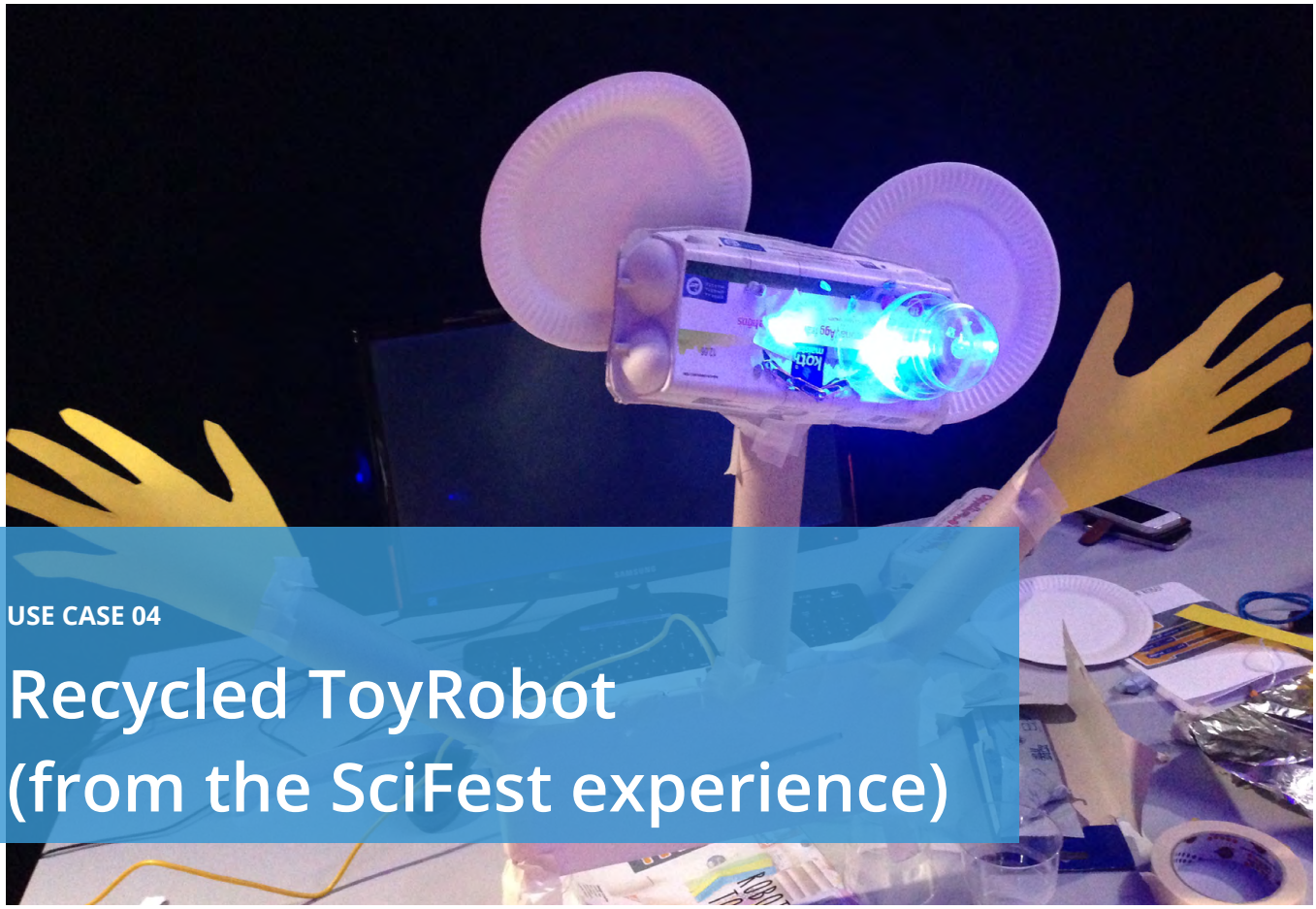

USE CASE 04

Recycled ToyRobot (from the SciFest experience)

