



## Workshop Description: Smart Bicycle Accessoires

Using the IoT cardboard kit, students (14 to 16 years) of the BHAK/BHAS Hallein (near Salzburg) developed bicycle accessories to encourage more people to use the bicycle. With the help of experts they also thought about the feasibility, the target group and presented their prototypes and ideas at the end in a public final presentation.

**Topic:** Environment and nature (UN SDG 11 and 13)

**Setting:** Secondary school

**Group-size:** 20, teams of 2 to 5

**Age group:** 13 to 16

**Time frame:** Two-day workshops plus preparation and a final publication.

### Special technologies and materials:

- **Smart Cardboard prototype kit**
- A lot of cardboard, tapes, glue and color, scissors, hot glue
- **LED simple pocket light**
- **Simple business model and Marketing slogan (optional)**
- LEDs, batteries, copper tape
- Makey Makey kit and computer
- 3D printer and computers

### Learning goals:

After the DOIT action, the participants know how to handle problems in their surrounding, can come up with ideas on how to work on a problem, know how to give constructive feedback on ideas of others and learned how to present their ideas/prototypes in front of others. Additionally, the students learned how to develop an easy 3D model, how to make a simple LED pocket light or LED add-ons on prototypes as well.

**Source:** This action was carried out by Salzburg Research (Austria)



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## Preparation

To prepare the action, you should collect and prepare the makerspaces materials and technologies as described - especially a lot of cardboard is needed. If you have limited resources for hot glue, please see this as a challenge and measure to share and work appreciatively with a limited resource.

The following materials from the DOIT toolbox could be helpful for your preparation:

- The **Simple DIY Pocket LED** – If students are not familiar with the concept of LED, they can first build their own LED flashlight. Print out at least one instruction for 2 students.
- The **Feedback Cube** – This can be helpful in the feedback process. Print out the template once and assemble it.

- **First One Colour Draft** – this template can help the students to collect ideas. Print one template per student. Alternatively, you can also use white paper for the sketches.
- The **Smart Cardboard Kit** – This contains smart tools to equip the cardboard prototypes with smart functions.
- **Simple Business Model and Marketing Slogan (optional)** - Print one for each group.

Within this workshop concept we introduced 3D modeling and printing the Makey Makey kit. Therefore we had 6 laptops, so that everyone could explore the tools and make a 3D model, a name tag, for their prototype. This is not a necessary intervention and can be replaced with other (fitting) tools or technologies.

## Step 1: Co-Design of the action and code of conduct (45 Min)

The key message that should be communicated in this first step is that this action is about the students, what they are interested in and how they want to work.

**Discussing the topic (20-25 minutes)** - The students should agree to the idea and aim of the action. In our case, we already brought the idea of developing gadgets for bicycles to motivate people to use it more often. We asked them, if and in which way this is of interest. Luckily, the students were very interested in climate change and saw this as a personal goal to contribute to actions against climate change. Nevertheless we discussed, whom we want to address: The students of their school? Their parents? The teachers? Everyone in Austria? The students concretized and decided to address inhabitants of the school's region, the Tennengau.

We also recommend to ask as well for favourite topics within your action, since the described activities can be easily adapted to other topics such as how to...

- Increase the use of public transport using new gadgets and accessories
- Motivate people to walk using new gadgets and accessories
- Increase the use of (e-) scooters using new gadgets and accessories.

**Code of conduct (20-25 minutes)** - We started by defining our aim of the action and developed and discussed the rules for our work within the next two days of co-designing in the makerspace setting. All students and facilitators signed the contract, which also included how to deal with students who leave the spaces (we used 2 different rooms) or how we plan to agree upon possible changes of the code of conduct.





## Step 2: Simple LED pocket light and persona (45 minutes)

The goal of this second step is to get into the maker spirit of working hands-on and exploring new technologies as well as considering the background of our topic to get into the role of social innovators.

**LED pocket light (20 minutes)** - As a warm-up for the makerspaces the students got the instructions on how to make a Simple LED pocket light and were asked to build one. That is a fun and easy way to get familiar with the maker spirit.

**Persona development (15 minutes)** - Each group of 3-5 students got a prepared poster with a name, professional background and age, e.g. „Mohammed, 14, student of your school“ and „Sabine, 28, working in a office“. The poster included spaces for a portrait, for hobbies and a comment if and how she/he already uses a bicycle. One section was: Which ideas do you have to motivate this persona to use the bicycle (even) more – especially in the winter time?

**Presentation of persona and first ideas (10 minutes extra)** – All groups presented their personas and their very first ideas on how to motivate the persona.

**Comment on group work** – If it is important for the students, let them know that the team composition only applies for this part and that they have the option to form new groups for the next step.

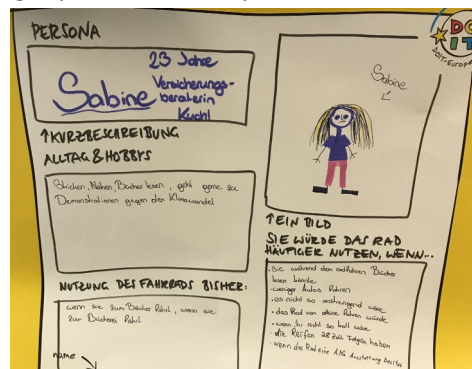


Photo: Persona development

## Step 3: First ideas and group building (90 minutes)

The goal of this unit is to collect and share the findings of the second unit and to bring together children in teams of 2 to 4 and develop first ideas.

**First Prototypes (5 minutes):** Each student got one (or more if wished) **First Prototype** print-out. Then all students were asked to sketch ideas.

**Presentation of findings (25 minutes)** – All students present their drafts which were placed on the wall for documentation.

