Teaching robotics education with a gender focus through a robotics course with Arduino: a study case in Pontificia Universidad Católica de Valparaíso

Sandra Cano[1]

[1]School of computer engineering, Pontificia Universidad Católica de Valparaíso, Chile

sandra.cano@pucv.cl

ABSTRACT

A case study was applied on the teaching of educational robotics with a gender approach is presented, which is offered as a free course for school teachers, with participants from different countries, such as Chile and Colombia. The design of the course is focused on the interests of the female gender and following the project-based methodology, where every week classes were given virtually for a period of 2 hours. 64 students approved the course, of whom 61% were women.

INTRODUCTION

Nowadays the teaching of educational robotics is one of the skills that are being included in the 21st century. In addition, there is a great interest from different organisations in encouraging women in careers related to engineering. In turn, educational robotics is related to STEM education which integrates the disciplines of science, technology, engineering and mathematics, which allows the development of related skills such as problem solving, creativity, collaboration, communication and others [1].

The teaching of educational robotics requires didactic methodologies focused on teachers, so that they can transmit the acquisition of this learning to their students. In turn, the course design in the teaching of educational robotics with a gender approach. Therefore, the course is designed focusing on the interests of the female gender.

The aim of this course is improve the processes of attraction, access and orientation in STEM program in roder to increase the number of women. Engineering has several sub-disciplines, some of which attract the attention of women better than others. Areas as engineering design and humn-technology interface are gaining interest[2].

CONTEXT

In turn, to work in the STEM areas it is proposed a course on introduction to the educational robotic with Arduino. To design the course with a gender focus, 5 workshops are designed to appeal to the female gender by agreeing on topics that motivate the female gender, which involves topics related to health sciences, interactive toys, music and agriculture. Areas that focus on the teaching of computer science and electronics. Based on the proposed workshops, a kit with electronic components is made so that the teachers can buy it in an electronics shop. It is important to mention that the cost part is also considered, for that reason the selected electronic components were low-cost.

The course follows a project-based methodology. The course is open to all audiences but is more oriented to school teachers with the interest that they can work on it in the future with their students. The classes are given in virtual mode using the Zoom platform. A virtual classroom is also created using the google classroom platform to share the course material and to upload the different tasks that are assigned each week.

There were 176 participants in the course, where each week there was a 2-hour workshop focused on the topics mentioned above, on average there were 57 attendees for each class, where in turn each participant uploaded a recording with a duration of 1 to 2 minutes of the completion and operation of the task using Arduino and electronic components. Each task consisted of interacting through a platform for teaching electronics and arduino called Tinkercard and making the physical assembly of the circuit.
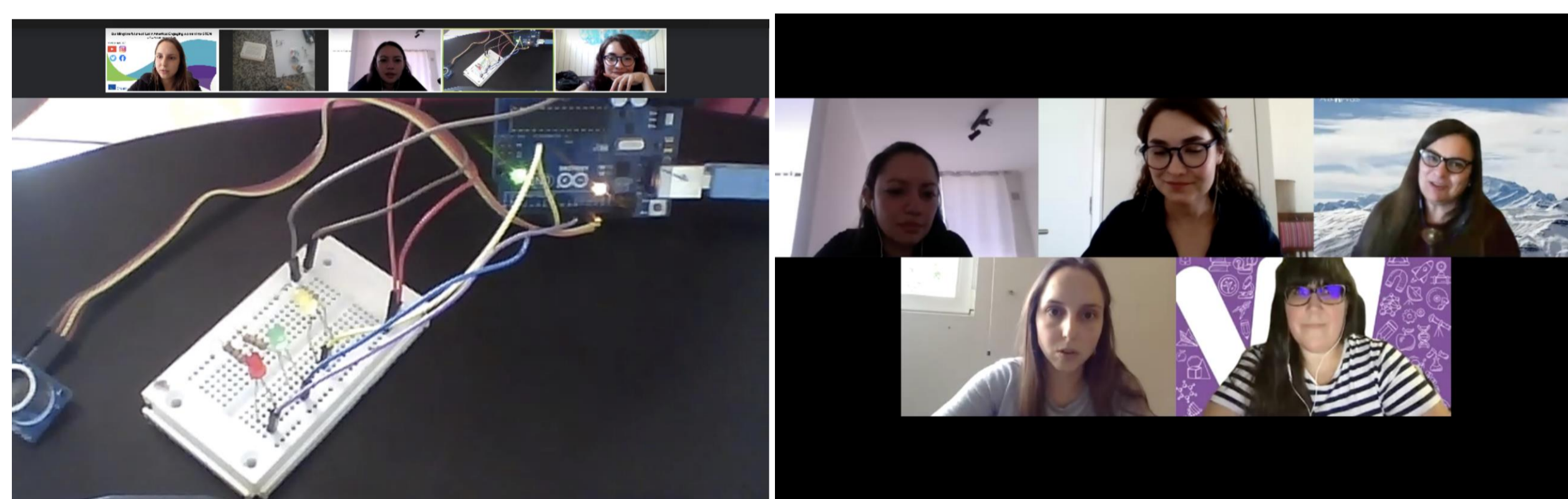

Figure 1. Classes through the Zoom platform

As an attraction campaign, the course was promoted through social networks and mailings sent

Figure 2. Attraction campaign for the course.

RESULTS AND DISCUSIONS

64 students passed the course, of whom 61% were women. Of the total number of passers, 15 fulfilled the attendance and homework requirements, 35 fulfilled only the attendance criterion, and 14 fulfilled only the homework criterion. All of them were awarded a certificate of participation in the course on behalf of the W-STEM project and the Pontificia Universidad Católica de Valparaíso.