Age & Level

SciFest is a scientific faire, that attracts thousands of visitors every year. There are companies, schools and departments from university who are running the workshops, experiments or presenting showcases and their products/services which is related to science, engineering, technology, arts and crafts, mathematics, and other subjects taught at schools. One of the workshops of SciFest was dedicated to creating recycled robot heads (and bodies!) out of cardboard boxes, plastic bottles, and other available, easy to find everyday materials. Idea of the workshop was to engage not only kids who are enthusiastic about technology, but also kids who are interested in arts and crafts. Sonja also observes that 10-16-year-old kids can take part of this workshop. For more advanced students, there is the opportunity to choose tasks that are more challenging. Robots are very familiar, especially for boys, but hardly in any place, have kids built up a robot head from the recycled materials. Some kids are also familiar with programming, but Sonja notices that especially it is hard to engage girls and some boys for this activity; they think that it is boring. Therefore, Sonja thinks of modifying her idea to let the kids in her club to use their imagination to create/bring to life their own version/conceptualization of what a 'robot' is by making their own Recycled ToyRobot. This could attract the interest of a wider group of boys and girls. The workshop was about making and hands-on activities, with the aim of attracting a wide variety of girls and boy (e.g., those who are not so interested in technical activities such as programming). This was to emphasise that robot building is more than programming. Sonja, an after-school crafts and arts club instructor, is very interested in handcrafts and she likes to make things by herself, because then what she makes is personalised and has her signature. She is not interested in ready made products and has not had interest in programming. She wants to teach her club kids to be creative and that they can recycle things for creating something new. She and other colleagues from the club are observing and participating in the RoboHead workshop in SciFest, involving themselves in a short hands-on activity to understand how this workshop could be run with the kids at the club.Sonja also observes that 10-16-year-old kids can take part of this workshop. For more advanced students, there is the opportunity to choose tasks that are more challenging. Robots are very familiar, especially for boys, but hardly in any place, have kids built up a robot head from the recycled materials. Some kids are also familiar with programming, but Sonja notices that especially it is hard to engage girls and some boys for this activity; they think that it is boring. Therefore, Sonja thinks of modifying her idea to let the kids in her club to use their imagination to create/bring to life their own version/conceptualization of what a 'robot' is by making their own Recycled ToyRobot. This could attract the interest of a wider group of boys and girls.

Primary Actor and Main Goal

The primary actors will be the instructor (Sonja), the students (boys and girls). Instructors are concerned about the feedback they receive from the parents (secondary actors). Parents are little bit concerned about programming, because kids are playing with the computer for long periods of time. However, parents appreciate that the SciFest activities that they have the opportunity to see (and test if they wish) are more than just programming with the computer, more creative activities are performed.

Main goals of the Recycled ToyRobot scenario are to boost kids' creativity, problem solving and team skills as well as to demystify the use of technology while keeping in mind ecological perspectives (using recycle materials for building new toys/things/robots). Furthermore, girls enjoy being creative using crafts and arts, as well as some boys, too. Technology could be attractive for boys more than for girls, but it might be that when integrating crafts and technology, all kids can find that there is something they are keen to make/create and enjoy.

Topic and Content

In the Recycled ToyRobot activity, kids are asked to plan and design their own version of what a robot/toy is, using recycled materials, such as paper rolls, boxes, plastic yoghurt mugs. An interactive part of the toy, such as the eyes, will be made using LEDs (light-emitting diodes), which will be programmed to blink at a certain rate. At the beginning of the activity, the kids are given the instructions, they form groups and are introduced to the five stages of craft- and project-based learning (ideate, plan, create, program, share). They are also asked to follow the instructions about how to make the LEDs blink. There are 3-4 students in each group and each group has their own PCs and Arduino kits at the table as well as different recycled materials, pencils, glue, scissors, colour paper, foil paper, etc. Each group is designing their own version of a ToyRobot and how the eyes of the robots will blink or how lights in the eyes are on or off.