**Building teams (15 minutes)** – Students were asked if they already had a clear idea and whether they wanted to work on their own ideas or the ideas of others. We also asked the students with similar ideas if they would like to work together. Step by step, teams members found each other.

As a first step the groups were asked to select a table in the makerspace and to build a sign with their (first) prototype idea or topic and the names of the group.

Please note: A teacher who already knows the characters and relationships of students, can support the team formation and be quite helpful in this phase.





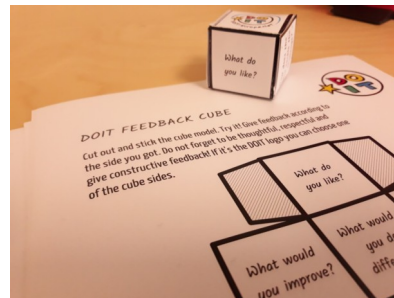
## Step 4: First prototypes and Presentation (90 minutes)

The goal of this unit is to build first cardboard prototypes, to give and get feedback and to hence see this as a chance to enhance the group results. Please prepare a workshop setting with materials such as hot glue, cardboard. Additionally you will now need: colours, stickers, coloured paper, LEDs, batteries, copper tape and print-outs of the Smart Cardboard Kit.

**Work at Prototype (45 minutes)** – The students get a short introduction into the smart kit. They have the option to use it for their prototypes but it is not obligatory. The groups are asked to present a first prototype built with cardboard after 40 minutes.

**Prepare a presentation (5 minutes)** – Ask the children to prepare a short presentation of their prototype to the other groups, by asking them to introduce themselves, the addressed issue, and their solution.

**Presentation in front of all and feedback (45 minutes)** - Each group should get feedback from the others. You can use the DOIT Feedback Cube for this step. You can also give the students some time to reflect on their work in their groups. - **See Feedback Cube**



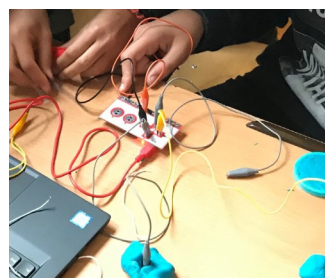
*Photo: The feedback cube is available as paper version or for a laser cutted version.*

## Step 5: Tools and technologies for prototyping (90 minutes)

To enrich the students' possibilities of prototyping, we had a session to get into contact and explore some make tools. For this purpose we introduced the 3D modelling and printing as well the Makey Makey kit in parallel working groups. After this input, within the following phase of prototyping, all groups had the additional task to build a name tag for their group.

**Makey Makey Kit (45 minutes)** – In this session, 2 kits and 2 computers were available for 8 students each, and they were introduced to the kit and its diverse usages. They built e.g. pianos and game controller with modelling clay.

**3D modelling and printing (45 minutes)** – The workshop leader showed the functionalities of a 3D printer at the running printer and then introduced the students to Tinkercad. The idea was that all groups had their own 3D name tag of their group name.



*Photo: The Makey Makey kit is one of many different options for a tool that can be used for prototyping.*





## Step 6: Revision and preparation for expert(s) (40-60 min)

The aim of this step is to re-design or build a new prototype, using the feedback and knowledge about the Makey Makey kit as well as 3D modelling. The facilitators then address the co-design session with an expert in the next step.

**Prototyping (40 minutes)** – The group re-build their prototypes or make completely new ones (if they want to).

**Simple business model and marketing slogan (optional)** – The groups that were satisfied with their solution were asked to fill out the Simple Business Model and to develop a corresponding marketing slogan.

**Preparation of presentation (20 minutes)** – The groups are asked to present their prototypes.



*Figure: With the Smart Cardboard Kit you can attach sensors to your cardboard prototype – without the need of the real technology*

## Step 7: Co-Design session with expert(s) (45 Min)

The participants now have the opportunity to receive supportive and constructive feedback for their prototypes, which they can further incorporate. An expert from the field was invited for this purpose and was introduced to the background of the workshop. We planned this intervention as 10 minutes meetings for each group where, in the meantime, all other groups continued working on their prototypes. Alternatively, all participants and experts meet in a plenum and give feedback on each others ideas.

**Short presentation by each group (5 minutes)** – After a handshake and a short welcome, the group members introduce themselves and their product idea and the solution.

**Feedback by expert (5 minutes)** – In our case, the expert focused on the potential interest of customers as well on the technical solution and implementation.

In our opinion, the integration of an expert is very helpful to show that the student's work has value, since it motivated the students a lot to work on their prototype in preparation of the presentation – and as well afterwards.

In our case, the expert offered the students special materials or tools which could be used by them for the final presentation, if they are interested. Some groups took this opportunity and even visited the expert in his workshop before the final presentation.





## Step 8: Preparation of final prototypes and presentations (120 min)

In this last session the teams were asked to prepare their prototypes and organise their project work by themselves. After an hours all groups were asked to present their prototypes and to receive feedback.

**Prototyping (40 minutes)** – The groups now finalize their work on the prototypes.

**Simple business model and marketing slogan (optional)** – The groups should now either start or continue their work on the Simple Business Model and the Marketing Slogan for their product.

**Preparation of presentation (20 minutes)** - The groups are asked to present their prototypes and get feedback.



*Photo: The work in the makerspace*

## Step 9: Public presentation for public and experts (60 Min)

Finally, the students present their prototypes, typically followed by very positive feedback of teachers, parents, experts.

**Public presentation (60 minutes)** – Moderated by the students themselves, the public presentation starts with a welcome by the school and an introduction of the process and by the workshop tutors. Each group presents their prototype and show the material and photos of the developments on a pin wall.



*Photo: In our pilot the students produced slides for their final presentation in their free time.*

