OPEN SCIENCE HUB

EMPOWERING CITIZENS THROUGH STEAM EDUCATION WITH OPEN SCHOOLING

Open Science Hub

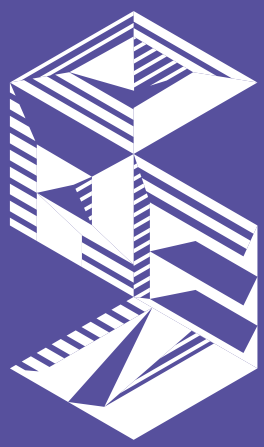
Blueprint

AUTHORS

Maria Vicente (ULEI), Aoife Taylor (TCD), Shaun Ussher (TCD), Autumn Brown (TCD), Alba Bellofiore (IH), Virginia Careri (IH), Rosario Sapienza (IH) and Pedro Russo (ULEI)

CONTRIBUTORS

All partners



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Abstract	This document corresponds to the Open Science Hub Blueprint and provides guidelines, best practices and real examples on how to establish an Open Science Hub.
Keywords	Open Science Hub, Open Schooling, Social Business Model Canvas, Case studies, Activities, Evaluation methods

Revision History

REVISION	DATE	AUTHOR	ORGANISATION	DESCRIPTION
0.1	01 November 2022	Maria Vicente, Aoife Taylor, Alba Bellofiore	ULEI, TCD, IH	Initial outline
0.2	09 November 2022	All partners	All partners	Submission of case studies
0.3	21 November 2022	All partners	ULEI, TCD, IH	Initial Draft
0.4	21 November 2022	Aoife Taylor, Mairéad Hurley, Shaun Ussher	TCD	Content Input and Review
0.5	29 November 2022	Maria Vincente, Aoife Taylor, Autumn Brown	ULEI, TCD	Final Version

List of Acronyms

ACRONYM	DEFINITION
AE L	Ars Electronica
AI	Artificial Intelligence
CCSTI	La Casemate
DEIS	Delivering Equality of Opportunity in Schools
FAB	Onl'fait
GA	Grant Agreement
IH	Impact Hub
IT	Information Technology
MFCR	Município de Figueira de Castelo Rodrigo
NGO	Non-Governmental Organisation
OSHub	Open Science Hub
OSHub-NL	Open Science Hub – The Netherlands
OSHub-IE	Open Science Hub – Ireland
OSHub-CH	Open Science Hub – Switzerland

OSHub-AU	Open Science Hub – Austria
OSHub-FR	Open Science Hub – France
OSHub-CZ	Open Science Hub – Czech Republic
OSHub-PT	Open Science Hub – Portugal
OSHub-GR	Open Science Hub – Greece
OSHub.Network	Open Science Hub Network
SBMC	Social Business Model Canvas
SciCo	Science Communication – Greece
SDG	Sustainable Development Goal
STEM	Science, Technology, Engineering, and Mathematics
STEAM	Science, Technology, Engineering, Art, and Mathematics
SGD	Science Gallery Dublin
TCD	Trinity College Dublin
TY	Transition Year
ULEI	University of Leiden
UN	United Nations
WP	Work Package

Executive Summary

The Open Science Hub Network is an EU project which works towards promoting school-led community development through research and innovation. It has been operational since October 2019 and was funded by the European Union's Horizon 2020 Framework Programme for Research and Innovation. Open Science Hubs (OS Hubs) have been created in eight countries as part of the project. These operate as mediators in each local community, where they support schools to become active agents for collaboration between families, universities, industry, local governments and civil society. The activities position schools as drivers for societal innovation and community well-being, by engaging in real-life projects where school and community needs are at the core of the collaborative projects undertaken.

As such, a local OSHub is composed by their local team, a local management board – which consists of different stakeholder groups that are involved in all key processes and decisions of the local OSHubs – and their partner schools, with whom they work closely and in a manner that is aligned with their needs and context. Moreover, each OSHub is rooted on their local challenges, which can be of different nature, depending on the local reality.

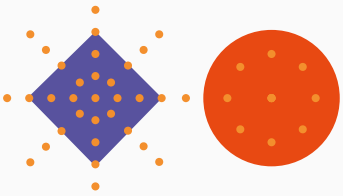
Based on their value proposition, approach, activities and relations with partners, OSHubs were clustered in three main categories:

SCHOOL – BASED OSHUBS

OSHub teams work together with schools with the objective of facilitating the integration of Open Schooling in the school institutional structure and culture, namely by working together with teachers and school heads, so that in the future schools become fully autonomous.

SCHOOL – SUPPORTING OSHUBS

These OSHubs are normally based in a physical space with equipment and resources that schools, generally, don't have access to, and develop projects where schools create tangible solutions to community challenges through science, technology and fabrication techniques.



SCHOOL – CONNECTING OSHUBS

These OSHubs facilitate the establishment of new relationships and processes between schools and stakeholders that, normally, are not part of school's daily-life, opening-up student's horizons while contributing to the development of meaningful societal meaningful experiences.

This document constitutes the Open Science Hub Blueprint and provides guidelines, best practices and real cases and examples that will guide aspirants through the different building blocks for establishing an OSHub.

This document is organised as follows:

- **What is an Open Science Hub**

  Where we describe the main concepts and principles underlying OSHubs;

- **How to set up an OSHub the Social Business Model Canvas**

  Where OSHub aspirants are guided through a process to identify and define their value proposition, results, actors and stakeholders involved, as well as human and economic resources, towards impact and sustainability;

- **OSHub Case Studies**

  Where we provide the profile of each of the OSHub that was created, by describing the respective value proposition, target public, approach and model;

- **Physical Spaces**

  Where we make available the furniture blueprints of what we consider the basic set to furnish an OSHub, and the guidelines and plans for setting-up a makerspace based on the OSHub experience;

- **The Activity Handbook**

  Which contains a list of activities and workshops that were developed and implemented by OSHubs across the OSHub network;

- **Impact Evaluation Toolkit**

  Which consists of a guide to creating an evaluation approach for Open Schooling projects and programmes, including descriptions of different evaluation forms so that educators can accurately choose the form which suits their needs.

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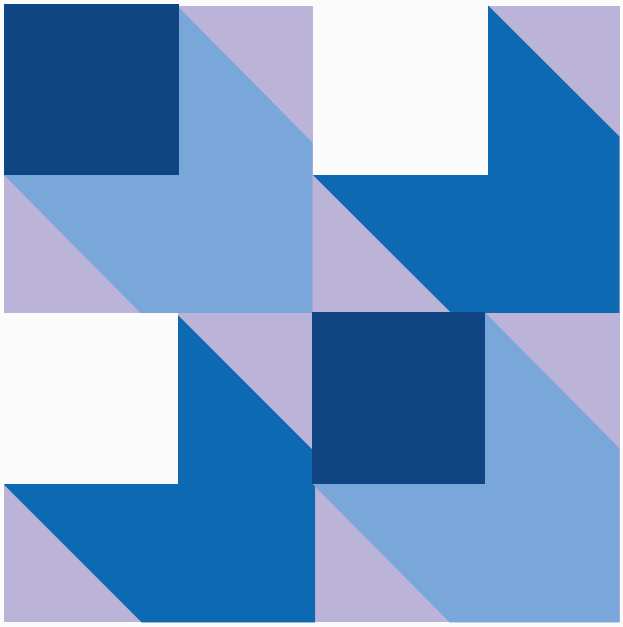
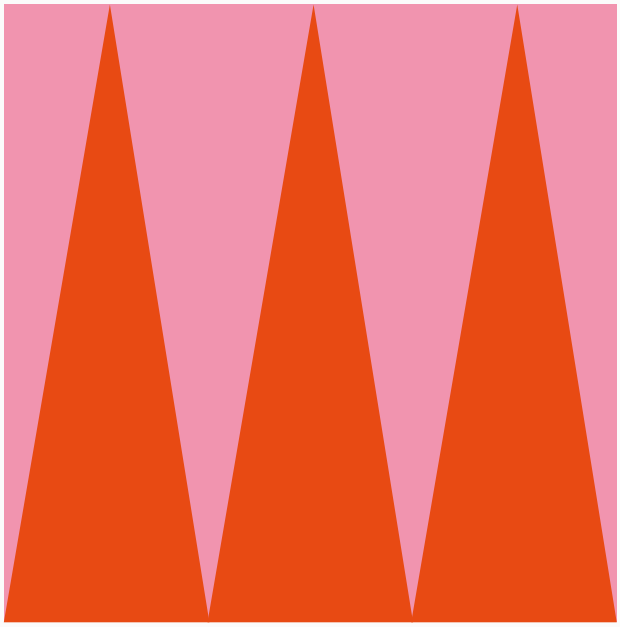
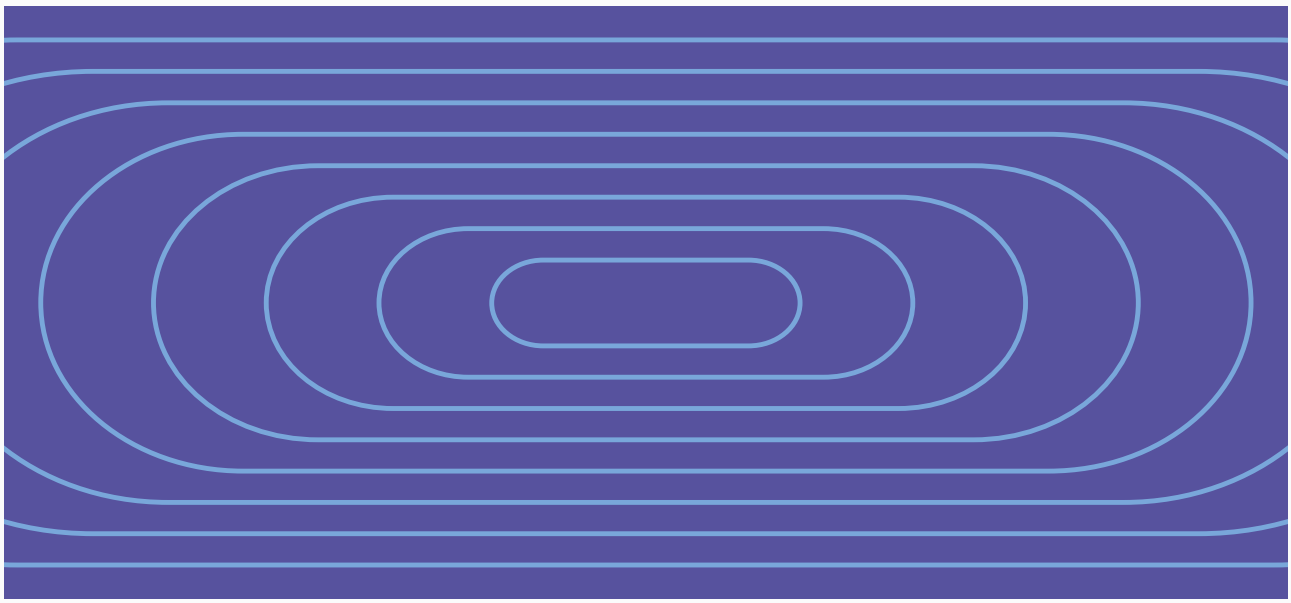
Open Science Hub

01







The Open Science Hub Network is an EU project which works towards promoting school-led community development through research and innovation. It has been operational since October 2019 and was funded by the European Union's Horizon 2020 Framework Programme for Research and Innovation.

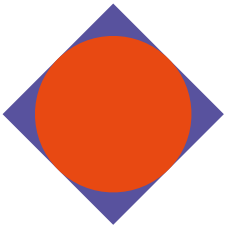
Open Science Hubs (OSHubs) have been created in eight countries as part of the project, mainly in communities that traditionally do not engage with research and innovation, whether due to geographical location, socio-economic status or ethnic minority group background.

OSHubs operate as mediators in each local community, where they support schools to become active agents for collaboration between families, universities, industry, local governments and civil society. The activities position schools as drivers for societal innovation and community well-being, by engaging in real-life projects where school and community needs are at the core of the collaborative projects undertaken.

As such, a local OSHub is composed by their local team, a local management board – which consists of different stakeholder groups that are involved in all key processes and decisions of the local OSHubs – and their partner schools, with whom they work closely and in a manner that is aligned with their needs and context. Moreover, each OSHub is rooted on their local challenges, which can be of different nature, depending on the local reality.

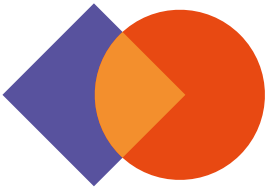
With the objective of ensuring common principles and processes, the OSHub.Network defined a common methodological approach, based on a social innovation model, that guides the OSHub teams to identify and define their value proposition, results, actors and stakeholders involved, as well as human and economic resources, towards impact and sustainability.

From this common road, different and tailored solutions emerged in each of the different OSHub locations and contexts. However, despite this diversity, we were able to identify several commonalities across the OSHubs, which allowed us to group them in three main categories:



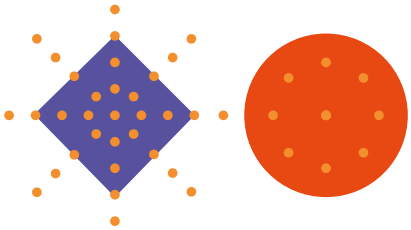
School – based OSHubs

OSHub teams work together with schools with the objective of facilitating the integration of Open Schooling in the school institutional structure and culture, namely by working together with teachers and school heads, so that in the future schools become fully autonomous.



School – supporting OSHubs

These OSHubs are normally based in a physical space with equipment and resources that schools, generally, don't have access to, and develop projects where schools create tangible solutions to community challenges through science, technology and fabrication techniques.



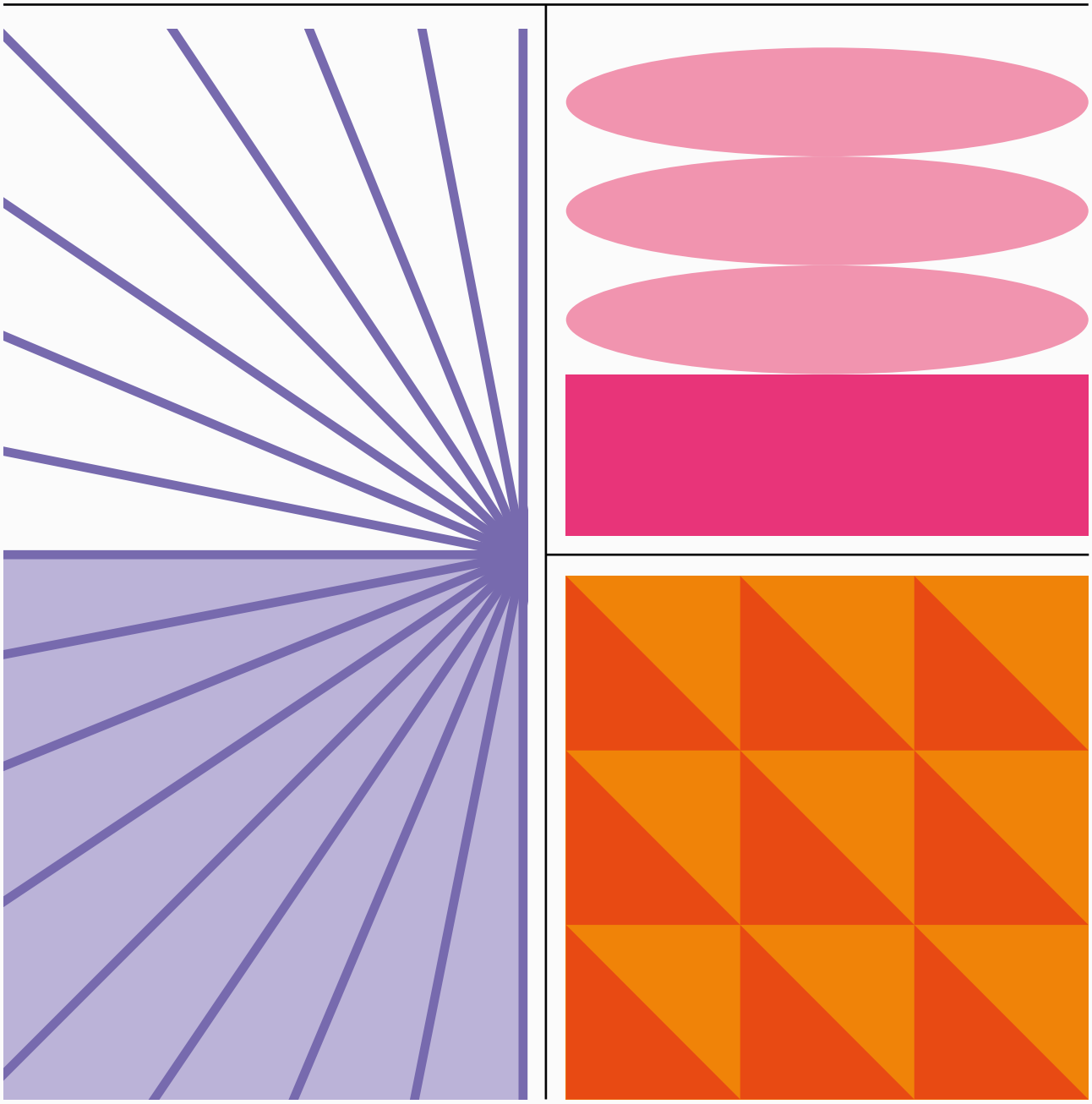
School – connecting OSHubs

These OSHubs facilitate the establishment of new relationships and processes between schools and stakeholders that normally are not part of school's daily-life, opening-up student's horizons while contributing to the development of meaningful societal meaningful experiences.

This document will allow the reader to delve into the different realities, approaches and activities of each OSHub, by providing real and practical examples, while at the same time guiding OSHub aspirants through the different building blocks for establishing their own OSHub.

How to set up an OSHub: The Social Business Model Canvas

02

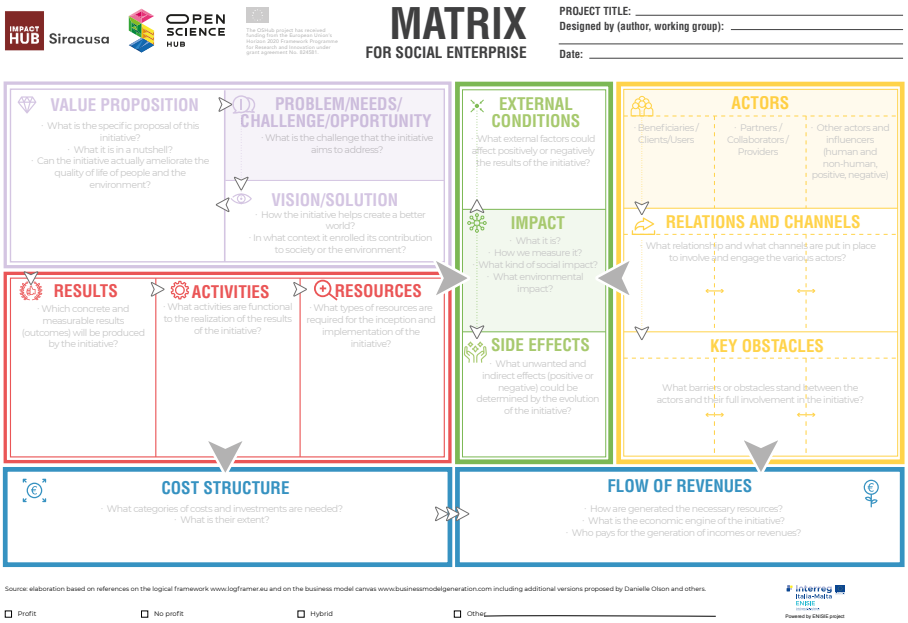


The OSHub Social Business Model Canvas (SBMC) is a matrix that supports users building a sustainability plan, while evaluating the economic feasibility and envisioning the impact of the OSHubs. It guides OSHub to follow a logical process to identify and define their value proposition, results, actors and stakeholders involved, human and economic resources as well as sustainability, impact, and any obstacle or external conditions that OSHubs may encounter.

The OSHub SBMC is a living tool that can be modified and adapted anytime to the reality of the user's circumstances, making it very flexible and powerful in that regard.

Visually, it presents different boxes all logically connected with arrows, in order to verify the consistency, efficacy and efficiency, as well as the feasibility of the plan. A special feature is that each box is differentiated by a colour to facilitate the logical reasoning of users. Even though the arrows indicate a path for filling in the matrix, their orientation can change, based on the level of knowledge of the user, as well as, the type of reasoning applied. Each section of each box is filled with questions that can help the user to understand the path to follow and the kind of information to collect for that specific section.

The canvas works with an input-output process through which the user organises information and, in the end, obtains a sustainable, feasible and efficient plan. The timeline of this plan is heavily related to the needs of the user and the nature of the initiative/project to be put in practice.



2.1 Yellow Box: Actors, Key Obstacles, Relations and Channels

An important part is the identification of target/beneficiaries, and in general stakeholders, necessary to support the project idea or the initiative. This block is divided into three sections which help the user to identify who is involved or should be involved, how they plan to ensure this involvement and what kind of obstacles can interfere with the engagement process.