Description of Environment and Possible Pre-conditions

Kids can perform the activities within 1.5 hours (however 3D printing is not included to this activity). The feedback received from the students that participated in the SciFest version of the activity indicates that some students wouldlike to involve 3D design and made the robots more professional looking. This implies that the activity could be set to be developed in longer time (2 days or more), so that kids really have a chance to carefully design and take longer time to make/create their ToyRobot. The robot building activity originally took place at SciFest, an inspiring environment, where the students can get comments and feedback as well as ideas from the audience and professionals visiting the event. There could be open place for everyone to join in, use the materials and get instructions and help when necessary. The activity is based on STEAM subjects, which serve well the curriculum of schools. However, more students might be interested when receiving the information about the workshop. Using social media and school network more efficiently could help to reach the wider audience.

Preparatory Work

For the activity, an instruction manual of the steps to follow when using the virtual programming environment (Snap4Arduino) needs to be prepared.

Also, during the workshop, an Arduino Uno board connected to a Raspberry Pi3 computer was set up, as individual work stations for each group. When other software is needed, if there are no restrictions of installation, it is easy to install. The instructors should check that the necessary software are pre-installed and the programs run. In addition, recycled materials as well as crafts materials should be collected and made available during the activity development.

Description of Activity

The instructor starts with a short introduction about what kids are supposed to do, what the process is and what the materials and tools to use are. The students are asked to form groups of 3-4 students and take a work station (Arduino board connected to a Raspberry Pi PC) and start working. In the SciFest version of the workshop, one group designed a square robot head, where the robot eyes are blinking one after another. Another group designed an elephant robot head - big eyes were supposed to be 3D printed, where the LEDs are set in the middle. Since there was not 3D printing available, the students set for using cardboard to create the eyes of the elephant. Students planned themselves, which recycled materials they need.

They also decide what part they need to 3D print for the head. Students are dividing the tasks among themselves, and when the group member struggles with a task, the other members are ready to help: they seem to solve the problems by themselves. Instructions are following the processes and especially in 3D designing and printing students need more guidance, because it is new for them all. Some problems with properly printing the 3D design meant that they needed to try printing again after adjusting their design. The instructor is helping by not giving direct answers but leading the group to check their design in order to print it correctly. At the end of the activity, the groups present and explain their creations for everyone else to see.

Other Stakeholders and their Possible Interests

Parents who provide positive feedback to their kids. Creative designers and makers with a positive attitude. Results also might interest companies and investors who might appreciate to have inspirations from young people.

Success and Condition

At the end of the workshop/activity, all groups are asked to present their creations to all and asked feedback about the implementation. Teachers experience that they have not seen the students working so well together and being so engaged on that kind of learning process. Even the girls were excited about the hands-on activities and arts and crafts and their ToyRobots look well designed and carefully made. As the groups got more experience they started to talk about how they could design and make more advanced ToyRobots, which would be more complicated and high-design product that reacts to voice, movement or light changes in the environment.

Failure and Condition

Time considerations for taking the project to completion. For instance, during the SciFest experience, there was one group, where one of the group members had to leave earlier and the other two were not able to decide how to continue with the activity. Their robot head was a simple one and it seemed that the two members were not happy about the result: it was not the product they designed in the first place.

Barriers/Facilitators

Barriers

Are the groups working well?

Grouping makes difference, to get students to work well with each other and make sure that they have time to work on their ToyRobot.

Is the given time sufficient for the workload?

Tracking the time is important. The students need to understand that the amount of time they have and the workload will be in good balance.

Do the students have the information they need to succeed?

Role of the instructor/teacher/coach

A limitation arises if the students do not have any idea about how to build a ToyRobot and creativity is missing. The instructor is to intervene: how to guide them to be free of the limits set by their own mind set.

Facilitators

Motivation

Some students were keen on the idea that they can create and make a real product by themselves.

Peer networks and Internet Information finding, a powerful tool to fuel creativity.

Extensions

From the robot head workshop to the ToyRobot activity the robots can advance towards becoming more interactive and reactive to changes in the environment. For instance, creating a robot alarm to wake the person up when it is day time; a robot guard to sound an alarm whenever someone trespasses a forbidden room; a talking robot that reacts to the close presence of people; etc.

Variations

Some students would like to design projects with the LEDs lights embedded to the accessories of clothing. Students started to think also how they could for example help the elderly people for having them the robot with blinking eyes, when their phone is ringing in the other room.