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INSPIRATIONAL CASES | FINALIST 2023 | ARGENTINA

#FAIRSOCIETY

Students adapt a Braille keyboard using a 3D printer

Low-cost solution promotes inclusion of visually impaired people.

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COMMUNITY/CITY
Posadas

SCHOOL
Escuela Secundaria de Innovación de Misiones

PROJECT NAME
Innova – Una sociedad inclusiva

STEM AREAS
Engineering

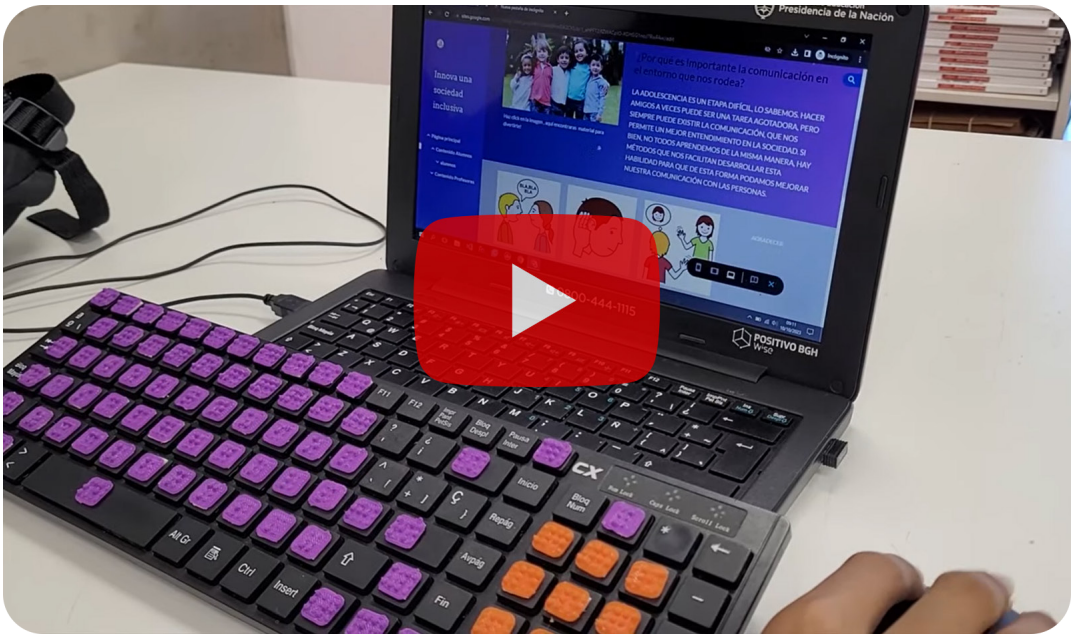
OTHER AREAS OF KNOWLEDGE
Sociology and Languages

Nearly 900,000 people in Argentina have visual difficulties, according to the National Institute of Statistics and Census (Indec). To facilitate access to information and communication for this population, Braille keyboards are essential to promote digital inclusion. But not all of them are affordable or easy to find. That's why some Argentine students decided to use their school's 3D printer to make a Braille keyboard.

The project entitled "Innova - Una sociedad inclusiva" (Innova – An inclusive society, in English) was a finalist for Solve for Tomorrow in the country, in 2023. The four students involved were between 16 and 17 years old and were in the fourth year of high school (the penultimate year of compulsory schooling) at the Escuela Secundaria de Innovación de Misiones school, in Posadas.

The project's mediator teacher, Samuel Kowalczuk, teaches Robotics and helped the students with the design of the website mainly. But the school has an integrated learning module, where teachers from different curricular areas come together. In this case, teacher Kowalczuk joined the Information technology (IT) Projects teacher, who has a degree in Industrial Design and has an approach based on Design Thinking. In addition, the Economics teacher also joined, who brought a vision of Entrepreneurship.

In 2023, the educators decided to take things a step further. “We said, ‘Let’s do real projects, go to places that need design solutions, and not just make money, but make a difference for people,’” Kowalczuk recalls.