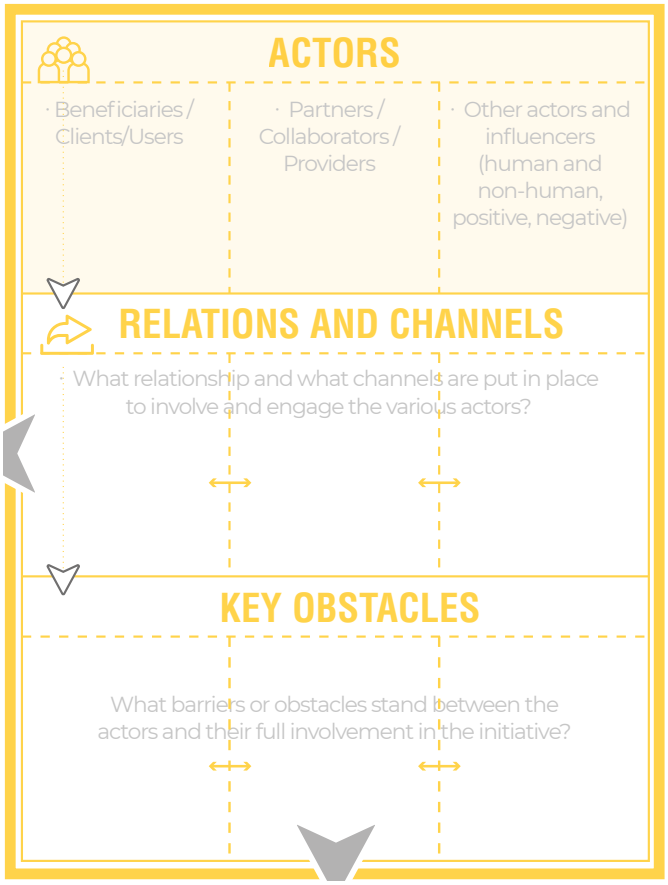


Figure 2.1: Yellow Box of the OSHub Social Business Model Canvas.

2.1.1 Actors

The first part asks the user to differentiate the direct beneficiaries of the project idea from those who are in one way or another useful to the implementation of the activities and the achievement of the goals (ie. providers, collaborators, partners and other influencers).

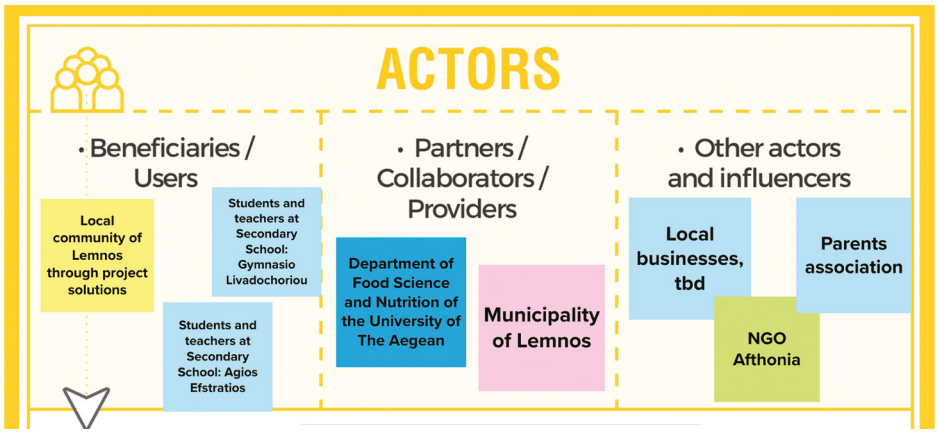


Figure 2.2: Yellow Box – example for the "Actors" section, from OSHub-GR.

2.1.2 Key Obstacles

The second part of the section asks the user to write down what possible limitations they may encounter in the process of actor involvement. This section forecasts one crucial element of the social business canvas which is the evaluation of risks and problems. Reflecting about potential issues will help the user to produce problem-solving strategies in advance.

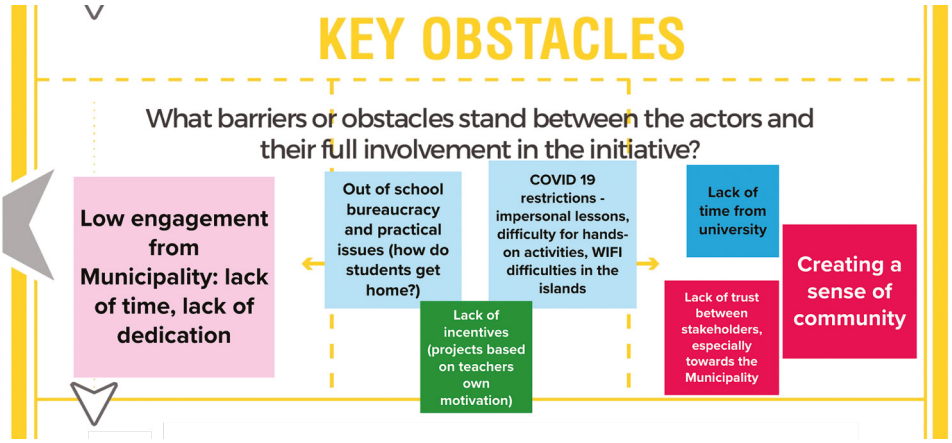


Figure 2.3: Yellow Box – example for the "Key Obstacles" section, from OSHub-GR.

2.1.3 Relations and Channels

The last section is dedicated to the explanation of the process of involvement of the actors. This section is the pillar of the social business canvas because it focuses on the "workforce" necessary to carry out the project idea or initiative.

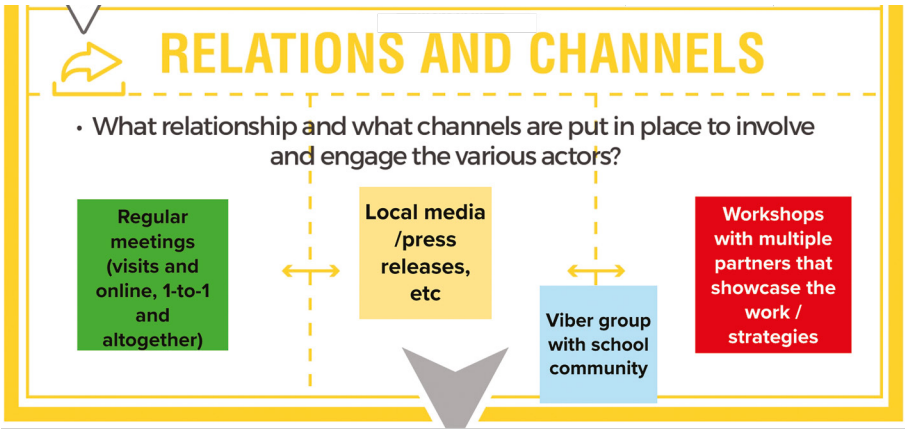


Figure 2.5: Example of the Yellow Box of the OSHub Social Business Model Canvas, from OSHub-GR.

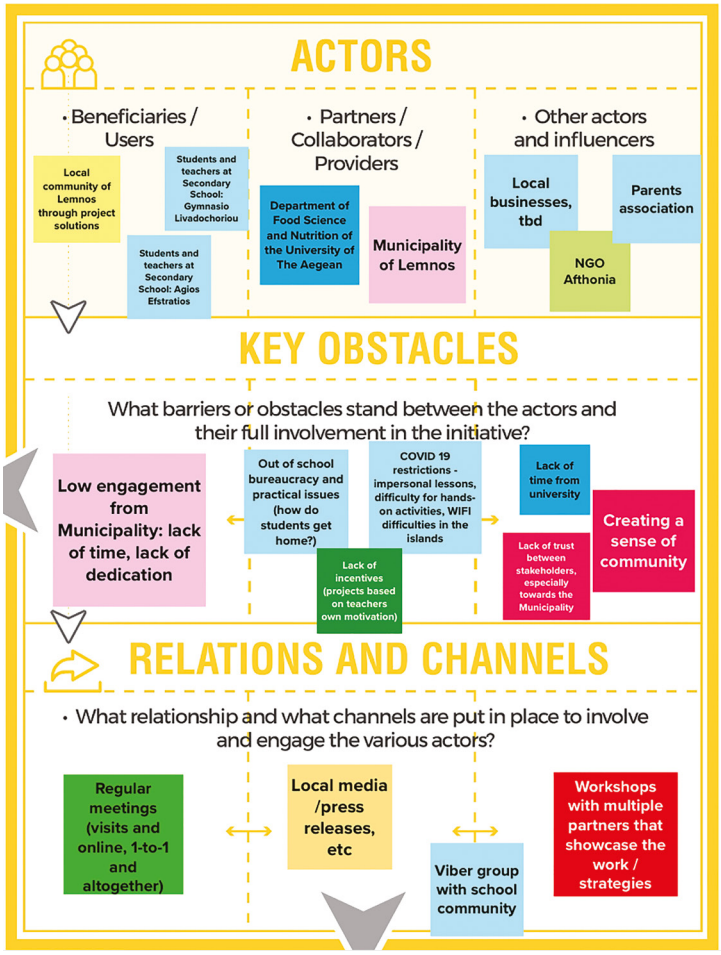


Figure 2.4: Yellow Box – example for the "Relations and Channels" section, from OSHub-GR.

2.2 Red Box: Results, Activities, Resources

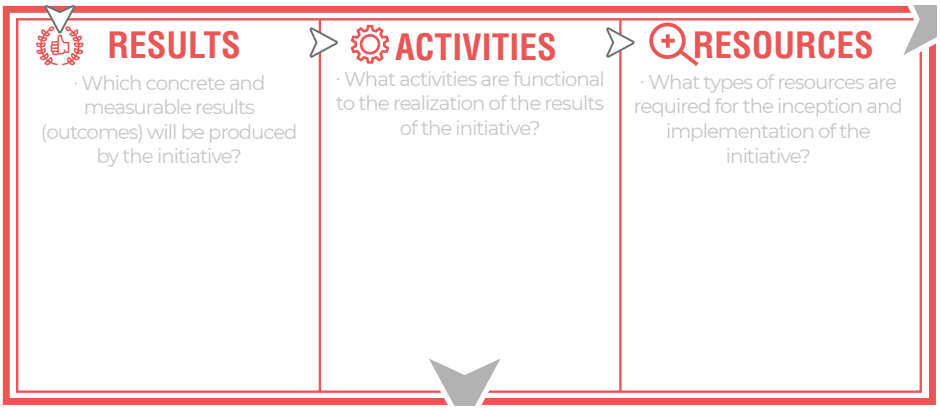


Figure 2.6: Red Box of the OSHub Social Business Model Canvas.

It is important to work on describing the kind of results, challenges, activities and resources OSHubs have identified or developed to realise the results. The results represent the specific objectives in which the value proposition, that is to say, the main mission of the OSHub, is broken up.

The reason why these three elements are part of the same box is threefold. First, it is important that these elements have a strict logical and coherent connection between each other. Specifically, results and activities need to be logically interrelated to obtain a feasible and efficient plan. Considering the different scales of the SBMC, if the value proposition represents the main goal/objective to realise, the results are the more "practical" and specific goals to achieve. In fact, depending on the inductive or deductive approach of the user, the canvas could be started from this box instead of the violet one or vice versa.

2.2.1 Results

Results have to be measurable, and this characteristic is important to obtain the feasibility and, later, to determine the costs.

In the section dedicated to results there is a question which is very similar to the one discussed in the value proposition, regarding social and environmental challenges. Following the scale scheme, the results may share the main challenge or address "sub-challenges" that are related to the main one.

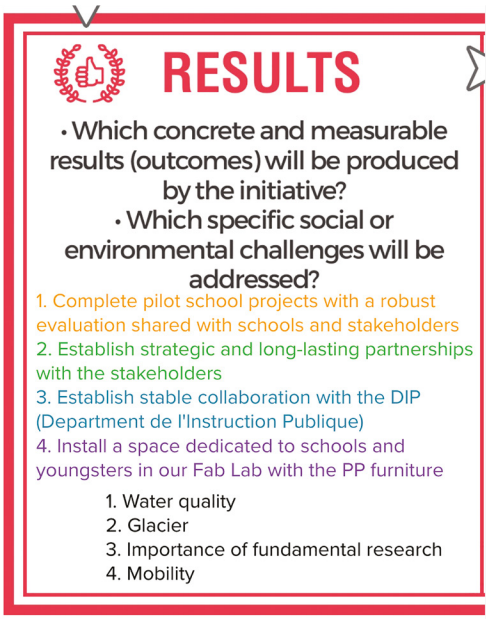


Figure 2.7: Red Box – example for the "Results" section, from OSHub-CH.

2.2.2 Activities

The activities refer to the practical action that will be developed and implemented in order to achieve the results. As for the results, activities also have to be measurable, so that one can obtain feasibility and to determine the costs.

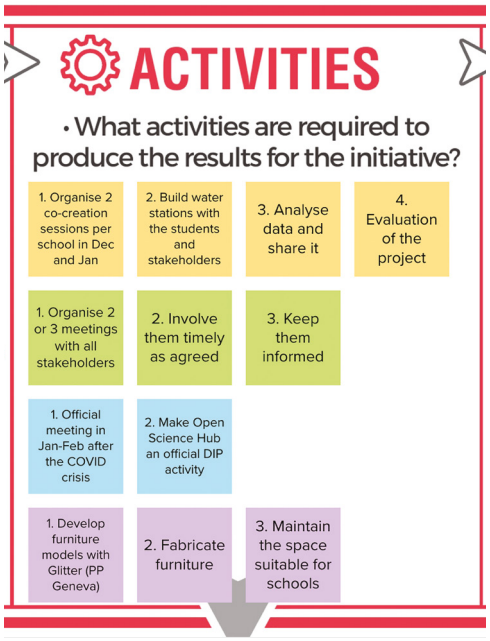


Figure 2.8: Red Box – example for the "Activities" section, from OSHub-CH.

2.2.3 Resources

The resources are the elements that allow you to concretize the activities, and can range from human resources to materials, equipment, facilities, etc. It it key to define the resources as clearly and specific as possible in order to facilitate the identification of costs.

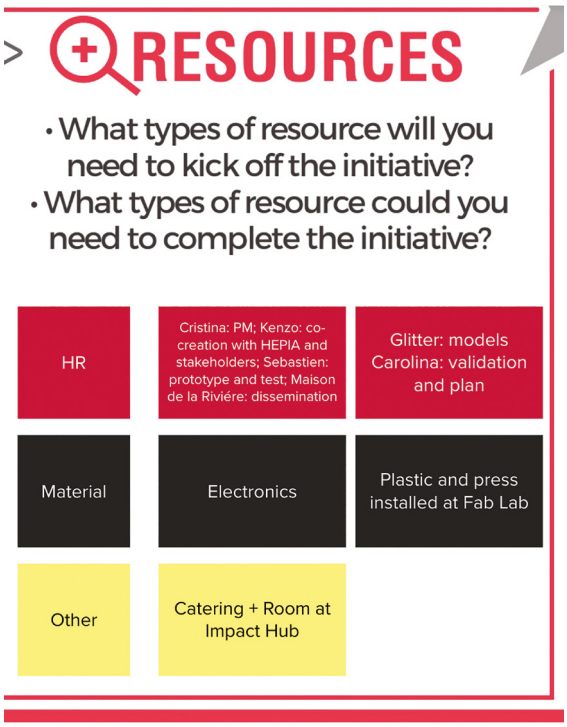


Figure 2.9: Red Box – example for the "Resources" section, from OSHub-CH.

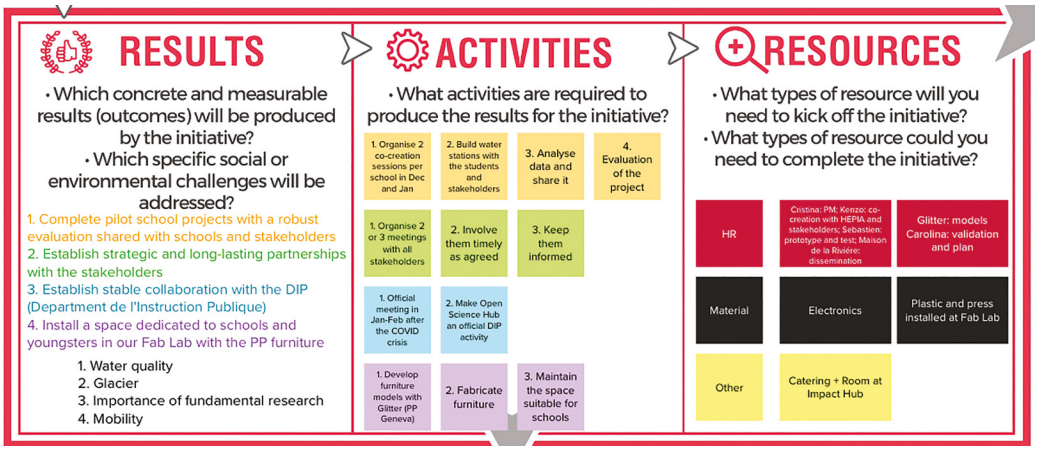


Figure 2.10: Example of the Red Box of the OSHub Social Business Model Canvas, from OSHub-CH.

2.3 Violet Box: Value Proposition, Problems/Needs/Opportunity

The value proposition is the beating heart of the Social Business Canvas because it represents the main objective behind any social business, or business in general, that allows the project idea to live and breathe. Identifying the value proposition is also important because it is the beginning of the logical process to regulate the Social Business Canvas. In the end every box needs to be coherent and logically related to the value proposition, because every block is the piece of the puzzle that composes the big picture, which is in fact the value proposition.

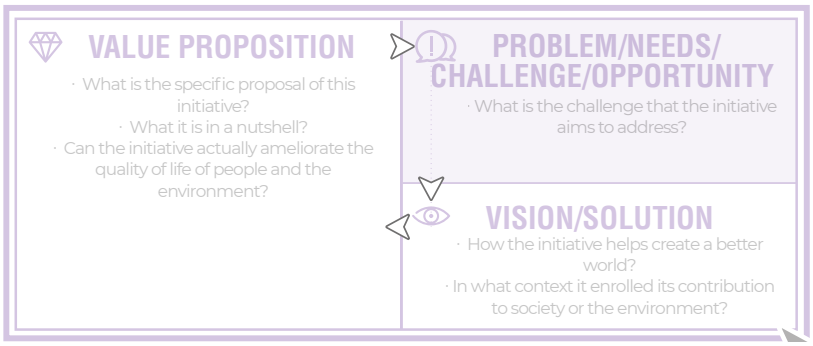


Figure 2.11: Violet Box of the OSHub Social Business Model Canvas.

2.3.1 Value Proposition

The section on the block dedicated to the value proposition presents some questions that help the user, not only to identify the specific proposal of the initiative, but also to identify the social and environmental purposes of the initiative, therefore highlighting the innovative and socially driven aim of the social business canvas compared to the traditional version.

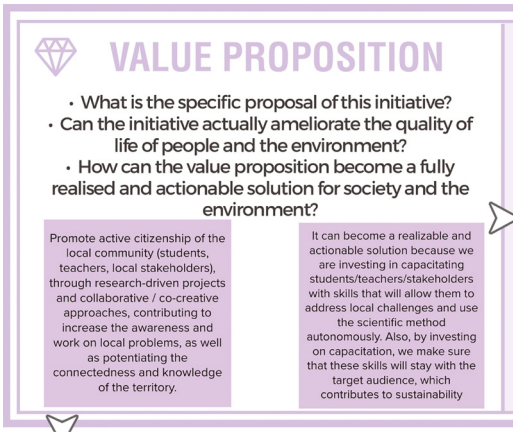


Figure 2.12: Violet Box – example of the "Value Proposition" section, from OSHub-PT.

2.3.2 Problems/Needs/Opportunity

Because the Social Business Canvas is an engine specifically designed to support business ideas and initiatives that have a social purpose, the tool itself proposes to integrate the section about the main challenge with the Sustainable Development Goals set up by the United Nation to be achieved by 2030. Similarly, in this case the aim is to facilitate the thinking process of the user in the identification of the challenges.

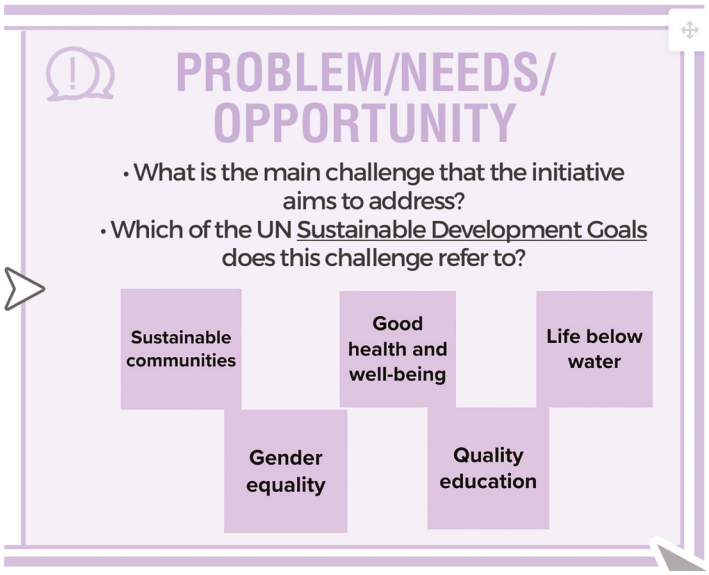


Figure 2.13: Violet Box – example of the "Problems/Needs/Opportunity" section, from OSHub-PT.

