NAME
Mechanization of coffee washing

STEM AREAS
Science, Engineering and Mathematics

OTHER AREAS OF KNOWLEDGE
Sociology

In the community of Nuevo Chirimoto, in Peru, the main economic activity is the production and sale of coffee, manually made mainly by families, with a lot of work and without much technological intervention. To facilitate the process, increase production and guarantee greater safety, a team of local students created a way to mechanize the work, with a machine that removes the pulp of the coffee, shakes it, cleans it deeply with pure water and takes it out, ready for drying. The innovation was a finalist in the 10th edition of Solve for Tomorrow in the country.

The students were 15 years old and were in their 3rd year, which is the year of admission at this type of school, “Colegios de Alto Rendimiento”- COAR (High-performance Schools). When teacher James Padilla, who is the mediator of this project, entered the classes to invite everyone to participate in Solve for Tomorrow, the student Angeli Tatiana decided to form her group with colleagues. “Many have family farmers who work with coffee and the grandfather of two students suffered from osteoarthritis. So, they wanted to find a way to prevent him from getting sick and allow him to continue working, which is what he wants,” recalls the educator.

The granddaughters of this potential “client” are Tatiana and Katty, who achieved the participation of an important ally: their uncle, also a farmer and an industrial engineer. The family estimates that the grandfather suffers from these pains due to decades of work in the fields, with

poor posture and great physical effort. “We not only saw the need in the family, but in the entire town. We concluded that a machine that mechanized coffee washing could be beneficial for the entire community, since they could share it or even rent it to other farmers who do not have the possibility to buy one of their own,” Padilla sees.

According to the educator, the statistics managed in the project show about 500 producer families in the region, and 30 of them were interviewed, due to time and internet limitations. “We saw that the elderly stay in the locality, with agriculture, while the younger ones sometimes migrate to larger cities to study or work. When they return to the community, they no longer dedicate themselves to this field. So, our purpose was helping these grandparents,” he declares.

Students dedicated themselves to help the rural community, especially the elderly

Design thinking helped structure the project

James Padilla is a Technology teacher at the school. With a background in Production Systems Engineering, he began teaching in 2017. Today he teaches robotics, mobile applications, graphic design and Arduino, among others. The teacher highlights that at school they already study STEM methodologies and especially in third grade, the five phases of the project trail are indicated: Empathy, Definition, Ideation, Prototype and Test. “They wanted to directly make the machine and I told them that this was only the fourth step. So, we advanced through each stage at its own time,” he recalls. For him, following this path was important to dedicate the necessary time to the search and so that they could focus not only on the result, but also develop critical thinking and other skills while carrying out the investigation.

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Eureka moment!

The initial idea was that farmers could see the inside of the machine while it was working, as they were used to doing it manually. But in the development of the project they made changes to guarantee more safety, efficiency and comfort. “At first the open machine worked well, but then we saw that when more quantity was placed, the coffee jumped and came out of the equipment,” said the teacher. They decided to close it and it can only be opened when the producer needs to look inside the machine. “It was a safety measure. A more curious child could put his hand in it and get hurt,” he says.

“I think that experience has taught us the importance of the ease of use, beyond following an initial design to the letter. We cannot think about the machine in isolation, but on the day-to-day life of those who are going to use it. use”,

Padilla believes.

The allied uncle had already made a similar machine before but it was very large, industrial and they changed this too. “With this reference in mind and the uncle’s help, the students improved the prototype and made a smaller one so that it can be transported in a normal van,” he explains. The ally was also important in informing specifications of the necessary materials for construction.

With mechanization, washing is much faster

Farmers can pour coffee into a funnel-shaped part of the prototype. With a motor attached, the machine spins the coffee, moving the poles and propellers inside. The movement, together with the impact of the water that comes out in a jet, guarantees effective washing of the fruit. See more details of this operation in the video below:

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Finally, testing the capacity of the machine, they were able to estimate that it can wash a thousand kilos per hour. Manually, this process takes approximately four times as long. “With the machine you also have much more control, because it is manually washed in a mesh where coffee beans are inevitably lost,” adds the educator.

The prototype was delivered to the students’ family, who supported the development from the beginning and even purchased all the necessary materials. “It is a solution that is not very expensive, compared to the options available on the market. All we spent was 3,200 soles, or 845 dollars,” he reports. The teacher explains that in other countries, a machine like this costs around 6,000 soles (or 1,600 dollars) and in Peru it is very difficult to find the equipment for sale. The initial investment pays off over time: the estimated useful life is 20 years and it can also be rented to other producers, since coffee washing is usually not a daily activity. The students’ family is already renting the equipment to other nearby farmers.

The teacher adds that it was important to have knowledge in Economics: “We think that there is a sales potential for these machines, since there is a boom in the coffee market. We did research and saw that we would be able to sell about 100 machines per month.”

The team of students still has two years of school left until the end of compulsory schooling and they continue with the goal of perfecting this project. “What we wanted now is to extend the interviews to more people and the mayor has told us that he is going to place an antenna nearby so that the students have internet and can take the surveys more quickly and online,” he says. Furthermore, according to him, the machine can be changed to meet different needs, in size and capacity, for example, and can be used in other countries, such as Brazil and Colombia, which are also prominent in this production.

According to the teacher, reaching Solve for Tomorrow finalists serves as an inspiration for the school community. “Many are excited to be able to apply this year with more projects. The program gives us more than we sometimes imagine, especially teenagers,” he says.

Explaining!

There is a more traditional method of extracting the coffee bean, where the fruit is first dried and then the bean is extracted. Generally, the purpose of washing coffee is to eliminate impurities and separate, by density, the coffees cherries called “floaters” and green coffees. Sprouted, malformed, raisined and dried fruits have a lower density and therefore “float” in water. The rest (very ripe cherries and green coffees) have a higher weight (higher moisture content) and are retained at the bottom.

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Focus on practice!

Take a look at the teacher's guide on how to create a machine to mechanize coffee washing:

1 Empathy

At the beginning, the teacher organized the roles according to his affinities. Angeli Tatiana was the leader, Leonel was in charge of engineering, Katty was in charge of research, and Merly was in charge of writing and supporting the rest of the group. Since the local economy is based on the production and sale of coffee, the students observed the challenges they face in the field.

2 Definition

Since there was no internet in the rural area of the city, the students went to the communities with paper surveys to talk to farmers and better understand local challenges. They discovered that washing the coffee was a step that took a long time and made the workers tired. Doing it by hand could mean carrying weights, having to adopt uncomfortable positions and wasting a lot of time.

3 Ideation

Based on the knowledge shared by an ally of the team (uncle of two students, who is also a farmer and industrial engineer), the team adapted the information according to the STEM and Design Thinking processes learned at school, such as creation of a Canvas.

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4 Prototype

To build the machine, they first made a sketch. Afterwards, they purchased materials, such as iron for the base of the prototype. Later, that metal was cut and joined to other pieces with welding, following the model. When planning, they introduced changes to the initial idea; especially in the size and making the washing part more closed than had been thought. These improvements made the machine safer and easier to transport.

5 Testing

Several tests were carried out with the empty machine to rule out errors in the construction, before painting. When the creation was ready, the team did more testing with coffee. At the end of the project, the teacher changed the organization of the roles so that everyone was able to respond to any aspect of it, in preparation for the Solve for Tomorrow pitch.