A set of rules for giving a certificate of participation to the course was established. These rules consisted of:
- Ever attended or handed in a homework assignment
- Diploma with mention for those who
- Attended 5 times
- Handed in 3 assignments or more
- Attended 4 times and handed in at least one assignment.

At the end of the course we applied a student experience questionnaire, which obtained very positive comments from the participants, with some teachers commenting that they are applying what they have learnt with their students.

There were also teachers with advanced knowledge in robotics, but who took the course with the purpose of continuing to learn, who liked the way the workshops were designed with a gender focus. Some teachers regretted not being able to attend the class week by week due to their academic activities. Therefore, it was decided to make recordings of each of the workshops so that they could access them asynchronously.

Also due to the positive comments and ratings obtained, as a future work it was decided to continue with the continuation of the course at a more advanced level and to go deeper into the teaching of scratch, since some teachers started to work with scratch in primary education. The purpose is to teach them how to build interactive stories with Scratch and which can in turn serve as a complement to their courses.

However, due to the fact that the classes were not face-to-face but virtual, some teachers faced technical problems in the operation and installation of the arduino platform when they had to carry out the practical part with real electronic elements. There were some zoomed-in tutorials, but sometimes it was a bit difficult for the participants to explain what was going on.
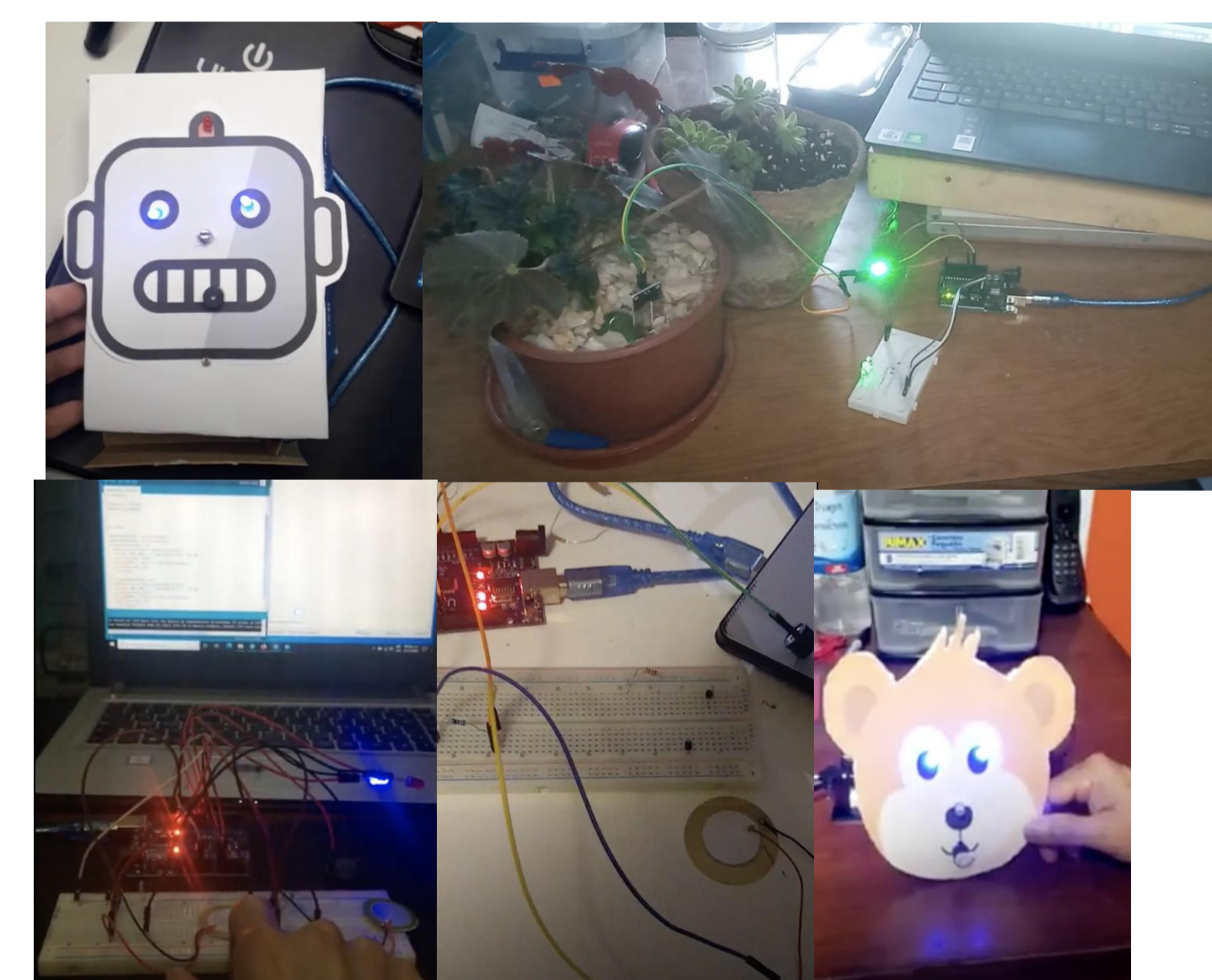

Figure 3. Some tasks handed in by participants

CONCLUSIONS

The course offered with a gender focus showed the interest of the school teachers in learning and transmitting these teachings to their students. Therefore, in turn, it is not only teaching the teacher about practical development, but also about the different competencies that can be worked on with the student in the classroom.

As future work we hope to continue with this course and encourage more school teachers and children in educational robotics competitions.

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