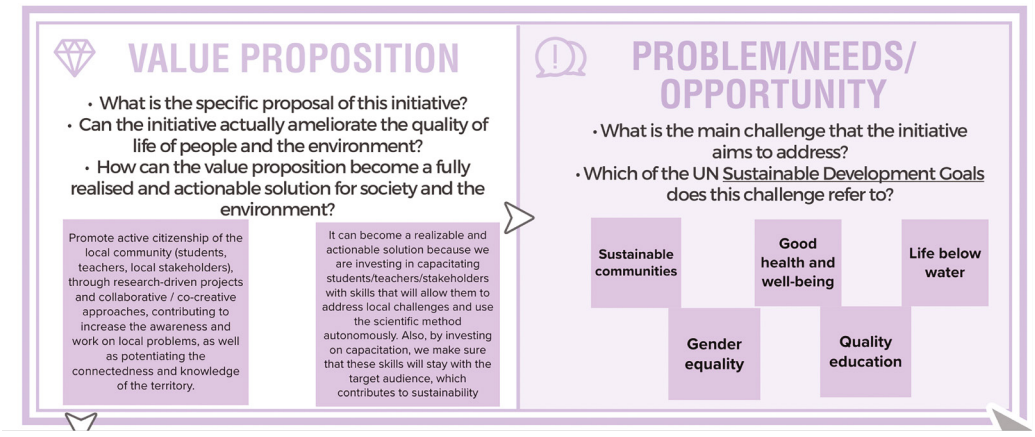


Figure 2.14: Example of the Violet Box of the OSHub Social Business Model Canvas, from OSHub-PT.

2.4 Green Box: External Conditions, Impact, Side Effects

The section about Impact is one of the most significant elements of the OSHub SBMC. It comes from the traditional logical framework used in project cycle management and asks the partners to reflect on the kind of impact they aim to produce.

As for the logical framework, in this section impact is not only divided in local, social and environmental but, most importantly, is related to the identification of measurable indicators to assess the level of impact produced. Furthermore, partners are led to think about what side effects and external conditions can influence and "impact" OSHubs, either positively or negatively.

Figure 2.15: Green Box of the OSHub Social Business Model Canvas.

2.4.1 External conditions

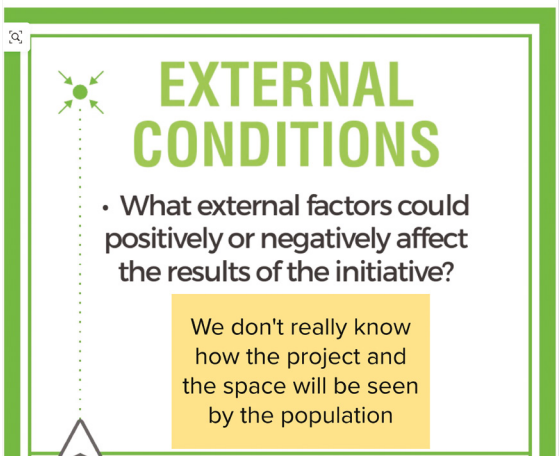


Figure 2.16: Green Box – example for the "External Conditions" section, from OSHub-FR.

2.4.2 Impact

In this section the user is asked to reflect on what impact they want to produce and size of this impact. In fact, one of the first questions is to explain how this impact is going to be measured. This block is strictly connected to other ones that we described above. The measurability of the impact depends on the measurability of the results and activities and on the identification of the identity and quantity of the actors involved. It is also related to the value proposition and, specifically in what way it will impact the local and, in percentage, the global community.

Figure 2.17: Green Box – example for the "Impact" section, from OSHub-FR.

2.4.3 Side effects

The section of side effects really addresses the positive or negative effects that the project or initiative may produce involuntarily.

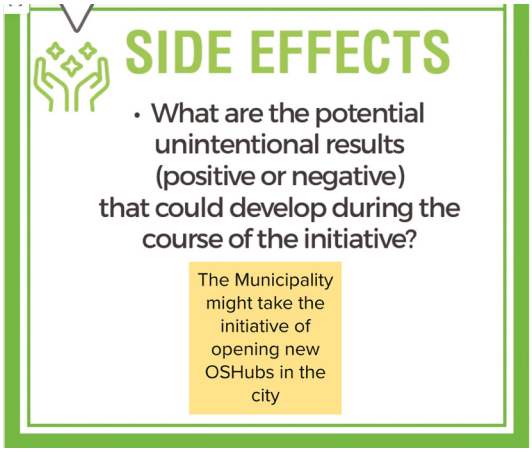


Figure 2.18: Green Box – example for the "Side Effects" section, from OSHub-FR.

Figure 2.19: Example of the Green Box of the OSHub Social Business Model Canvas, from OSHub-FR.

2.5 Blue Box: Cost Structure and Flow of Revenues

The last block is dedicated to numbers. Once all the other boxes are filled in, the last step is to draft a financial plan that is able to sustain the implementation of the project or initiative, on one side, and to envision a sustainability plan, on the other.

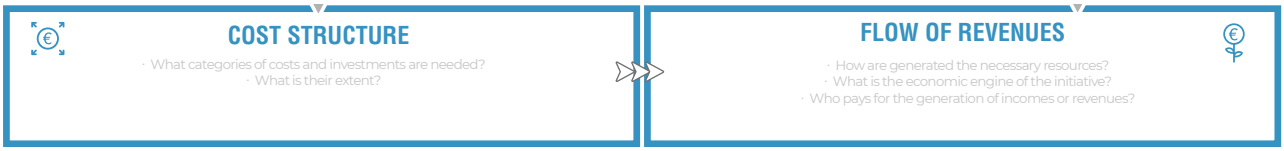


Figure 2.20: Blue Box of the OSHub Social Business Model Canvas.

This section of the OSHub SBMC has been also translated into a template that is depicted in the table below, in which partners are invited to reflect on the source of revenues and how the costs are split.

A) Turnover	**2021**	**2022**	**2023**
Sales of goods and services	- €	- €	- €
Grants	- €	- €	- €
Other income	- €	- €	- €
Total A	**- €**	**- €**	**- €**
B) Production costs			
Purchases of raw materials, consumables, consumables and goods	- €	- €	- €
Services:			
Utilities and facilities	- €	- €	- €
Transports	- €	- €	- €
Rents	- €	- €	- €
Consultancies	- €	- €	- €
Marketing	- €	- €	- €
Training	- €	- €	- €
HR	- €	- €	- €
Travels and events	- €	- €	- €
Tangible assets depreciation	- €	- €	- €
Intagible assets depreciation	- €	- €	- €
Overhead costs	- €	- €	- €
Total B	**- €**	**- €**	**- €**
Operating activity (A-B)	**- €**	**- €**	**- €**
C) Financial management			
Cost of interest	- €	- €	- €
Other financial costs	- €	- €	- €
Totale C	**- €**	**- €**	**- €**
Earnings before taxes	**- €**	**- €**	**- €**
Direct taxes	- €	- €	- €
Net profit	**- €**	**- €**	**- €**

Figure 2.21: Template used to build the costs and the flow of revenues.

2.5.1 Cost Structure

The first section is related to the cost structure which is strictly connected to the red box and, in particular, to the resources and activities. This section asks the user to provide costs for all the elements that are needed to carry out the activities. It also asks the user about the extent of the costs and investments, adding to the reasoning process the variable of time. This will help the user to organise the funding and the project revenues and expenses.

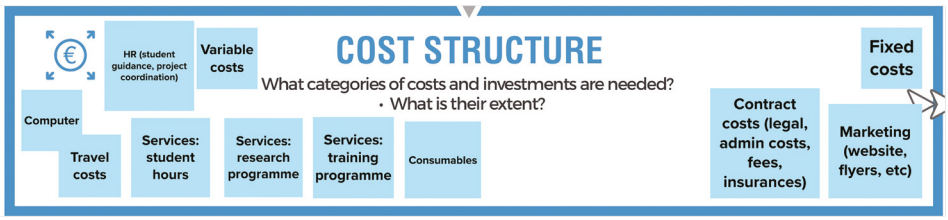


Figure 2.22: Blue Box – example for the "Cost Structure" section, from OSHub-NL.

2.5.2 Flow of Revenues

To build a plan that is able to be self-sustaining is of strategic importance. As such, this second section relates to the flow of revenues, which is especially important when thinking about sustainability. Most particularly, it asks the user to reflect about the cycle of funds, and from where and from whom the money comes from.

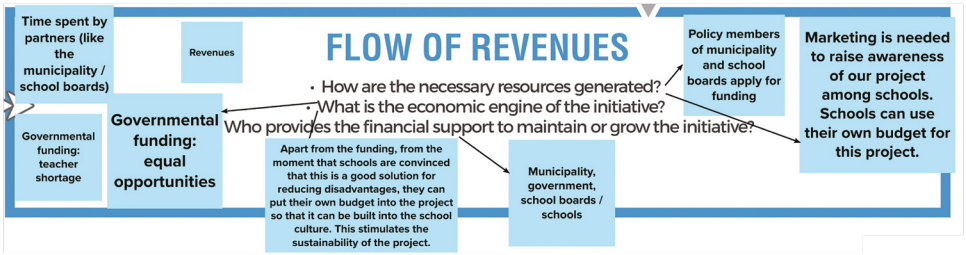


Figure 2.23: Blue Box – example for the "Flow of Revenues" section, from OSHub-NL.

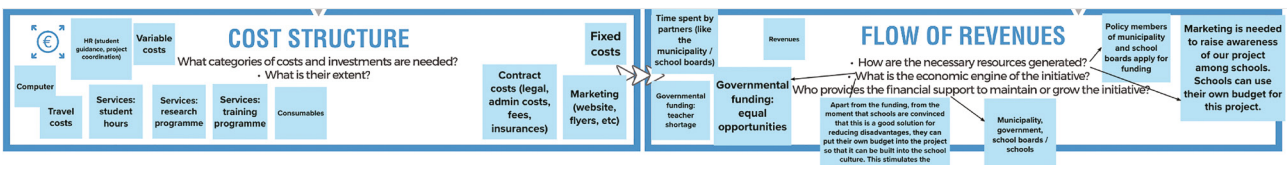


Figure 2.24: Example of the Blue Box of the OSHub Social Business Model Canvas, from OSHub-NL.

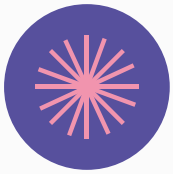
2.6 Co-creation tools to assist the OSHub Social Business Model Canvas journey

The OSHub SBMC actualises an idea into a high impact, working, feasible concept, allowing the user to combine all aspects required for its success and identify the channels and resources required to facilitate it. SBMC is built on co-creation and innovation within the local context, and OSHub has gathered a number of tools to assist users with this process, to ensure the best use of the canvas is gained.

These tools can be used individually or in tandem with one another. They should be revisited throughout both the planning and implementation process along with involved stakeholders as various aspects may change as the user moves through the project development journey. It is important to note that each tool can be helpful for multiple sections of the SBMC.

TOOL

Prioritising ideas and assumptions maps



SMBC SECTION Violet

OBJECTIVE

Decide on an initial project concept or topic to pitch to schools (or other relevant stakeholders) as a challenge-based starting point.

REASONS TO USE

- Brainstorm meaningful topics and challenges being faced by the schools you wish to engage and/or by their community.
- Brainstorm possible projects that overcome this topic/ challenge, and consider their feasibility vs impact.
- Explore assumptions of the hub and external stakeholders regarding their understanding of the school's relationship with each challenge topic.
- Identify areas where greater research is required to remove bias.
- Decide on three different projects to pitch to the school.

INTRODUCTION TO THE TOOL

This tool is a set of three maps that assist the hub in identifying possible challenge topics they may like to design their project around in collaboration with local schools, while understanding their own assumptions of the topic.

- The first map asks for answers to the question: "What issue have we seen that is important to our audiences?"
- The second map asks participants to map topics against perceived importance and feasibility.
- The third map encourages participants to think about what assumptions have to be made for the top rated ideas from the previous map before preparing a pitch to schools.
- At the end of using this tool, three project topics will be selected to pitch to schools.

HOW TO USE

This tool should be used in a session lasting no more than 45 minutes, and can be run internally only or together with a limited number of external stakeholders.

Move through each map in sequential order (starting with the first and ending with the third). In the 45 minutes only 5 minutes should be given to adding sticky notes to each map. The rest of the time should be used for open discussion. Prompts are included on the axes of this map to encourage a focus on Open Schooling.

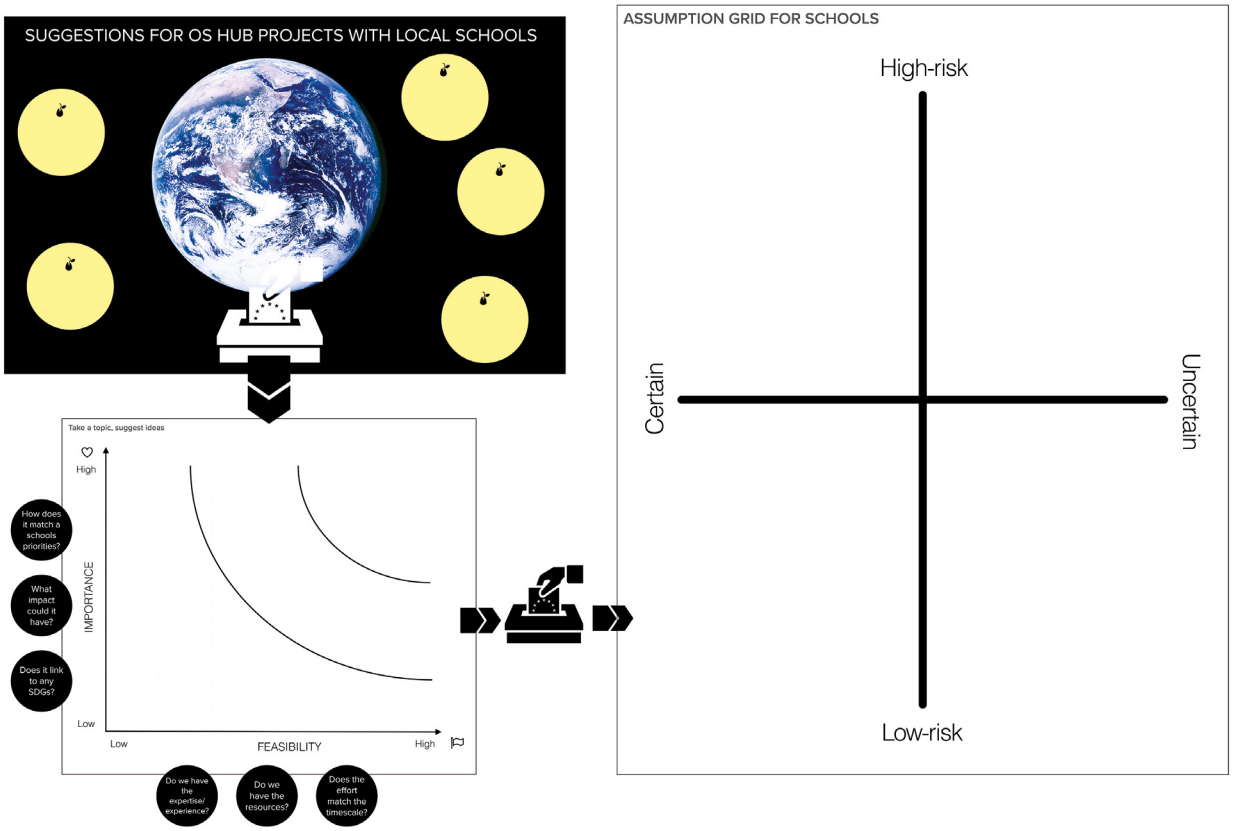
The third map may open up questions about the topic where more research is required to confirm or deny assumptions. This may happen in initial discussion with the school(s).

Note: *To avoid bias in the second map, participants should copy and complete their own grid individually before deciding to place the ideas on the shared map.*

1

1

Now we will use a relevant challenge topic for us to decide what to attempt to engage schools with.
Before looking at every stakeholder, first we must seek the buy-in from schools.
After renaming the stickies with 3-5 topics your facilitator will run a vote to choose a top topic. After this decision is made move to the next section in the outline to brainstorm ideas around the topic.



2

Use this to map to channel some ideas leading to a vote on the top 3 ideas to bring to a school.
Think about the importance of the project to a school, to us, to other local stakeholders.
Think about how feasible the idea is - is it doable given all the factors?
Use the questions to help place your ideas, but keep your thoughts free to come up with suggestions surrounding the topic.
After 15 minutes the facilitator will start a vote and you can choose your top 3 ideas. The overall top 3 will lead to the next task.

3

What do you think you know about school interest about the topic? What relevant assumptions are you confident about when it comes to teachers and students (**CERTAIN**)? What relevant assumptions are you not confident about (**UNCERTAIN**)? What evidence do you have or need to back the assumptions up? Imagine moving forward with an assumption - is it easy to act on (**LOW RISK)** or complicated to act on (**HIGH RISK**)?

This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement n.824581

TOOL

Stakeholder Map Template

SMBC SECTION Yellow, Blue, Red

OBJECTIVE Collate a longlist of diverse local stakeholders and identify subsets of key stakeholders for agreed project concepts/topics. Choose key stakeholders to approach for the local OSHub Management Board.

REASONS TO USE

- Identify all possible stakeholders of the project and ensure all contact information is available as required.
- Assign categories to each stakeholders so that they may be easily filtered through
- Identify those who may be beneficial to the OSHub management board
- Use to assist with understanding available resources and possible flows of revenue

INTRODUCTION TO THE TOOL

The Stakeholder Map provides a space where all possible stakeholders (both internal and external) of the project can be listed and categorised appropriately, allowing for simple selection when choosing levels of participation of each actor.

- The template offers proposed categories that will likely be helpful for an OSHub to use when discussing stakeholders.
- The template is easily accessible and adaptable to suit the needs of the hub and include as much information as deemed necessary for each stakeholder.

HOW TO USE

The core team should discuss all possible stakeholders, whatever level of participation they may have, and complete the template with the required information for each stakeholder. The template can be edited to include more or less information, or to request assignment of a specific set of possible responses (eg. Sector: Choose from Industry, Academia, Civil Society, Informal Education-related entity etc).

This objective does not necessarily need to be completed as a real time exercise and instead existing internal and external key stakeholders can add to the list. Therefore it is useful to consistently revisit the list.

The spreadsheet can be filtered by type, speciality, distance or any other number of properties that might be deemed useful.

Note: *It is important to recognise any bias to a particular stakeholder type and actively address this in seeking out diversity.*

ORGANIZATION NAME	ABBREVIATION	TYPE (NGO, SME, University, ...)	DESCRIPTION (e.g., "About us" from website)	NAME	ROLE	CONTACT	MEMBER OF MGMT BOARD (Y/N)?

TOOL

Stakeholder Analysis

SMBC SECTION Yellow, Blue, Red

OBJECTIVE Prioritise key stakeholders identified using the STAKEHOLDER MAP TEMPLATE and decide which to engage for the project or topic.

REASONS TO USE

- To identify the influence each stakeholder may have over the project
- To understand the level of communication and engagement required for each stakeholder due to their influence and interest/availability
- To ensure time and resources are allocated correctly to ensure engagement levels are met
- To envision and decrease possible engagement barriers that may arise during the project

INTRODUCTION TO THE TOOL

Stakeholder analysis allows the user to clearly identify the level of engagement that is required for each key stakeholder based on the influence they have on the project, as well as perceived interest of the topic and availability to participate.

- The main template consists of a grid with the x axis labelled *interest/availability* and the y axis is labelled *influence*.
- Each stakeholder is placed on the grid depending on their interest/availability level vs influence level. This tool splits communication priority left and right with those on the left seen as a lesser priority and those on the right as higher priority.
- The grid is separated into four boxes which are labelled various degrees of engagement: *Justify to Them; Monitor Them; Actively Engaged; Help Them Engage*
- Depending on the box in which the stakeholder is placed on the grid determines the extent of which they should be engaged in the project, and therefore the method and resources required to ensure successful engagement.
- In the template, the user will find an explanation of each engagement level.

As this tool is used for analysis of key stakeholders, it is important to remember that communication with all will be important, however this communication will likely differ per stakeholder depending on the outcome of this tool.