Creating a solution from a real frustration

Through the teachers’ connections, they visited Special School No. 1, a pioneer in inclusive education. There, they conducted interviews with professionals and built an empathy map, listing frustrations and motivations from people with visual impairments. They saw issues related to equal opportunities, access to services, and social participation. “A teacher with a visual impairment gave them a lot of information that allowed them to do the project,” he says.

One of the complaints was that there were not many simple and adaptable tools for everyday use and traditional Braille machines tend to be expensive and difficult to handle and transport. Thus, they came up with the idea of creating a keyboard adapted to that language system.

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Eureka Moment!

Through research and group reflections, they realized that it was not necessary to create a new keyboard from scratch. Using keyboards they had at home, students could make pieces with the Braille version of the letters, using the school's 3D printer. The pieces were attached to each of the keys. For teacher Kowalczuk, one difference of the prototype compared to the Braille keyboards on the market is that with 3D printing you can have a more personalized tool, because the user can use the keyboard they prefer, just by attaching the Braille keys.

The first model had some flaws, so they made changes on the design and printed other pieces. "Discovering limitations in terms of print quality, with respect to touch was a challenge for us. In a Braille key, the height is very important. The points on the key cannot be too high or too low," he stresses.

No one on the team could read Braille and, according to the educator, they were unable to find height standards in their search to help decide on the correct measurements for printing — there are many different types of standards. So they went back to the teacher at the Special School, who was very important at the testing stage. They had to print one letter at a time, take it to the ally and he would tell them when a piece was not understood or did not work.

> **"It was also an exercise on empathy, having patience and attention to every detail and really making the project for the user; not just for the school or for a competition",**
>
> says Kowalczuk.

Project resulted in prototype and learning

The students used an online tool called Tinkercad, which allows modeling for 3D printing. In the end, they managed to have a keyboard with a usable pattern. To do it on a larger scale, the teacher explains that it would be necessary to test with other types of filaments, keyboards and 3D printers.

Beyond the result of the prototype, the teacher observes that doing projects like this in the fourth year promoted the development of soft skills such as time management, communication and perseverance that prepares for educational internships, which is a practice that fifth-year

high school students can do in organizations or companies that are related to their education and training.

In addition to the prototype, the team also created a website aimed at teachers and students in general (not just those with visual impairments), which seeks to develop skills with technology, on the one hand, and on the other, offers a collection of leisure activities. The first session includes teaching materials and guidelines on how to use applications in class. The second has breathing and relaxation exercises and an interaction forum to answer questions from website users.

Explaining!

The city of Posadas is located near the triple border between Argentina, Paraguay and Brazil. According to teacher Samuel Kowalczuk, this impacts the local culture, as many people are descendants of immigrants; some speak Guaraní (an indigenous Paraguayan language) or Portuguese (from Brazil). For the teacher, this diversity is reflected in the school and in the way the students innovate. “At school there is always this attitude of putting oneself in the other’s place,” he thinks.

Focus on practice!

Take a look to the teacher’s guide on how to create a 3D printed Braille keyboard

1 Empathy

The project team visited Special School No. 1, a pioneer in inclusive education. There, the four students conducted interviews with professionals and built an empathy map, listing frustrations and motivations of people with visual impairments. They looked at issues related to equal opportunities, access to services, and social participation.

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2 Definition

One of the complaints was that there were not many simple and adaptable tools for everyday use and traditional Braille machines tend to be expensive and difficult to handle and transport. Thus, they came up with the idea of creating a keyboard adapted for this language system.

3 Ideation

Through research and group reflection, they realized that it was not necessary to create a new keyboard from scratch. Using keyboards they already had at home, they could make pieces with the Braille version of the letters, using the school's own 3D printer. And so they did. The pieces were fixed to each of the keys.

4 Prototype

The development of the prototype went hand in hand with the testing stage. This is because no one on the team could read Braille and, according to the teacher, they were unable to find height standards in their search to help decide on the correct measurements for printing — there are many different types of standards. So they had to print one letter at a time, bring in a visually impaired ally to test and he would point out when a piece was not understood or did not work.

5 Testing

In the end, they managed to have a keyboard with a usable pattern. To do it on a larger scale, the teacher explains that it would be necessary to test with other types of filaments, keyboards and 3D printers. Learn more about the prototype here.