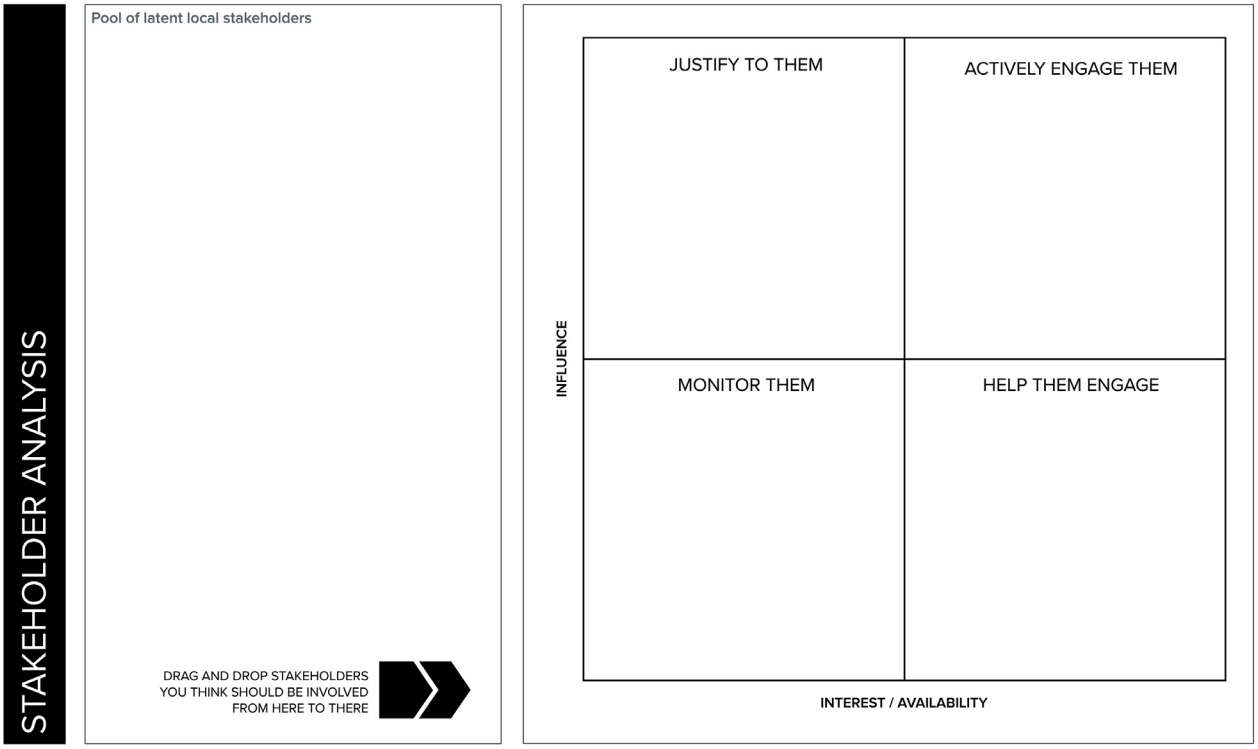
HOW TO USE

Identify key stakeholders from the 'STAKEHOLDER MAP' list and place them into the large box on the right of the tool. The core team should discuss their thoughts, perceptions and knowledge on the influence vs interest/availability of each stakeholder, and place them on the grid accordingly.

It may come to light that there is more knowledge on one stakeholder than another, prompting further research. Update the tool once necessary research has been carried out.

If new stakeholders are added throughout the process or previous engagement levels assigned change, revisit and update the tool.

3



1

This can be created at the very beginning before approaching anyone (including schools) to list all your known local stakeholders OR knowing the ideas you have you can choose to put only relevant stakeholders here.

The stakeholders can be dragged and dropped onto the next map (Influence vs. Interest) to help decide who you need to engage as well as schools to make the OS Hub project work.

2

If the schools you interviewed are onboard for the project idea(s) you can move forward with mapping other stakeholders. This is using your knowledge and other stakeholders knowledge of each other to map influence and interest in order to think about levels of communication and engagement.
The grid is divided into:

JUSTIFY TO THEM: Those who you believe will have influence over the project in some way. You will need to justify to them the importance of the project to schools and other stakeholders in the community.

MONITOR THEM: Those who you believe will not be engaged with the project but may be worth looking at what they are doing in case they start moving in interest or importance during the project.

ACTIVELY ENGAGED: Those who you believe have great influence and would be very interested in the project. These are a priority to engage.

HELP THEM ENGAGE: Those who you believe would be very interested in the project but wouldn't normally engage or be able to engage. This section can (if desired) be used to highlight underrepresented stakeholders who could have greater influence, but only with your help. In that last case they are a priority to engage too.

This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement n.824581

TOOL

Participation map

SMBC SECTION Yellow

OBJECTIVE Decide on the level of participation of your key stakeholders (actors).

REASONS TO USE

- Identify stakeholder participation level
- Highlight communication channels required
- Identify whose input is required for certain milestones

INTRODUCTION TO THE TOOL

The Participation Map provides a clear overview of the level of participation of your stakeholders. This map can be used as a starting point for who should be recruited for the project on the co-creation journey and their role.

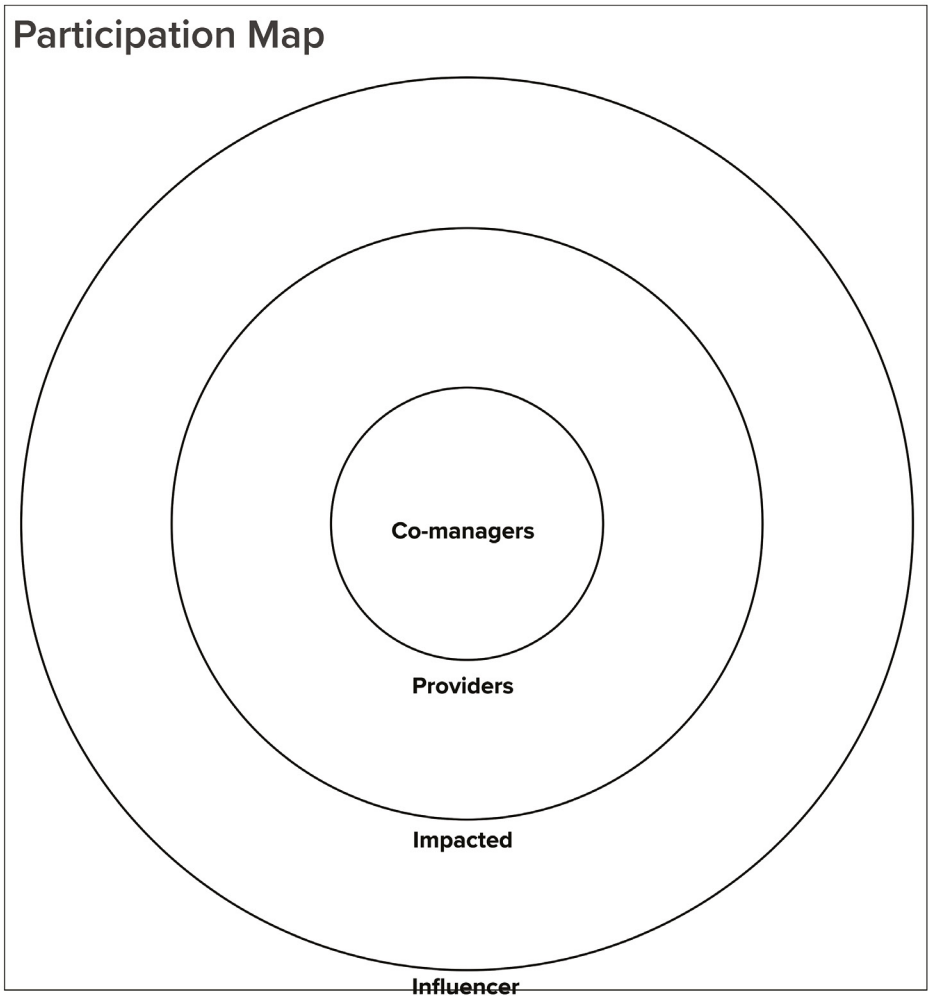
- The template consists of four (this may be adapted) concentric circles, each larger than and encasing the last. Each circle is given an 'actor role', and moving outwards from the centre, a stakeholder's participation level decreases.
- The actors located in the centre are those most involved in the project (Eg, Actors identified as users/beneficiaries) who will have a stake in all decisions made.
- As you move out from the centre, the necessity of actors being involved in decision making decreases, as does their stake in decisions.
- Discuss this map with your stakeholders, as they may feel they wish to participate more or less in certain areas.

HOW TO USE

Place each stakeholder within the map depending on their participation level. Use the category descriptions below to help you make your choice. Discuss this choice with your team.

The template should be revisited after the yellow box is filled. Possible obstacles or complicated engagement channels may alter the level of participation by a stakeholder, thus changing their role.

5



Co-managers are those involved in co-managing the solution (internal personnel/ pro-active stakeholders/ beneficiaries)

Providers are those that are strategic stakeholders and technical expertise who could help co-produce or co-design the project.

Impacted are those who could offer advice and/ or are impacted by the project outcomes

Influencers are those that might obviously influence the success of a project such as policy makers but also think about service providers that are thought of less often, but key. For instance what basic services are being relied on? Think of transportation, caterers, cleaners, technical support and more.

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TOOL

Empathy Map

SMBC SECTION Yellow

OBJECTIVE

Understand the needs and motivations of each prioritised stakeholder before pitching involvement in an initial concept or topic to them.

REASONS TO USE

- Consider the wants and needs of collaborating partners.
- Identify areas of most importance that can be focused on when pitching the idea.
- Identify possible obstacles the partners may face, and means by which the project can minimise those obstacles.
- Develop a pitch that is effective, impactful and engages the target partners.

INTRODUCTION TO THE TOOL

Empathy Maps ask hubs to take the time to empathise with partners by considering how partners interact with a topic or environment. This will help with understanding constraints and opportunities for deep collaborations, while providing a strong starting point for new partner relationships.

- The template consists of six sections, which prompt users to consider how the partner may think and feel, what they may see and hear, what they may say and do, and what they may gain or lose during their involvement in the proposed project.

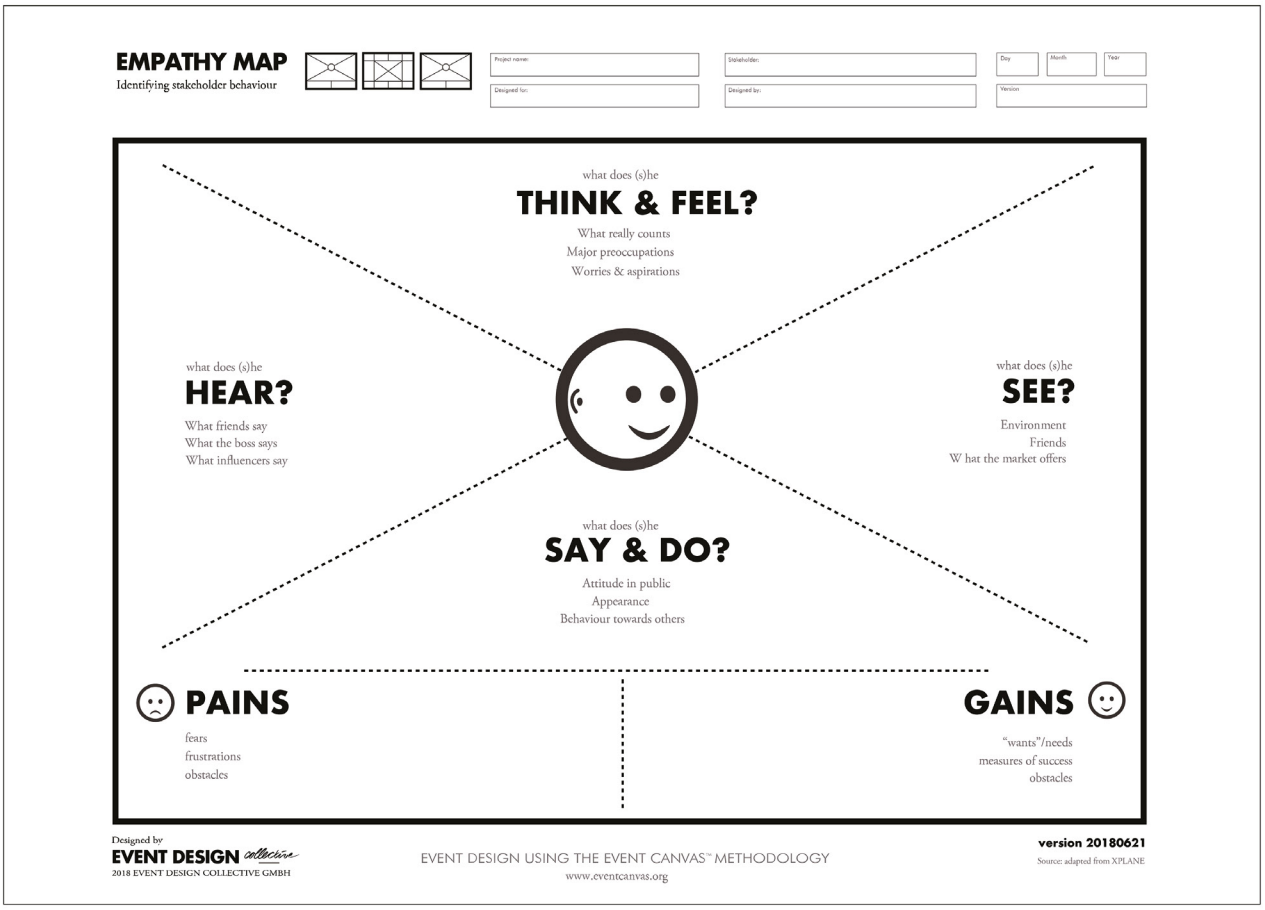
HOW TO USE

Introducing and completing this exercise should take no more than 20 mins and should be used by those who are going to be engaging with partners in initial discussion and follow up meetings.

Each area of the template should be discussed, and then results from this discussion placed on the map using sticky notes. The map can be used for one or multiple stakeholders, however sticky notes should then clearly state which stakeholder they refer to.

A facilitator may want to give time for the map twice, broken up with an empathy exercise or simple scenario to consider to maximise output.

2



For OS Hub a key goal is to explore open schooling principles with local school stakeholders. While all stakeholder type analysis is important, the start of the journey relies on the investment and interest of students in your school(s).

1 Everyone can work on this one map together. On your stickies make sure to indicate if you are talking about a teacher or student.

Now you should have a good way of engaging schools empathetically to probe the assumptions you have made in order to discover if one or more of your ideas are feasible.

After these conversations you will need to revisit the assumption grid and readjust it before moving on to identifying key players that may be needed to co-create a project.

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TOOL

Pitch Map

SMBC SECTION Yellow

OBJECTIVE

Develop a pitch for a specific stakeholder based on their needs, interests and possible role in the project.

REASONS TO USE

- To highlight the needs and wants of a stakeholder that are relevant to the project.
- To decide on the role the stakeholder will play – why are they being engaged and what can they offer?
- Develop a pitch that is effective, impactful and engages the target partners.

INTRODUCTION TO THE TOOL

Note: *This tool builds on the EMPATHY MAP, which should be completed first before using this tool.*

Using knowledge gained from the empathy map, the pitch grid allows the user to clearly list the interests and needs of the stakeholder to the useful qualities and resources they possess which makes them a beneficial stakeholder. From this, an elevator pitch of the project for a stakeholder can be developed.

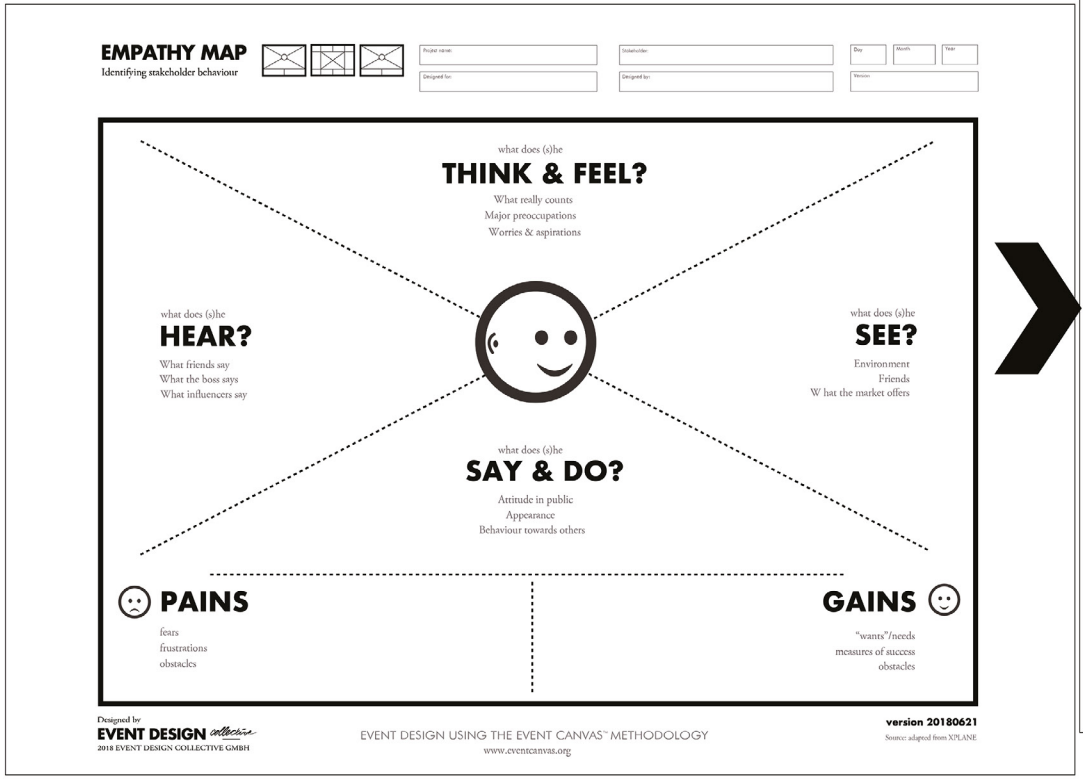
- The template consists of a grid with four quadrants labelled; Qualities; Interests; Offers ; Needs.
- When filled out, it will be used to ensure the elevator pitch developed is correctly catered toward the stakeholder you wish to engage.
- The pitch is the first impression stakeholders will have of your project, and therefore it is very important it is impactful on each stakeholder and that they are inspired to work on the project. Otherwise the project may miss out on valuable skills, knowledge and resources.

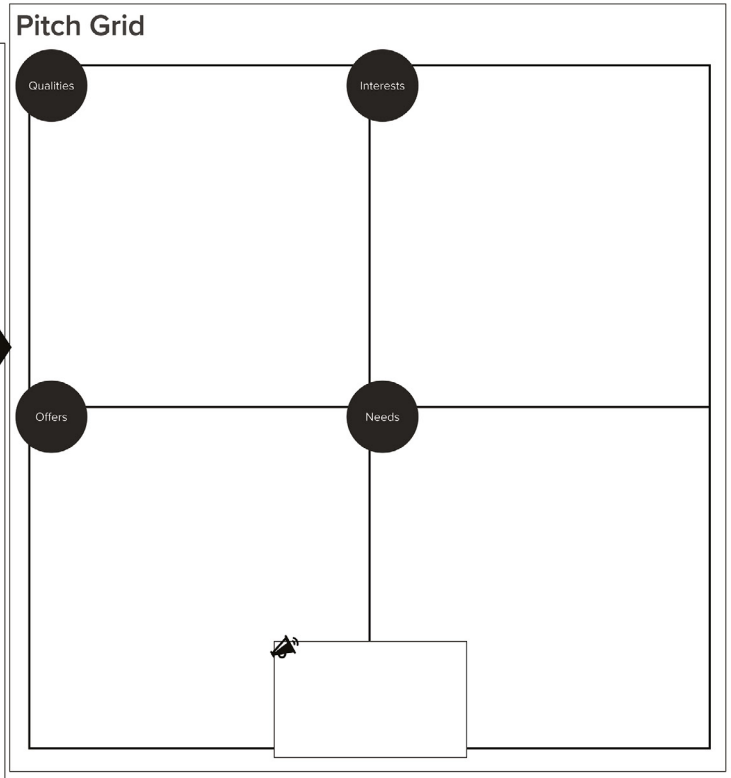
HOW TO USE

Using the same frame of mind as used in the empathy map, build the list of qualities, interests, offers and needs within the tool. Remember possible bias, and ensure correct research is carried out if knowledge is lacking on a particular stakeholder.

Spend 15 minutes to build the list and consider a 'pitch script'.

The tool can be repeated for as many stakeholders as is deemed necessary.





1

Before engaging stakeholder types it is important to think of their motivations through empathy mapping like we did for students and teachers. Empathising here will help you pitch the concept of the OS Hub project idea to them so they know how much involvement you are seeking from them and are considerate of their situations.
In the next step we will use this consideration of stakeholder types through empathy mapping to help create an 'elevator pitch' to help engage a desired stakeholder.

2

Now that you have empathy mapped your stakeholder, think and note down their qualities/properties, what they could potentially offer, what their needs are and what interests they have. From these decide together a short opening elevator pitch. Perhaps test this pitch on another group of colleagues for feedback and discussion. Making the first, best steps with a stakeholder will help them invest in your idea(s). This can be repeated for multiple stakeholder types. Your facilitator can expand the canvas size and duplicate the empathy and pitch maps as needed.

This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement n.824581

TOOL

Local Context Canvas: Defining the Challenge

SMBC SECTION Red, Green

OBJECTIVE Define and analyse the challenge being tackled within the context of the project.

REASONS TO USE

- Consider the needs of the local community/context that the project is based in.
- Identify the challenge connected to these needs, and the reasons for this challenge.
- Analyse the possible factors that feed into this challenge, and the requirements for overcoming these.
- Ensuring research has been carried out to remove assumptions regarding social needs in the local context.
- Consider the challenge within the wider community, providing the opportunity for important stakeholders and resources to be acquired for involvement.

INTRODUCTION TO THE TOOL

This local context canvas prompts the users to use co-creation and collaboration to consider the local context of the challenge they are hoping to tackle with their project, thus ensuring the involvement of local stakeholders who have in-depth knowledge of the context within the project development process.

- The template consists of four boxes, each viewing the challenge from a different perspective.
- It covers the social needs hoping to be addressed, an in-depth review of the challenge, the external factors leading to this challenge, and the evidence that such a solution is actually required.

HOW TO USE

Spend 30 minutes discussing the tool with your team and local stakeholders, and add content where appropriate. Use the prompts to assist where needed. Consider possible research that may need to be carried out to further an understanding of a particular area, and ensure expert opinion is included.

Revisit this tool after the appropriate research is done or if new actors are introduced to the project. Use this tool to assist with understanding resource requirements and stakeholder participation.

Note: *This tool was developed as part of the SISCODE (Grant Agreement n.788217) toolbox, and has been repurposed by OSHub. Check out the full toolbox here.*

LOCAL CONTEXT : DEFINING THE CHALLENGE

NEEDS

What is the key social need that you are addressing?

Explain the reasons why the need is important and for who it is relevant.

CHALLENGE

What is the local challenge?

Describe the local challenge (problem) that the Lab will address, elaborate a question you would like to answer by working on this challenge.

FACTORS

What social & cultural factors shape / generate this challenge?

Sociocultural factors are customs, lifestyles and values that characterize a community. Think about esthetics, education, language, law and politics, religion, social organizations, technology and material culture, values and attitudes.

EVIDENCES

What evidences do you have that this is a significant challenge?

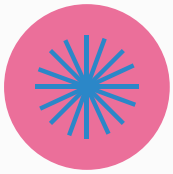
Describe what you know and your experience about the topic. Identify the possible effects of working on this challenge.

Comments:

This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement n 788217

TOOL

Local Context Canvas: Defining Hub Capabilities



SMBC SECTION Red, Yellow, Blue

OBJECTIVE To understand the resources, knowledge and capabilities available to the project.

REASONS TO USE

- To clearly identify what resources are readily available to the hub, and what will be required to source.
- To identify the skills, knowledge and experience available to the hub, and which stakeholders must participate in order to make use of these.
- To outline the co-creation approach currently adopted by the hub (if any), and how that may need to change depending on stakeholders being engaged and desired objectives of the project.
- To fully understand the strengths and weaknesses of the hub so that the project is designed to be feasible, high impact and relevant.

INTRODUCTION TO THE TOOL

This local context canvas prompts the users to identify resources at their disposal and consider where stakeholders may be engaged to assist with any skills and knowledge deficit.

- The template consists of three boxes, each asking the user to define the position of the hub within the three categories of Technology and Resources, Knowledge and Competencies and Co-creation Approach.
- A detailed understanding of a hubs position within these categories is vital for the feasibility of the project, as if required tools and skills cannot be located, the project will likely be unsuccessful.
- It also ensures that the hub takes full advantage of the capabilities of the local community and the benefits its local context has.

HOW TO USE

Spend 30 minutes discussing the tool first with your core team, and then local stakeholders, adding content where appropriate. Use the prompts to assist where needed. Consider possible stakeholders or industry that may need to be contacted.

Continue to revisit the tool if a new partner is added to the hub/project, updating resources and capabilities acquired along the way.

Note: *This tool was developed as part of the SISCODE (Grant Agreement n.788217) toolbox, and has been repurposed by OSHub. Check out the full toolbox here.*

LOCAL CONTEXT: DEFINING THE LAB CAPABILITIES

TECHNOLOGY & RESOURCES

What are the technologies and resources available?

Describe the different technologies and resources available in the Lab for addressing the challenge.

KNOWLEDGE & COMPETENCIES

What are the knowledge and competencies available?

Describe the knowledge, experience and competencies available in the Lab for addressing the challenge.

APPROACH

What is the co-creation approach adopted in the Co-creation Lab?

Describe and illustrate the approach that the Lab has on co-creating initiatives with different stakeholders.

Comments:

This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement n 788217

TOOL

Local Context Canvas: The Policy Environment

SMBC SECTION Violet, Green, Yellow

OBJECTIVE

To define the policy environment surrounding the topic/ challenge of the project, with a focus on local policy.

REASONS TO USE

- To identify what existing policies connected to the project topic are present within the local context.
- To understand the role these policies play within society and how this may impact the project.
- To consider how the project may be used to influence and improve both local and global policies on the issues being addressed, and whether this is an aim of the project.
- To consider what stakeholders may need to be involved in the project to assist with the role of policy within the project.

INTRODUCTION TO THE TOOL

This local context canvas prompts the users to identify local policy related to their topic of interest, and how this policy will play a role within the project.

- The template consists of three boxes, each asking the user to form an understanding of existing, influencing and future policies within the context of the project.
- If policy is not considered, it can lead to unexpected obstacles in the future of product development, while also removing the opportunity of the project to have an important impact on the local community.

HOW TO USE

Spend 30 minutes discussing the tool with your core team and local stakeholders, adding content where appropriate. Use the prompts to assist where required. Consider research that may be required to ensure a complete overview of policy is captured. Continue to revisit the tool if new research comes to light, or new actors are added to the project, possibly bringing in new policy from other areas of society.

Note: *This tool was developed as part of the SISCODE (Grant Agreement n.788217) toolbox, and has been repurposed by OSHub. Check out the full toolbox here.*

LOCAL CONTEXT: DEFINING THE POLICY ENVIRONMENT

EXISTING POLICIES

What are the existing policies related to the challenge?

List the policies that already address tematics related to the challenge. Describe how existing policies could limit/block or support/encourage the development of the challenge.

INFLUENCING POLICIES

What are the threats on addressing existing policies?

Describe the ease and difficulties about influencing policies in the local context.

FUTURE POLICIES

Pitch your idea about how the challenge could influence future policies

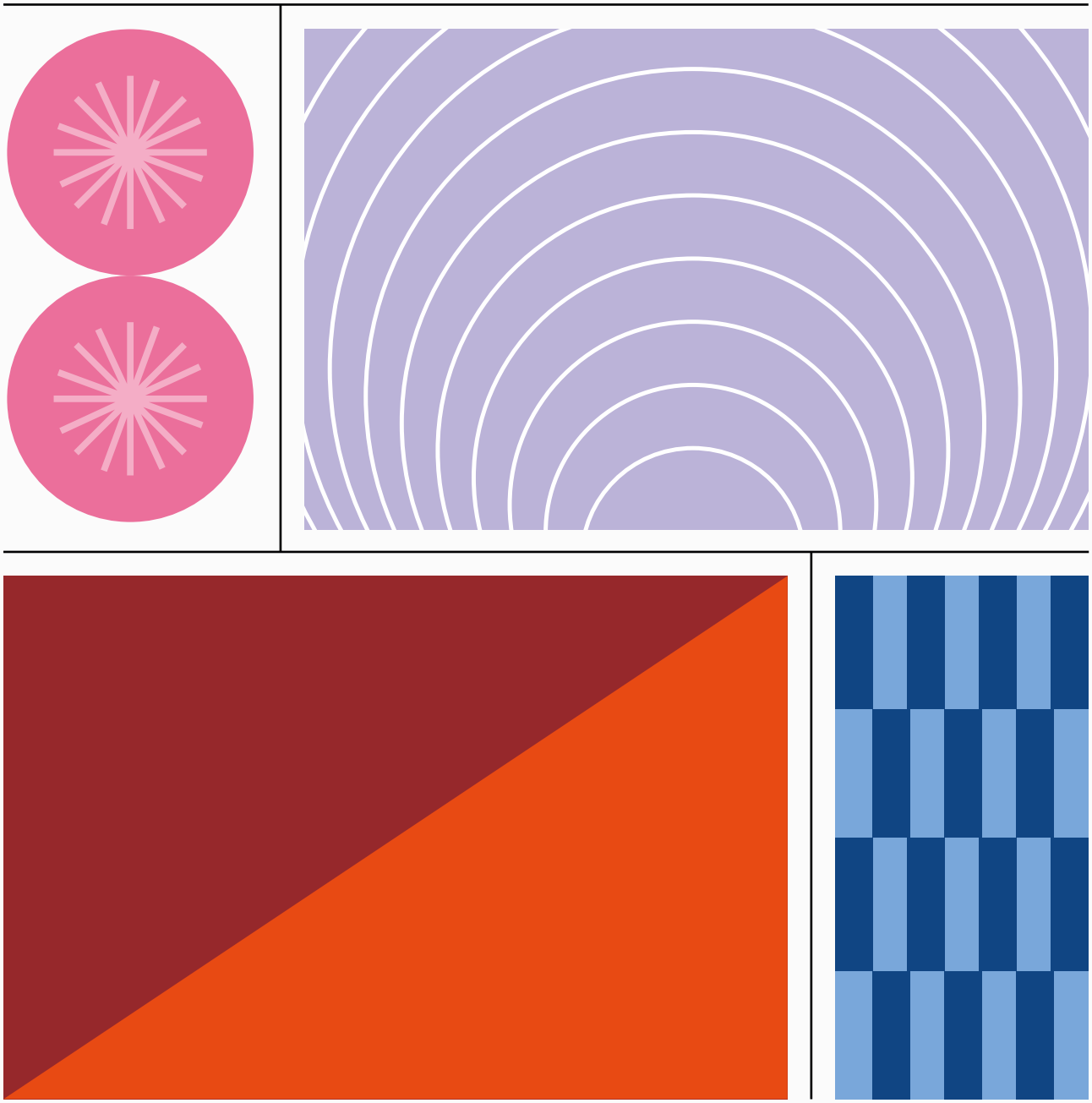
Describe how addressing this challenge could inspire policy making and discussion.

Comments:

This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement n 788217

Case studies

03



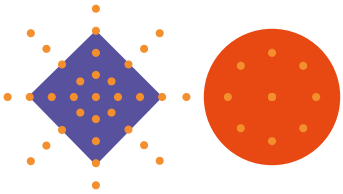
As mentioned earlier, despite the diversity of community-grounded solutions, there are several common patterns across OSHubs which allowed us to cluster them in three main categories.

School – based OSHubs

OSHub teams work together with schools with the objective of facilitating the integration of Open Schooling in the school institutional structure and culture, namely by working together with teachers and school heads, so that in the future schools become fully autonomous.

School – supporting OSHubs

These OSHubs are normally based in a physical space with equipment and resources that schools, generally, don't have access to, and develop projects where schools create tangible solutions to community challenges through science, technology and fabrication techniques.



School – connecting OSHubs

These OSHubs facilitate the establishment of new relationships and processes between schools and stakeholders that normally are not part of school's daily-life, opening-up student's horizons while contributing to the development of meaningful societal meaningful experiences.

Is it important to note that these categories are not closed, and several OSHubs share features of several categories.

The value proposition, approach, activities, relations and sustainability plan of each OSHub depends on several variables, such as the surrounding context – geographical, socioeconomic, ethnic, and the institutional nature of the host institution – its mission, assets, human resources, funding, facilities and networks.

Based on this, we propose the following clustering of OSHubs:

School – based OSHubs	School – supporting OSHubs	School – connecting OSHubs
OSHub – Ireland	OSHub – Switzerland	OSHub – The Netherlands
OSHub – Portugal	OSHub – France	OSHub – Austria
OSHub – Greece		OSHub – Czech Republic

In this chapter, we provide the profile of each OSHub, where we describe the respective value proposition, target public, approach and model by specifying their roles in the relations they established with their partner schools and communities.

OSHub Ireland

OPEN SCIENCE HUB MAKEDOCK IRELAND

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Trinity College Dublin

OSHub-IE is led by Trinity College Dublin (TCD), a research-intensive university, with expertise in several disciplines including nanotechnology, information technology, immunology, mathematics, engineering, education, psychology, politics and English. OSHub-IE started out as part of the education programme in TCD's former art-science public engagement space Science Gallery Dublin, and is now led by researchers in TCD's School of Education.

TCD is based in the heart of the capital city, with direct access to networks of researchers, innovators, educators and students, both locally and internationally.

OSHub-IE works as a community broker between schools, researchers and industry that promotes transdisciplinarity and active global citizenship, by providing or pooling networks of stakeholders that support teachers building student action out into local communities and vice-versa.

Target public

Transition Year Students, particularly from communities at high risk of educational disadvantage.

Transition Year (TY) is a one-year programme that forms the first year of a three-year senior cycle in many schools in Ireland. TY provides an opportunity for learners to reflect on, and develop an appreciation of, the value of learning in preparing them for the ever-changing demands of the adult world of work, further and higher education and relationships. Hence, each school designs its own TY programme by taking into account the possibilities offered by local community interests, in a way that suits the needs and interests of its students, thus providing an ideal opportunity to activate students as active global citizens.

Although not exclusive to these schools, OSHub-IE places focus on schools with a DEIS (Delivering Equality of Opportunity in Schools) designation, meaning the students there are at the greatest risk of educational disadvantage, or Educate Together Secondary Schools, with a high proportion of students with Special Educational Needs.

Approach

OSHub-IE developed a STEAM-focused year-long programme to empower students to become active citizens within their own communities. This programme aimed to spark inspiration through STEAM workshops, to identify challenges of local concern, to construct projects to tackle these challenges and to showcase their work beyond the classroom.

The role of OSHub-IE throughout this process is the following:

- to connect schools to experts and local stakeholders who assisted with workshops and provided guidance to students throughout their OSHub project development phase, placing these projects within a real-world context. Through these interactions, students gain relevant and real-world insight into the topics they are exploring and are encouraged to share their thoughts and opinions. In addition, it acts as inspiration for future career paths for the students;
- to prepare the sessions and inform the invited stakeholders of their role, ensuring clear communication between all actors involved;
- to evaluate the programme from the perspective of students, teachers and the hub itself, to make suitable improvements for the following year;

- to coordinate the project showcase, including organising a location, ensuring the physical design of informative panels and student projects, inviting the guests, and developing the programme;
- to ensure sustainability of the programme.

To support teachers in secondary schools facilitating this year-long programme, TCD organised teacher training workshops, and co-created the OSHub-Ireland: Teacher Handbook using teacher consulation, which outlines all elements of the programme and links to required resources, providing a means for teachers to adapt the material to suit their local context. Specifically, it includes relevant definitions, diversity equity and inclusion guidelines, a selection of transdisciplinary inspiration workshops and a series of guidance materials. These guidance materials include co-creation session outlines, how to build a research question, how to activate the research question as a project and finally tips and tricks for showcasing student work.

Model

This programme consists of weekly sessions that bring the students through the process of formulating an idea to actualising it as a solution in a real world context.

These sessions include:

- ### Inspiration workshops

  Students are introduced to a number of science topics from the perspective of their relationship with a societal concept or challenge through workshops designed by OSHub-IE. The topics were Bias and Technology; Astronomy and Diversity; Sustainability and Future Cities; Mental Health and Wellbeing; Activism and Climate Change; Innovation and Ethics, Trust and Science. Experts in these topics would often be introduced during these workshops.

- ### Ideation sessions

  Over 2 sessions, students collaboratively select a challenge topic and initial project ideas for an Open Schooling project. The rapid ideation approach is used to assist students with concept generation.

- ### Accelerator session

  Students are introduced to a variety of experts related to their chosen topics, one or more of which are then paired with the school for the research and project phases. One aim of this session is to inspire possible pursuits of interest and make aware the career paths available to students.

- ### Research sessions

  Students carry out research into their concept, guided by experts and local stakeholders to ensure real-world relevance.

- ### Project development sessions

  Students develop project outputs that address their chosen issue, which are then later presented in the form of a physical or digital showcase.

The entire programme can be separated into milestones that teachers should aim for when planning their activities: Kick-off, Inspiration, Ideation, Accelerator, Research, Project, Showcase. However the programme is designed to be flexible around time commitments of TY, as well as adaptable to suit the resources of the school.

Resources

- **Open Science Hub Ireland Teacher Handbook and associated presentations**

  Developed in Summer 2021 and informed by the pilot programme feedback, the Teacher Handbook outlines all elements of the programme and links to required resources, providing a means for teachers to adapt the material to suit their local context. It is designed for a collaboration with Trinity College Dublin, but much of the pack can be reworked for another local context in a different country. The handbook is laid out in a way that the workshops can be given as stand-alone activities.

  — Links for resources:
    — *Suitable for devices*
    — *Suitable for print*
    — *Slides for Inspiration Sessions, that complement the OSHub Ireland Teacher Handbook*

- **Diversity and Astronomy**

  An exploration of how diversity affects decision making and the selective sharing of knowledge based on dominant cultural identities, all through the lens of astronomy.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Diversity and Astronomy.*

- **Sustainability and Future Cities**

  An exploration into sustainable living and current and potential future challenges our world faces, how we can come together to tackle these challenges as local communities and a global society.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Sustainability and Future Cities.*

- **Innovation and Ethics**

  This workshop expands learners' perception of what is considered ethically appropriate when engaging the public through art practices and scientific research, and how to innovate responsibly.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Innovation and Ethics.*

- **Ideation Session**

  This is a series of co-creation sessions designed to collaboratively select a challenge topic and initial project ideas for an Open Schooling project through the approach of rapid ideation.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Ideation Session.*

- **Ethics Walking Debate Workshop**

  The goal of this workshop is to provide an open and supportive space in which learners can voice their opinions and insights on societal topics that often pose challenging ethical questions.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Ethics Walking Debate Workshop.*

- **An introduction to Zines**

  Overview of how to make and implement zines as a creative and personal way for learners to reflect on their learning experience of any activity/workshop undertaken.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: An introduction to zines.*

OSHub Portugal

OPEN SCIENCE HUB
PLATAFORMA DE ESCOLA ABERTA
PORTUGAL

FIGUEIRA DE CASTELO RODRIGO
MUNICÍPIO

The Municipality of Figueira de Castelo Rodrigo (MFCR)

The Municipality of Figueira de Castelo Rodrigo (MFCR) is located in the northeast of Continental Portugal, in a low density territory on the border with Spain. In 2017, the MFCR started a social innovation programme – Plataforma de Ciência Aberta – aimed at bringing together science, technology and innovation with local/regional communities, by using research and innovation as tools to tackle local challenges, like freshwater quality, agricultural innovation and circular economy. Plataforma de Ciência Aberta works as an education and innovation hub for the region, connecting multiple schools, universities, municipalities and civil society organisations, and has wide experience: 1) in the development and implementation of educational activities targeted at students; 2) development of implementation of teacher training programs; 3) development and implementation of initiatives and events for the general public in collaboration with multiple stakeholders of the territory; and 4) in the facilitation of community-based action research processes between local stakeholders.

OSHub-PT supports and works together with schools in the co-creation and integration of relevant and sustainable strategies that promote the development of active citizens in addressing local challenges, through research and innovation projects in collaboration with relevant actors.

Target public

The school community as a whole, with more continuous actions targeted at teachers and students.

Approach

OSHub-PT is based in the county of Figueira de Castelo Rodrigo, in a border, low density territory located in the northeast interior of Portugal, with a population density of 12 inhabitants/km. The population of this region has traditionally limited access to STEAM-related initiatives and the importance of community development has been identified by the EU programme Interreg V-A-Spain-Portugal (POCTEP). This is associated with low school performances and high rates of school failure, low innovation and reduced capacity for investment and entrepreneurship. On the other hand, it is a region that entails an immense potential regarding natural, archaeological and historical heritage, including two UNESCO World Heritage sites – the PreHistoric Rock Art Sites in the Côa Valley and Siega Verde and the Alto Douro Wine Region. Moreover, it is part of the Network of Historical Villages of Portugal and of the Douro River Cruises Route, receiving several hundred thousand tourists per year.

OSHub-PT has been working as a facilitating agent in the community, promoting open, inclusive and interdisciplinary processes in which citizens and community groups collaborate with researchers, professionals from enterprises and policy-makers to tackle community-defined problems at local and regional levels.

In particular, at school, OSHub-PT has been collaborating directly with school heads and teachers in providing structural support and an interface for the integration of Open Schooling approaches in the school organisational culture, so that schools become effective and autonomous drivers of community development and well-being.

The role of OSHub-PT in the establishment of this school-based OSHub model entails:

- to liaison with the Municipality and other relevant partners so that this strategy can become a territory-wide approach (vs. a focal initiative at a school);
- to work directly with schools, supporting teachers and school boards in the integration of Open Schooling approaches, in both formal and non-formal settings, including:
    - co-designing, developing and implementing curricula/projects based on best practices;

  - documenting and evaluating the process and practices;
  - facilitating the dialogue with community stakeholders;
  - ensuring a continuous training program for teachers and school heads;
- to advocate for the importance of Open Schooling with school boards and decision-makers, facilitating its integration at the school organisational culture.
- to foster the development of local networks amongst schools and community stakeholders to exchange knowledge /experience;

Model

With the objective of providing schools with the support to integrate open schooling approaches in their daily-life and organisational culture, OSHub-PT works together with the school community in the following:

- **Continuous professional development activities,** which can range from:

  Long (25h) training programs for teachers and school heads on how to develop and implement open schooling projects co-creatively with students. This training program promotes a project based methodology settled on equity, inclusion and democracy, which guides educators through the following steps: tackling local challenges/opportunities, collaborating with stakeholders, sharing with the local community and evaluating the impact of the project. This training program, as well as the supporting practical manual, was developed together with teachers from the School Cluster of Figueira de Castelo Rodrigo.

  Short (2h to 6h) training sessions for educators and school heads about the development of projects based on youth-identified local challenges in collaboration with community partners.

  Follow-up sessions for teachers, individual or in group, to support them in the daily-implementation of open schooling practices.

- **Facilitated sessions inside the classroom**

  Although the focus of OSHub-PT's approach is to support teachers increasing their knowledge and confidence to use open schooling practices in their daily-life, whenever necessary or requested, the OSHub-PT team also works directly with the teachers inside the classroom, either by aiding in the implementation of specific dynamics, following groups of students in the development of their projects, establishing specific contacts with stakeholders.

- **Brokerage events between the school community and stakeholders**, including:

  Practical workshops to promote/strengthen connections and foster collaborative work, projects and activities between teachers and external stakeholders, while at the same time creating the opportunities and conditions for the beginning of effective partnerships between the school and their communities.

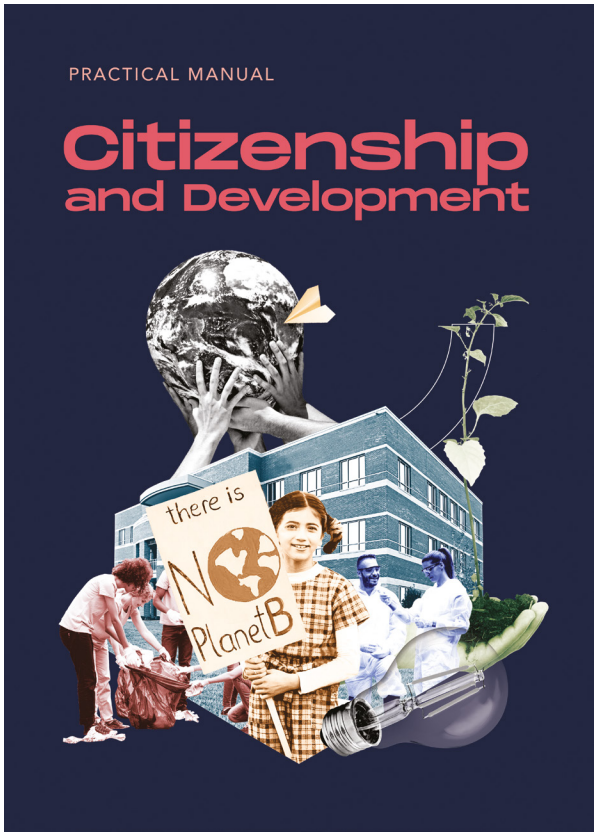
  Informal discussions about open schooling and democratic education approaches between educators and professionals working in the field, with the objective of creating a community of practice, while sharing real experiences, good-practices and challenges.

Resources

- **Citizenship and Development | Practical Manual**

  Practical experience/evidence-based manual aimed at integrating Open Schooling in the Citizenship and Development discipline. This resulted from the collaborative work with 17 teachers in 2019 and 2020.

  — *Link for the manual*



- **Integrating Open Schooling in the daily-life of schools: A teacher training program**

  Training program for teachers on how to develop and implement an Open Schooling project co-creatively with students. This training program promotes a project based methodology settled on equity, inclusion and democracy. The main characteristics of this methodology are focused on: tackling local challenges/opportunities, collaborating with stakeholders, sharing with the local community and evaluating the impact of the project.

  — The guidelines for this teacher training program can be found in *Chapter 5 – Activity Handbook: Integrating Open Schooling in the daily-life of schools: a teacher training program.*

OSHub Greece

OPEN SCIENCE HUB
SCICO
MAKER LAB
GREECE

21 Sci science
27 Co communication

SciCo (Science Communication)

SciCo (Science Communication) is a non-profit organisation, based in Athens, that communicates scientific issues to the general public through innovative, interactive and entertaining activities, from talks and workshops, corporate training, events and festivals, to STEM education and citizen science. SciCo has extensive experience in STEM education, having been awarded by the Mariano Gago Ecsite Awards in 2019, under the category Sustainable Success.Over the past years, SciCo has reached more than 400.000 people all over Greece. It has also reached audiences outside Greece by expanding some of its own projects internationally and by participating in EU Programs and Networks.

OSHub-GR supports and works together with schools and the surrounding community to establish school-led community hubs that enhance STEM education and hands-on learning in a way that is integrated in the local reality.

Target public

The educational community as a whole (school heads, teachers, students, parents, local community), with more continuous actions targeted at Information and Technology teachers and students (12-18).

Approach

OSHub-GR | SciCo Maker Lab was established in the island of Limnos. Limnos is a Greek island, with approximately 17,000 inhabitants, located in the Northeastern side of the Aegean sea, very close to Turkey. Due to its geographical location and proximity to Turkey, it is considered as a remote island and has a severe army presence (multiple army camps, air force hubs and soldiers on the island). Schools, students and communities in such geographically isolated locations, usually have fewer opportunities to engage with innovative participatory programmes and lack staff and resources in education. On the other hand, the island of Limnos has a notable environmental and cultural wealth, as well as rich biodiversity. In addition, it experiences an increasing influx of visitors and tourists over the past years, leading to continuous development. It is also home to the Department of Food Science and Nutrition of the Aegean University.

More specifically, OSHub-GR established a school-based OSHub model, which has a physical space that works as a maker lab, where the educational community develops science and technology projects to tackle local relevant challenges and/or opportunities. It is led, namely, by teachers and students, which then, depending on the specificity of the projects, form networks and liaisons with the local community and local stakeholders (university, municipality, parents, local organisations, other schools) who can serve as collaborators, consultants or end users.

Some examples of projects that emerged from this approach include: students developed a smart stick with smart goggles for visually impaired or a smart feeder for the stray animals on the island, by using coding and programming, tinkering with sensors and microcontrollers and recyclable materials; or developed applications for locals and visitors to use in case of emergency, or to showcase the island's biodiversity and the nutritional elements of local products, based on the programming environment MIT App Inventor.

The role of OSHub-GR in this process is multi-fold:

- to liaison with the Municipality and other relevant partners so that this strategy can become a territory-wide approach (vs. a focal initiative at a school);
- to provide training and continuous support to educators, promoting confidence and autonomy to lead science and technology based projects that tackle local relevant challenges;

- to support schools establishing their own makerspaces;
- to foster the development of local networks amongst schools and community stakeholders to exchange knowledge /experience;
- to connect local schools and communities with global initiatives and networks, allowing to disseminate the work being done locally and, at the same time, creating opportunities for local to global collaborations.

Model

In order to establish a meaningful and sustainable school-based OSHub, where school projects meet real-life challenges and learning takes place within the community ecosystem, the educational community is guided through a series of steps:

- **Community-based decision making sessions:**

  The objective of these sessions is to bring together the local municipality and the school heads of the existing schools to discuss the project, its objectives and respective impact, and to jointly define the general strategy of OSHub-GR. On average, these meetings happen once a year, a couple of months before the start of the new school year (to define future strategies but also to evaluate previous actions).

- **Co-creation workshops:**

  By guiding school heads, teachers and key stakeholders through a co-creation process, these workshops are aimed at setting a common vision and goals for the coming school year. On average, these workshops happen once a year, before the start of the new school year.

- **Train-the-trainer approach:**

  The scope of this approach is to increase teacher's knowledge and autonomy with technological tools, such as 3D Design & Printing, Arduino and AppInventor, so that teachers can use them in a confident and independent way together with their students. Once learners get to grips with the basics of these tools, they are guided through a co-creation process to identify local issues or opportunities that can be tackled through science and technology projects. This is an ongoing process, grounded on inquiry-based and hands-on learning. The ultimate goal of this approach is to develop inclusive, hands-on educational methods and a curriculum based on real life-issues, which will engage and motivate students, while providing them with knowledge and important skills, like problem-solving and collaboration.

- **Student training workshop:**

  Throughout the school year, the OSHub-GR team also keeps regular contact with students to ensure that the projects are on track and to gather feedback and ideas for improvement. On an ad-hoc basis it also provides specific training on particular themes of interest or specific tools.

- **Science communication workshops:**

  Particularly when there are academic partners involved, the organisation of workshops about science communication methodologies and tools is very relevant to demonstrate the importance of reaching out to the general public and to the local community, and to share the research processes and outcomes happening at universities and research institutes. In the specific case of OSHub-GR, these workshops triggered the interest of the Aegean University, and its students, to collaborate in the organisation of the first Aegean Festival in the island of Limnos.

- **Establishing a makerspace at the school:**

  OSHub-GR created a simple guide to support schools setting-up their own makerspaces, which includes information about material, equipment, tools and safety. This document is updated on a continuous basis based on the experience of the participating schools.

Resources

- **SciCo Maker Lab – Equipments, tools, materials and safety**

  A set of guidelines that include basic materials, tools and equipment, as well as safety recommendations, to establish a SciCo Maker Lab. The first one was created in the secondary school of Livadochori Limnos and then reapplied to the Vocational School of Myrina.

  — These guidelines can be found in *Chapter 4 – Physical Spaces.*

- **Raspberry Pi Gaming Console**

  Creating a gaming console with retro games by using open source technologies.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Raspberry Pi Gaming Console.*

OSHub Switzerland

OPEN SCIENCE HUB
CITÉ
DE SCIENCE
OUVERTE
SWITZERLAND

Onl'Fait

Onl'fait is the first educational Fab Lab in Geneva, a space open to everyone around digital craftsmanship, which provides its community with technical, technological and human resources. The goal is to offer a diverse community of enthusiasts and professionals the tools to repair, create, share, develop, design a prototype or a product, while facilitating an intergenerational and multicultural meeting place to reflect on an ecological, citizen-led and sustainable approach to science, technology and consumption.

Onl'Fait offers a portfolio of events and activities, namely on science and technology education, that promote the spirit and mindset shared by scientists and makers: analyse, research, create, modify, solve; encourage inclusion, from children to scientists, by contributing to the democratisation of science and sharing of scientific and technological knowledge; facilitate science learning by offering hands & minds-on programmes with a special attention to children and disadvantaged communities; and support the open hardware and software movement to share, take ownership of, and contribute to science and technology knowledge and culture.

OSHub-CH offers a methodology and practical tools to place schools at the centre of community projects about sustainability, science and technology by providing support to teachers and students.

Target public

Secondary school students from pre and vocational schools (>15 years-old), teachers, Department of Public Education.

Approach

The scope of OSHub-CH | *Cité de Science Ouverte* programs are two-fold:

- on one hand, to demonstrate to young people the multidisciplinarity of societal challenges, offering the possibility to meet and work together with experts from many different areas (e.g. natural sciences, electronics, communication, european relations, stakeholder facilitation);
- and on the other hand, how to develop technological solutions for these societal challenges, namely in relation to sustainability, through research-based practices grounded on community relevant issues. Throughout this process, students and teachers are acquainted with the knowledge to better understand the problem and with the technical tools to design and make a technical device.

These projects are developed at Onl'fait, which due to its Fab Lab nature is equipped with the necessary technical skills and resources, and connected to several different networks and people from science, technology and innovation.

More specifically, throughout this process, the role of OSHub-CH is the following:

- to organise co-creation sessions with experts and/or students and/or local stakeholders to identify the community issues to tackle;
- to connect schools to experts to understand the importance of science and technology for sustainability, define the "research questions" related to the identified issue and discuss the role of scientific research in society;
- to connect schools to local stakeholders to gain relevant and real-world insight about the identified issue, namely by investigating its complexity and how public and private institutions are dealing with it;
- to offer a workspace, materials, tools and machines to develop the chosen technical solutions;
- to support teachers during the development of the project at school and to identify tasks that suit the different profiles of students;

- to promote the work of students in collaboration with the local community and different stakeholders.

Additionally, OSHub-CH also plays an advocacy role targeted at policy-makers, namely the Department of Public Education, by demonstrating the strengths of maker education, open schooling and transdisciplinarity.

Model

This programme consists of weekly sessions that bring the students through the process of formulating an idea to actualising it as a solution in a real world context.

These sessions include:

- **Co-creation workshops:**

  Students and/or teachers and/or relevant stakeholders are guided into a co-creation process to identify the issue to tackle and understand the role of each stakeholder to implement the programme. The topics that have been identified and developed are related with freshwater in the Geneva region, COVID-19, climate change, food waste and healthy soils.

- **Research sessions:**

  Experts working on the identified topics are invited to provide a scientific contextualization of the theme, talk about recent developments and perspectives, set the research questions, as well as discussing technical constraints. After this, students start by doing their own research about the topic, guided by their teachers, before focusing on the technical solution to the problem.

- **Maker sessions:**

  Over several sessions (5-10), students prototype and implement a technical solution using the tools, machines and materials available at Fab Lab Onl'fait.

- **Sharing session:**

  Students are asked to share their work using different communication formats (e.g. social media, presentations, exhibition) and by presenting it in different contexts (e.g. at a students' symposium, the Natural History Museum of Geneva or at their school).

- **Evaluation sessions:**

  Students and teachers are asked to self-reflect and evaluate the programme and the activities, providing OSHub with relevant information to improve the implementation of Open Schooling programmes.

Importantly, in addition to the steps above, OSHub-CH also invests several hours in one-to-one meetings with teachers, thus creating trust and empathy relationships that are pivotal for the legacy of these programs.

Finally, the programme described is flexible and can range from a month-long activity to two years of continuous work. The number of students, their personal profile, the school curriculum, and the time available are key elements to consider while co-designing the programme with teachers.

Resources

The activities of OSHub-CH, including hardware and processes, were documented and made openly available according to the Fab Lab chart regarding open source and open access. These resources can be found in the website of Onl'fait and, in particular, in the links below:

- **Freshwater monitoring**
  - — *Github*
  - — *Wiki*

- **CO_2 monitoring**
  - — *Wiki*
  - — Building a CO_2 sensor: the guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Building a CO_2 sensor*

- **Biomaterials**

  Food waste and biomaterials: Give a second life to food waste and fabricate biomaterials that can be used to produce small objects and accessories.

  - — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Food waste and biomaterials*
  - — Materiom project *website*

- **Open Science Hub Board**

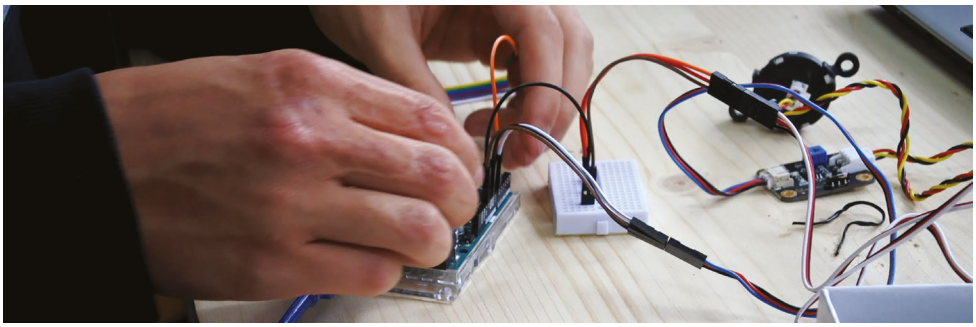
  A co-creation tool to get familiar with the Open Schooling methodology and to identify themes, resources and stakeholders involved in implementing a programme in the local community. The tool has been adapted from the Full Stack Tool Board, developed by IAAC, Barcelona.

  - — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Open Science Hub Board.*

- **Onl'fait – Educational Fab Lab | Equipment, management plan and safety**

  Set of guidelines for establishing and running a Fab Lab, including materials, tools and equipment, as well as safety recommendations.

  - — These guidelines can be found in *Chapter 4 – Physical Spaces.*



OSHub France

La Casemate

La Casemate, the centre for scientific, technical and industrial culture (CCSTI – Centre de Culture Scientifique, Technique et Industrielle) of Grenoble, was the first structure of this kind created in France, being now part of a network of around forty CCSTIs. Its main mission is to promote scientific, technical and industrial culture to all populations. La Casemate building includes an exhibition space and a fablab/makerspace, where a multidisciplinary team, from the fields of culture, science, journalism, communication, mediation and project engineering, develops interactive exhibitions, science workshops, digital publications, Science Festivals, public debates and participatory events with stakeholders.

Within the OSHub project, La Casemate has chosen to settle at the heart of the Villeneuve neighbourhood of Grenoble, and to open the OSHub space – Espace de Science Ouverte – within La Machinerie, to work closely with the local inhabitants.

OSHub-FR works as a community hub that supports teachers and students developing new practices and projects using digital fabrication tools, to improve science and technology teaching, empower student's agency in their communities and promote connections and collaborations between local partners and schools.

Target public

Teachers and students, particularly from Villeneuve, a low socio-economic background neighbourhood from Grenoble.

Approach

OSHub-FR is a collaboration between La Casemate – CCSTI Grenoble and the third place La Machinerie located at Villeneuve, a low socio-economic background neighbourhood from Grenoble. La Machinerie works as a concierge and meeting place in the heart of the neighbourhood, where it hosts an open space for meeting and learning by doing, promoting the exchange of know-how and local initiatives by residents and actors from the neighbourhood (DIY, repair, homemade, reuse, digital, etc.). In addition, it provides access to several digital fabrication tools, such as 3D printers or laser cutters, allowing to develop and prototype projects and to create all kinds of objects.

As such, the collaboration between La Casemate and La Machinerie works as an effective synergy, where La Machinerie brings the space and mindset for community collaboration, and La Casemate the open science framework, tools and resources, thus creating the conditions to develop projects based on relevant issues together with the local inhabitants (youngsters, families, associations, etc.), by using a multidisciplinary STEAM approach and digital fabrication skills and tools. Furthermore, this participatory space also provides training and resources for educators, and organises workshops, meetings and events, bringing together the different kinds of local actors.

The role of OSHub-FR is to promote teacher's autonomy and skills that allow them to:

- develop and implement a project-based learning approach in a Fab Lab, creating opportunities for their students to explore, invent and transform abstract ideas into tangible objects by using digital technology;
- create new resources and tools that can be easily shared, adapted and used by the teacher community.

For that, OSHub-FR uses a combination of approaches, which comprise intensive training programs for teachers and/or in-class follow-up sessions.

Model

Below we describe the process of supporting teachers integrating a project-based learning approach in a Fab Lab together with their own class. This process includes a set of sessions, where a facilitator from OSHub-FR guides the teacher, in a real setting with their students, throughout each stage of the project, guaranteeing that the teacher gains the necessary competences to develop it autonomously.

Before starting, it is important to make sure that the following points are met:

- The objects that will be created are aligned with the educational objectives of the teacher and are integrated in a class project, that needs to be feasible in terms of skills, equipment and materials;
- The teacher acknowledges that, in addition to producing the objects, a fundamental part of the process is also learning how to design the objects using 2D or 3D design softwares. As such, before starting, it is important to define which parts will be designed and which software is needed;
- The teacher has connections with other teachers in the school and the technology teacher will be involved in the project,
- It is key to establish a calendar that includes the main project steps and the amount of time needed, and possible, to work with the students.

After this, the teacher and the OSHub facilitator make a project plan and define the type and number of workshops that will be implemented with the students.

This is highly dependent of the project that will be developed, but, as a starting point, one can consider the following general reference:

- Presenting and discussing the project with the class and how the OSHub facilitator will be helping
  1 session
- Training students on a design software program
  2 to 3 sessions

It is important to make sure that students have time to learn how to 2D/3D design depending on their age. If needed, alternatively one can search for files that have already been designed by others, or to use pictures or handmade drawings;

- Deciding on the type of machines needed.
  1 session
- Making test prototypes with recycled materials
  1 session

The exact number of sessions needed for the fabrication steps depends on the kind and size of the project, thus being difficult to define a precise number. However, the important point is to have students actively participating in ideation and drawing, so that they understand how to go from an abstract idea to creating the actual object, by experiencing the different stages of prototyping and testing.

Resources

- **Mathematics pedagogical kits**

  Resource pack to support teachers to use the Fab Lab to prototype the design of tools to teach mathematics to children aged between three and eleven years, and to test out how to use these tools in the classroom.

  — Resources available in *La Casemate's website*

- **Make your own kite**

  Discover air and its properties and learn how to make your own kite with recycled materials and tools in a Fab Lab.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Make your own kite.*

- **How to engage and support teachers developing pedagogical practices and activities using Fab Lab tools**

  A set of guidelines on how to establish a small Fab Lab / Tinkering Lab, including information about materials, safety and troubleshooting, based on the experience of OSHub-FR.

  — These guidelines can be found in *Chapter 4 – Physical Spaces.*

OSHub The Netherlands

Leiden University

Leiden University is a public research university in Leiden, Netherlands, founded in 1575. The university has seven academic faculties and over fifty subject departments, housing more than 40 national and international research institutes. It has a campus in both Leiden and The Hague, with around 8 000 staff members and 35 000 university students.

Relevant to this context, in the most recent Leiden University Strategic Plan 2022-2027 – Innovating and Connecting, one of the primary focus is on making stronger connections, with a strong emphasis on the connection between the University and society: "Increasing our impact in society requires more interaction and collaboration between the University and the world around us, based on the issues that are relevant to that world." In particular, the University is working towards increasing their share in societal debates, enhancing their integration within society, while at the same time offering more opportunities to students to gain experience with research and teaching with a central focus on societal challenges.

OSHub-NL increases educational opportunities for all students, by fostering collaboration between schools and universities, thus opening up schools to new community members while promoting educational careers for university students.

Target public

Students from primary to secondary school, students from University students, teachers, school directors, school boards, parents.

Approach

Universities are hubs for knowledge, connection and creativity. Through a community of teachers, students and scientists, all closely connected with stakeholders – from alumni to other universities, society and businesses – regionally, nationally and internationally, universities seek to unveil the frontiers of knowledge and, ultimately, contribute to community development, both through knowledge creation, but also, by equipping students with the skills and networks to become the professionals and citizens of tomorrow.

As such, university students are well-positioned and have the skill set to help universities opening-up and to create, strengthen and sustain meaningful and functional connections with society. On one hand, university students have the academic knowledge and a critical and inquisitive mindset, are able to take on leading positions, are entrepreneurial and can work in partnership with colleagues from different disciplines and backgrounds. And on the other hand, as citizens, they experience and engage with today's societal challenges and feel the motivation and responsibility to use their skills to find solutions.

Hence, the mission of OSHub-NL | Het Open Leerplein is to work together with the academic community to provide meaningful educational, social and professional experiences to university students, that simultaneously allow them to contribute to society's educational challenges while opening-up their horizons regarding their future careers.

For that, OSHub-NL plays a leading role in incubating and accelerating projects aimed at this goal, which includes the following steps, that we describe in more detail below: 1) identifying the challenge; 2) gathering partners and co-creating the project; 3) piloting and implementing; 4) evaluating; 5) creating conditions for sustainability

Model

To demonstrate the approach described earlier, we provide here the real example of the project Studenten voor Educatie, which started in the beginning of 2020.

- **Identifying the challenge**

  Educational inequality and teacher shortage in primary schools are two of the main educational challenges in the Netherlands, being the latter a key contributor to the first one. During Covid-19 outbreak, this situation got even worse, leading to an increase in the number of students falling behind in their academic, creative and emotional development.

  Considering this scenario and the approach described before, OSHub-NL defined as a goal to support schools reducing the workload of primary school teachers and increasing the educational opportunities for all students, by increasing the collaboration between primary schools and universities, while at the same time promoting educational careers for university students. Importantly, there was a particular interest to work in The Hague (where Leiden University also has a campus), given the high social and educational demands prevalent in some neighbourhoods.

- **Gathering partners and co-creating the project**

  Right from the beginning, OSHub-NL contacted the Municipality of the Hague, with whom quickly set up a network of relevant educational partners – Stichting Brede Buurtschool and the School Boards from the Hague – to devise a plan to tackle this challenge.

  This gave rise to the Studenten voor Educatie project, whose essence is to match university students with primary schools based on the student's assets and on the school's needs, so that university students can provide an extra force at schools, by working as tutors of primary students, while gaining relevant experience in teaching and being involved in meaningful societal experiences.

  Importantly, in order to ensure professional support, university students receive dedicated training, both from teachers and school heads working on the ground, as well as from professionals from Leiden University working on the fields of education and inclusion.

- **Piloting and implementing**

  OSHub-NL led the piloting and implementation of the project, where it acted as a broker, coordinating and facilitating the work between all partners, schools and university students. In addition, was also responsible for identifying the needs of schools as well as recruiting and training university students and matching them to the different schools.

- **Evaluating**

  A key aspect of the Studenten voor Educatie project was the establishment of a monitoring and evaluation programme, in collaboration with the University of Applied Science from The Haguel, to keep track of the project's progress, evaluate its effectiveness and adjust it where necessary, on an evidence basis. Again, OSHub-NL was responsible for recruiting the research group and working with the researchers in the co-design of the monitoring plan, as well as liaising between the different project partners, namely the School Boards.

- **Creating conditions for sustainability**

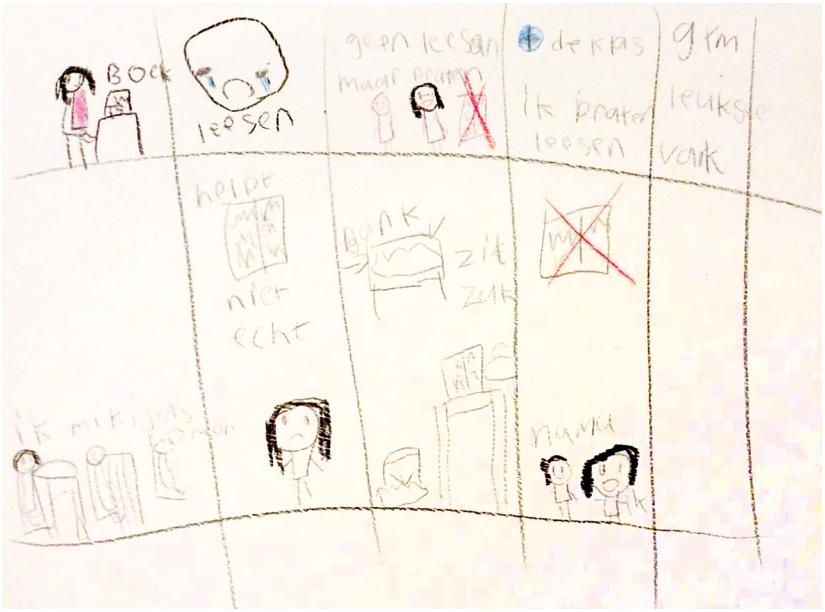
  Studenten voor Educatie started as a pilot with 4 schools and 8 mentors in the spring of 2020, and it has become today a citywide facility with over 50 primary schools. In addition, it is anchored within The Hague's educational agenda until 2026 and receives municipal support. For this, the experience, expertise and connections of the partners involved, as well as the involvement of the Local Councillor since the beginning involvement, were fundamental to create the conditions for ensuring both financial and institutional sustainability.

Resources

- **Art-based mapping**

  The art-based mapping evaluation method was implemented in the context of the Studenten voor Educatie as one of the research instruments of the Monitoring and Evaluation Program developed by the Centre of Expertise in Global and Inclusive Learning at The Hague University of Applied Science.

  — The guidelines for this evaluation method can be found in *Chapter 5 – Activity Handbook: Art-based mapping.*



OSHub Austria

OPEN SCIENCE HUB
CREATE
YOUR WORLD
AUSTRIA

ARS ELECTRONICA

Ars Electronica Linz GMBH

OSHub-AT is part of Ars Electronica Linz GmbH, an Austrian cultural, educational and scientific institute, founded in Linz in 1979, which represents a comprehensive approach in the confrontation with techno-cultural phenomena. It works as a hub for contemporary developments in the field of technology, science and arts, and the discourse about its meaning for society. It is based around the Ars Electronica Center, which houses the Museum of the Future, in the city of Linz. In addition, it runs the annual Ars Electronica Festival, manages a multidisciplinary media arts R&D facility known as the Futurelab and confers the Prix Ars Electronica awards, amongst many other activities.

This multi-armed ecosystem keeps alive a network of scientists, artists, peers and other experts working in the technology field, which inspire and drive these developments.

Importantly, Ars Electronica has an in-house education and content development department with wide experience in non-formal / informal education and state-of-the-art cultural mediation, which is influenced by the create your world initiative, which provides a framework to discuss the Ars Electronica topics from the perspective of young people.

OSHub-AT brings into schools the perspective of society on contemporary science & technology developments through the lens of art, by brokering and curating a collaborative process between artists, scientists and technologists from the Ars Electronica network and teachers.

Target public

Students (10-18 years-old) and teachers from all school types, with a focus on students from rural areas or from low socio-economic urban backgrounds.

Workshop leaders who embody a professional position from STEAM field, with a priority on those at an early stage of their careers and with non-formal education background.

Approach

The scope of OSHub-AT programs, with the umbrella designation of "create your world Tour", is to stimulate into the formal school education system contemporary and relevant topics, developments, issues, discussions and views in the intersection of science & technology with arts and society that would not have flown into the classroom by itself.

This is achieved through quick and agile 2-4h workshop modules run by experts, specialists, artists or interesting thinkers about the future – so called inspirators – where the topic and content is quite unrestricted and the only "must" is to be relevant for students now or in their future.

Thinking together about what's actually going on behind the moon, chatting about our own expectations of artificial intelligence with a programmer in English class, becoming part of a fantastic universe with a visual artist and slipping into the role of a cyberpunk activist, or getting creative with new software and hardware – these are some workshop examples that can be brought into the classroom.

The role of OSHub-AT in this process is to mediate between the world of the workshop inspirators and the world of schools, by aligning the workshop inspirator's offer with the needs and perspectives of the school's daily-life, thus ensuring that each workshop is fit for each school's context.

For that, OSHub-AT, through the Ars Electronica network – which provides access to state-of-the-art knowledge and experience of hundreds of experts – starts by approaching artists/experts to curate their workshop ideas. After this, OSHub-AT initiates and coordinates a co-creation process between individual teachers and the respective workshop inspirator, to tailor a customised version of the workshop concept according to the school needs, the specific setting, the context of the subject and how the workshop will be contextualised within the teacher's narrative.

Model

It is important to mention that OSHub-AT itself does not develop, facilitate or offer the workshops. Although this could have been a path to establish a sustainable and stable system of educational offer, as it happens, for example, at the Ars Electronica Center, this framework was not the chosen one for the create your world Tour. The underlying reason is the focus on high agility and contemporaneity by exploring the rich potential of the Ars Electronica network.

This implies that, throughout this process, OSHub-AT plays both the role of a knowledge broker, between the workshop inspirators and schools, and of a curator, which includes the following steps:

- ### Establishing contact with schools

  After the workshops are set, schools, school heads and teachers are contacted individually via email or phone, as an attempt to reach those who normally do not have access or follow Ars Electronica via the standard communication channels. Complementary, some contacts can also be established via existing educational communities, e.g. for primary schools or middle schools. Then, for the teachers or school heads that show interest about a given workshop topic, the information about the corresponding workshop is sent directly to them.

- ### Matching schools and workshop inspirators

  After the teacher or the school head communicates their interest for a specific workshop, OSHub-AT asks the respective workshop inspirator whether she/he is interested in facilitating the workshop at that school, and after this sets up the contact between the teacher and the host (usually via mail). This direct contact between the teacher and the workshop inspirator allows to define logistical aspects (e.g schedule) but, very importantly, also to discuss the content and format of the workshop.

- ### Adapting the workshop to the school context

  This adaptation step can be seen as a co-creation process within a certain range between the workshop inspirators and the teachers. Importantly, the workshop proposal presented by the inspirator is not a final and closed product, but more like a scaffold which can be adapted to the specific school situation, as such: the content can be framed and provided with focal points that align with the material that is being covered in the classroom; or the time and number of participants can be adjusted.

  In order to be a relevant and sustainable inspiration, it is key that the workshop goes beyond the single shot event, by integrating, contextualising and discussing the underlying topics, in the classroom, both before and after the workshop. This adaptation step is also the moment to prepare the process before and after the workshop and to define on how to integrate it with the teacher's curricular subject and objectives.

- ### Implementing the workshop

  Now it's time to bring the workshop to life and to experience it with the students.

- ### Post workshop-follow-up

  After the workshop, there is an additional contact with the teacher to provide any additional support that might be needed regarding the follow-up and to gather feedback about the overall process and workshop.

Resources

- **Sound of Insects**

  Through the process of creating a film with sound, learners understand the value of insects within our ecosystem by sharpening their senses for their auditory and visual appearance.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Sound of Insects.*

- **Story-Telling and Content Revision**

  Learners use story-telling methods to structure, revise and engage with learnt content.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Story-Telling and Content Revision.*

- **Free Flow Writing**

  A creative way of getting started and finding unique approaches.

  — The guidelines for this activity can be found in *Chapter 5 – Activity Handbook: Free Flow Writing.*

OSHub Czech Republic

OPEN SCIENCE HUB
ŘEŠÍME VĚDOU!
CZECH REPUBLIC

science in

SCIENCE IN

SCIENCE IN is a company specialised on creative interpretation of various scientific topics. Activities of SCIENCE IN spread from leading accredited educational programmes, designing and manufacturing interactive exhibitions, developing applications to, for example, producing educational TV films. SCIENCE IN also formally collaborates with important bodies responsible for the development of national Curricula, such as the Ministry of Education and the National Pedagogical Institute of Czech Republic.

OSHub-CZ facilitates the collaboration within the local community to creatively deal with interesting/important daily-life challenges.

Target public

Members of local communities, especially students, teachers, parents/families and local actors, such as municipalities.

Approach

OSHub-CZ implemented a decentralised approach by establishing a network of OSHubs across different regions of Czech Republic, based on existing local premises/entities – with their own facilities, teams, equipment. More specifically, local OSHubs have been established at: Kovarska, Ore mountains, managed by the NGO Do Krajin; Trebon, Trebon lowlands, managed by a local section of the Czech Union of Nature Protectors; foothills of the Sumava mountains, managed by the Elementary School – Zdikov.

This approach aims to strengthen the role of OSHubs as centres for knowledge-based local development, thus increasing the resilience of local communities and ensuring long-term sustainability.

Despite their different contexts, all local OSHubs share the common objective of using real-life issues/topics to increase the interest of local communities in scientific processes and tools, while promoting the development of local networks that contribute to community development.

In addition, SCIENCE IN, the coordinator entity of OSHub-CZ, also develops programs and activities with national reach, as we describe below.

Model

The programs and activities of the local OSHubs are designed specifically according to their needs and capacities and have the specific objectives of developing strategies to tackle local relevant problems, increasing their visibility in the region and establishing new collaborations or strengthening existing ones. For example, OSHub Zdikov focused on the issue of air quality, which is the main environmental problem at this location, by developing strategies with local schools to periodically monitor air pollution and to generate public discussion with the local community; OSHub Kovarska uses their expertise on producing film documentaries to boost the interest of children, teachers and their families to discover their territory through the creation of their own film documentaries; and OSHub Trebon works with local schools transforming the knowledge

acquired during educational field experiences and adventures into graphically impressive layouts, which can then be used by other schools and the local community).

Although these approaches are based on the specific context of each local OSHubs, the activities are easy to replicate by other similar institutions (NGOs, schools).

The national coordinator, SCIENCE IN, on the other hand, focuses on the development of initiatives with national reach. An example of such initiatives was the production of a TV series – Koumando TV series – , together with the national Czech Television and the Czech Technical University, about how kids discover interesting everyday life topics, like public space, drought, new wilderness, landscape memory etc. The episodes were nationally broadcasted from April to June 2022, and are now on the portal of the *Czech Television*.

Importantly, these episodes have been used to stimulate local communities' interest about important real-life challenges, such as drought, sustainability, air pollution, public space, through scientific experiments and creative activities, which are then discussed during public meetings and school-led seminars.

Additionally, the experiments of the Koumando TV series are currently being transformed into educational programmes that will be placed at the CT-EDU, the educational portal of the Czech Television (and one of the most used educational e-portals in the country) supporting schools and extra-school education.

Resources

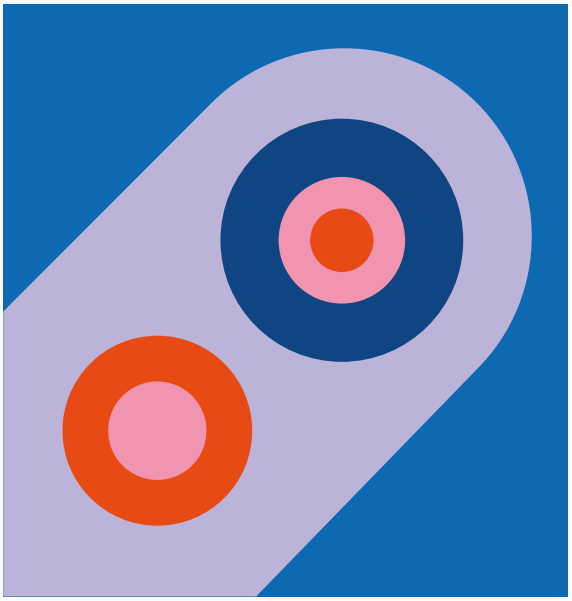
- **Koumando TV series, 9 episodes**

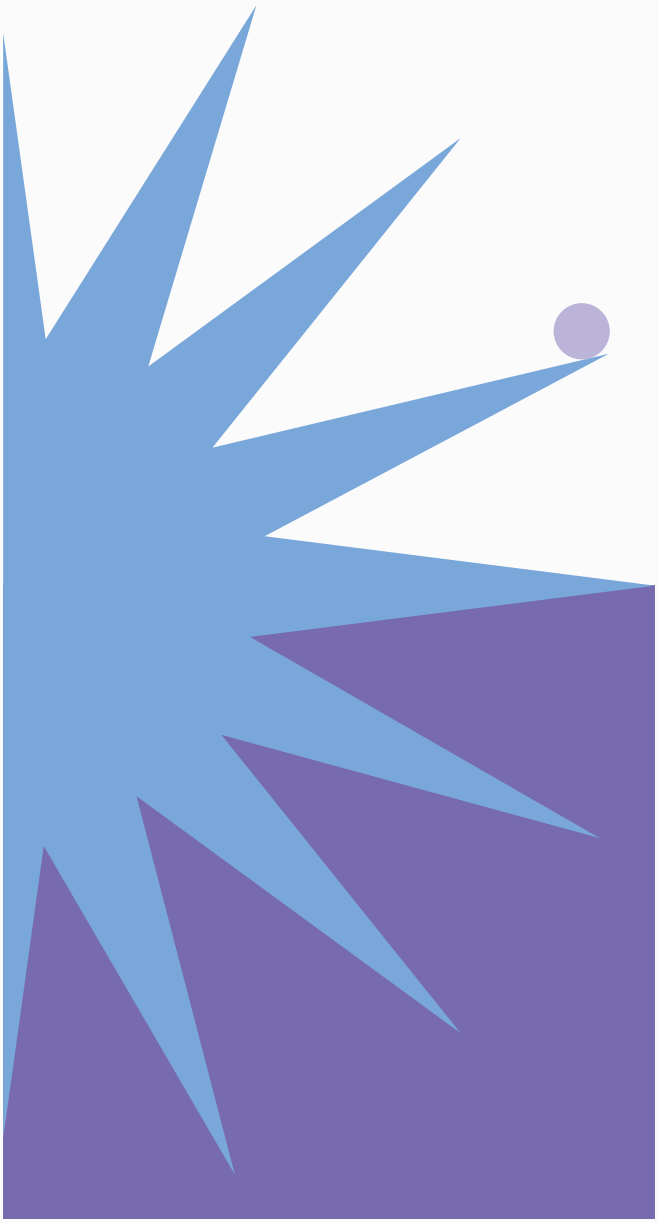
  Set of guidelines for establishing and running a Fab Lab, including materials, tools and equipment, as well as safety recommendations

  — Available in the portal of the *Czech Television.*

Physical spaces

04





The physical implementation of each OSHub depends on the context and needs of each OSHub location. For example, OSHubs can be based in dedicated permanent physical spaces or they can also occupy temporary spaces at schools or public spaces (e.g., libraries). In addition, as we saw in the previous chapter, OSHubs can serve different roles and functions in their communities.

As such, it is important to create the conditions for OSHubs to be adaptable to different kinds of context, while at the same time to provide the guidelines, recommendations and best practices from existing OSHubs with well-established physical spaces.

This chapter will be divided into two parts: in the first one – 4.1 Open Furniture – we make available the furniture blueprints of what we consider the basic set to furnish an OSHub – stool, table, and bookcase – that anyone can reproduce or adapt; in the second part – 4.2 Guidelines and plans for setting-up a makerspace – , based on the experience of OSHubs Switzerland, France and Greece, and also on their different profiles and action, we provide a set of complementary guidelines and plans on how to establish a makerspace / Fab Lab.

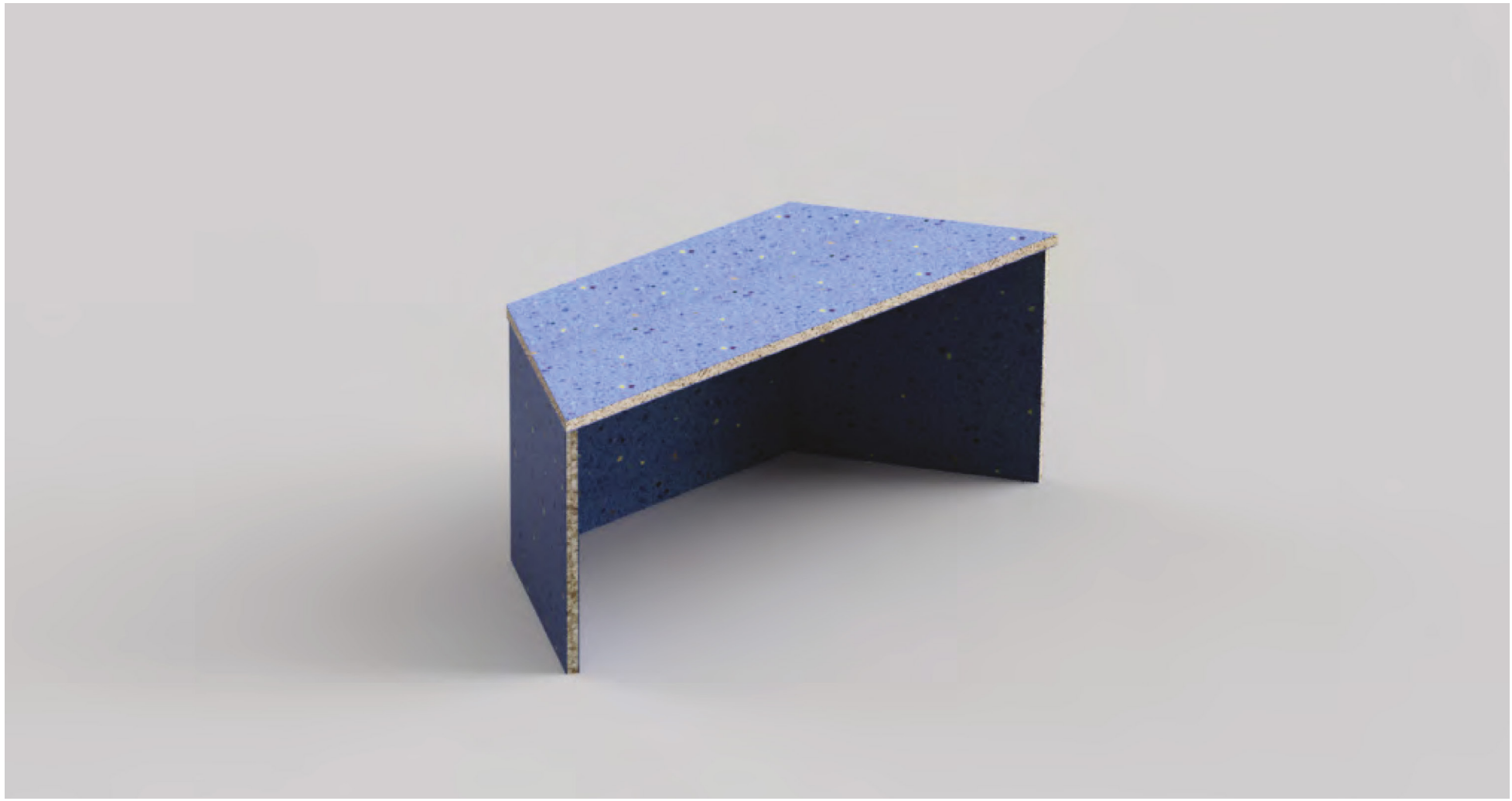
4.1 Open Furniture

In order to support the physical implementation of the OSHubs, we partnered with *NOSIGNER* and Precious Plastic – particularly, *Precious Plastic Portugal* and Precious *Plastic Geneva (Glitter)* – with the objective of creating products that could be made from recycled materials, namely plastic, as well being produced locally.

For that, we designed and prototyped a series of furniture pieces that we consider as the basic set to establish a flexible OSHub space: a stool/bench, a table, and a bookcase.

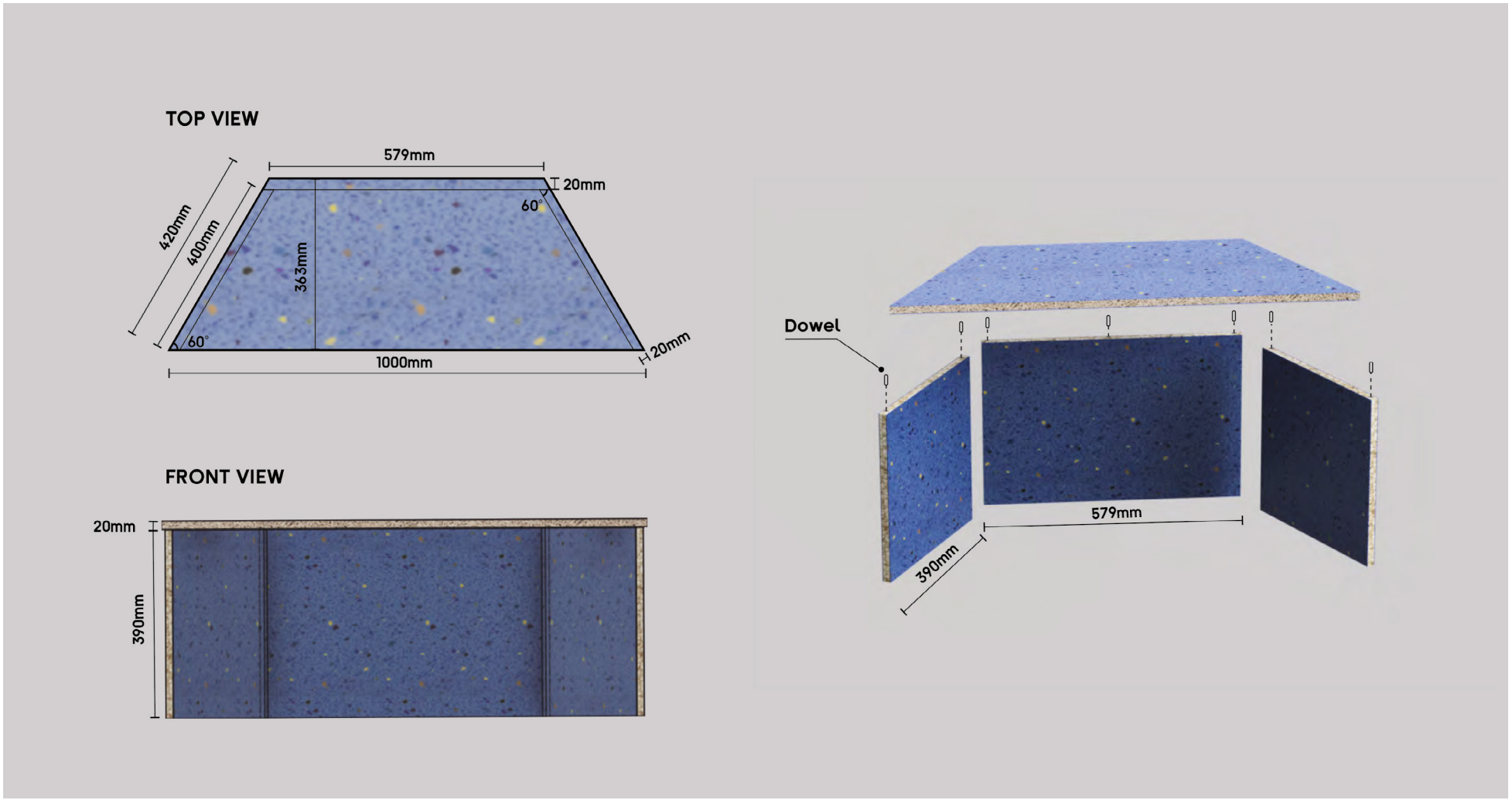
Here we make available the technical drawings and respective steps to produce these objects.

Bench



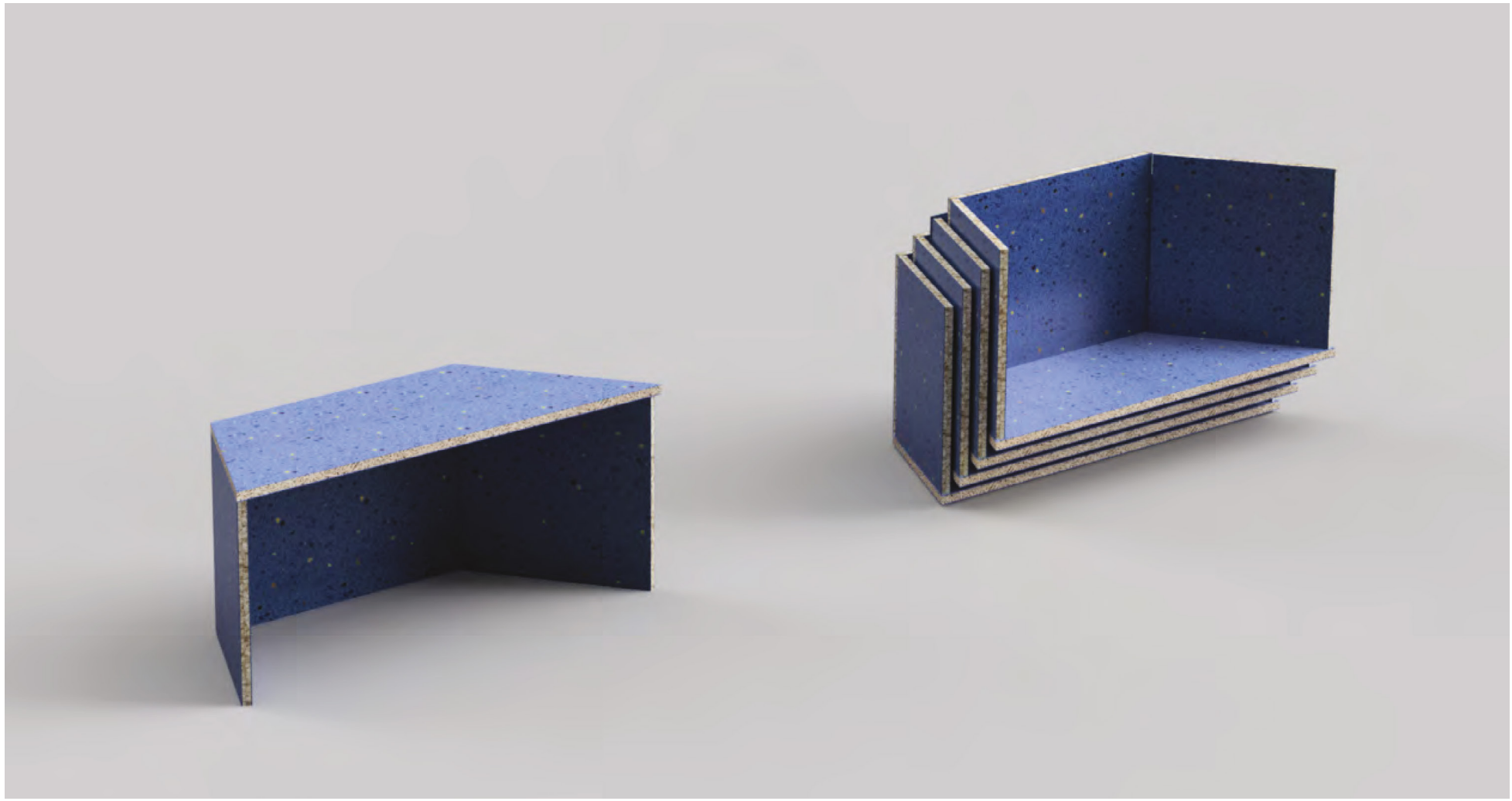
Bench

DIMENSIONS AND ASSEMBLY DRAWING



Bench

STACKING



Bench

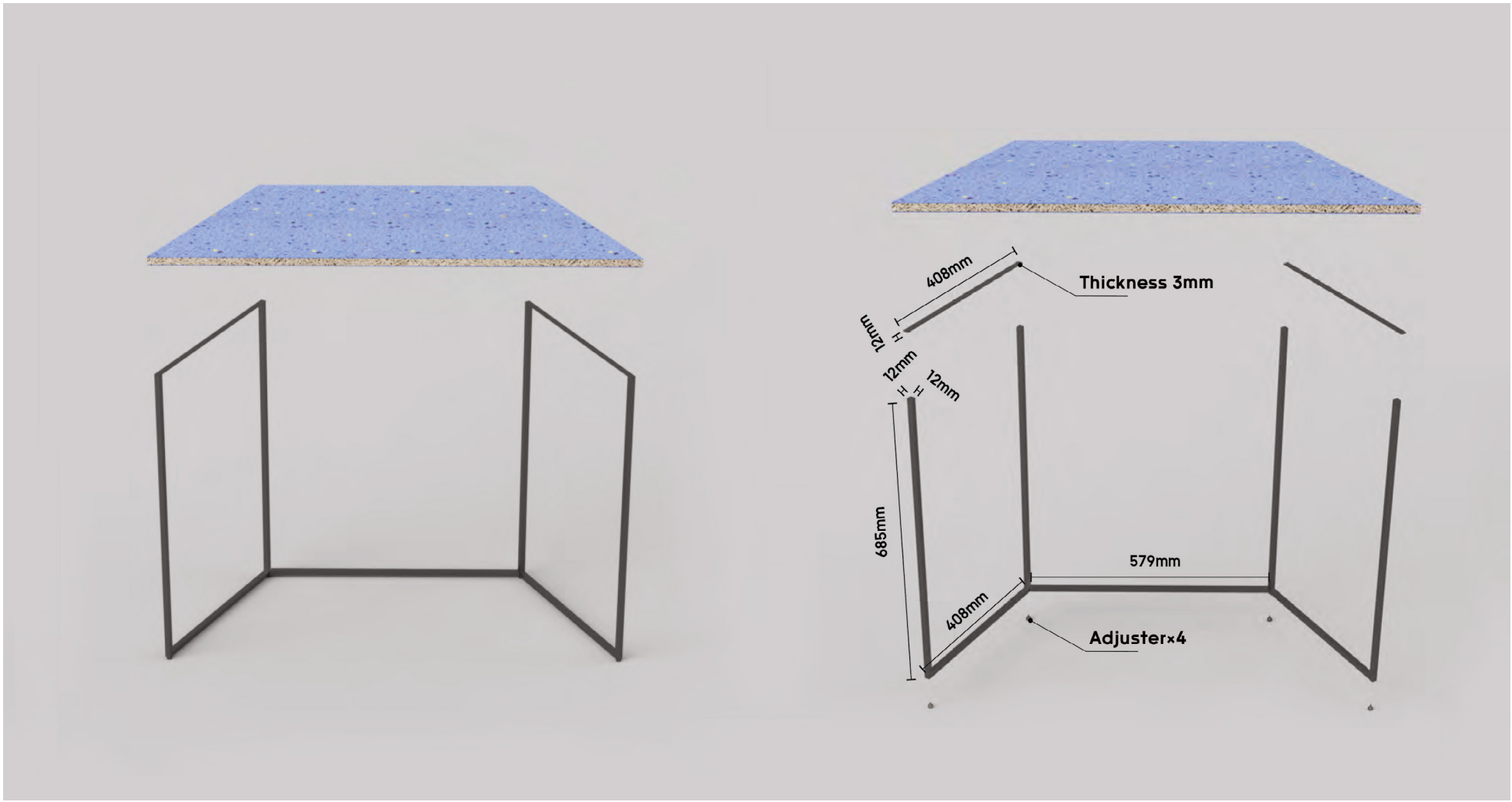
COLOR VARIATION

Table

WITH METAL LEGS

Table

ADJUSTABLE LEGS WITH ADJUSTER



Table

ADJUSTABLE LEGS WITH ADJUSTER

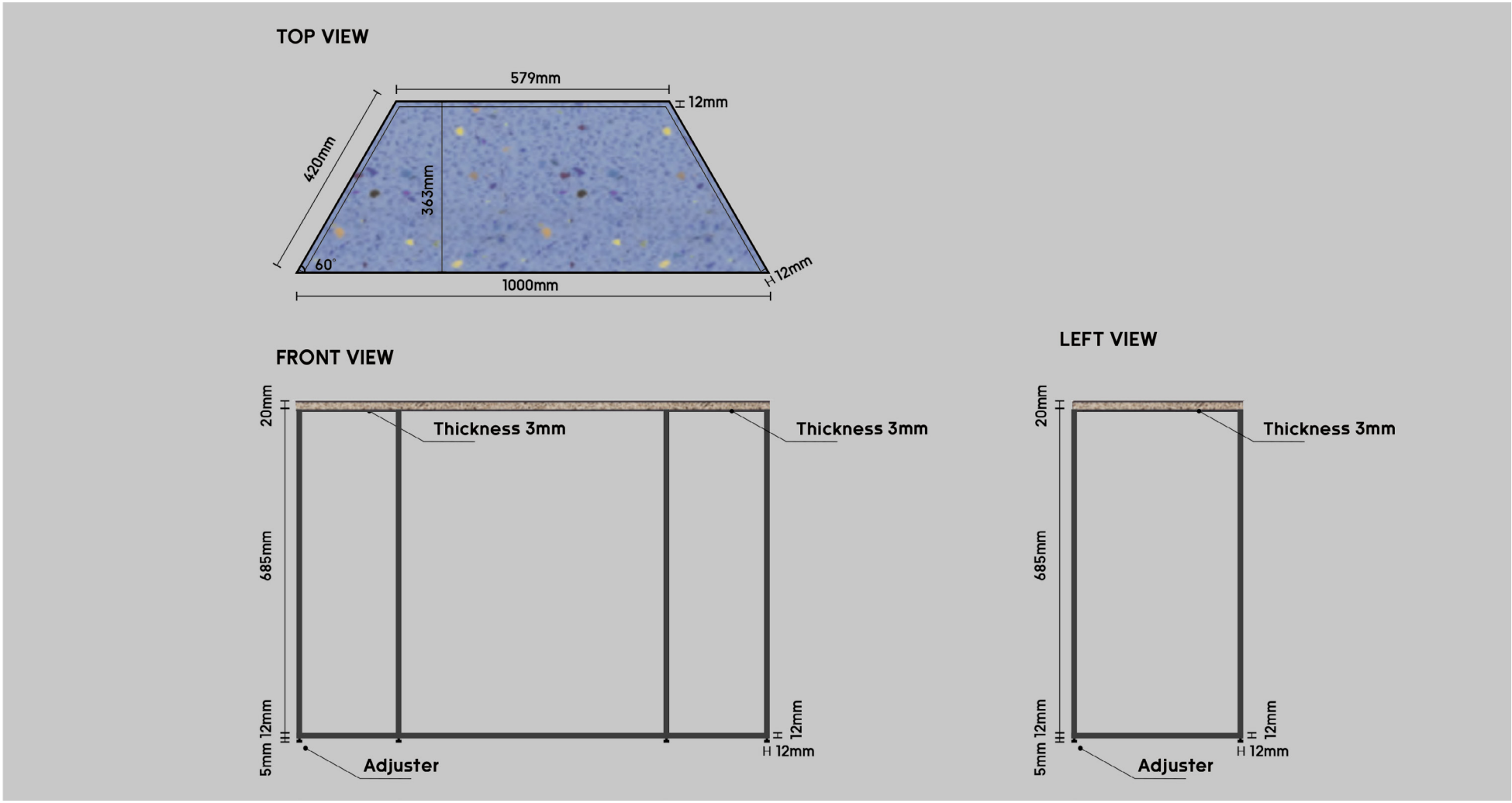


Table with metal legs + Bench

COMBINATION

Table with metal legs

STACKING

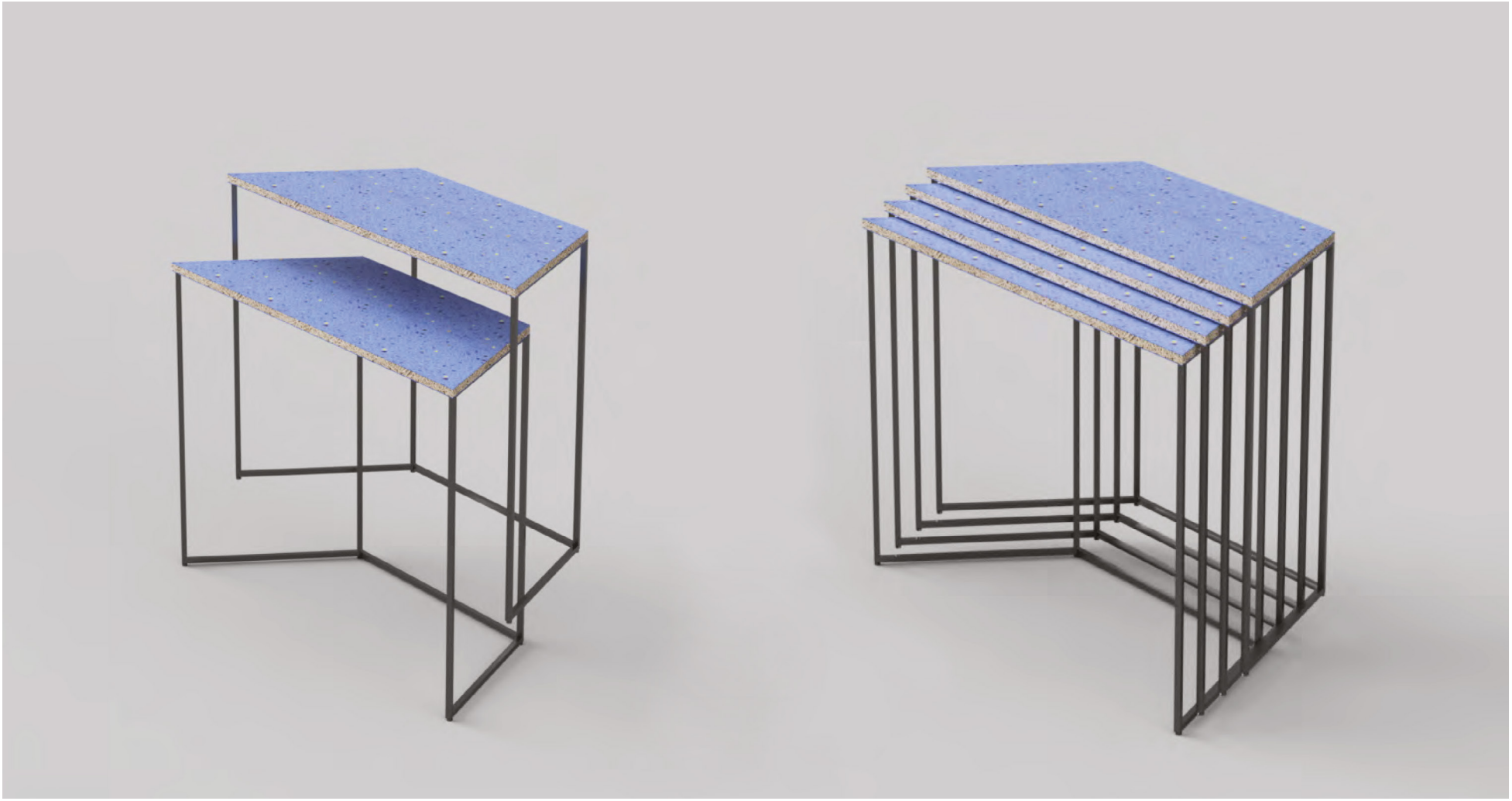
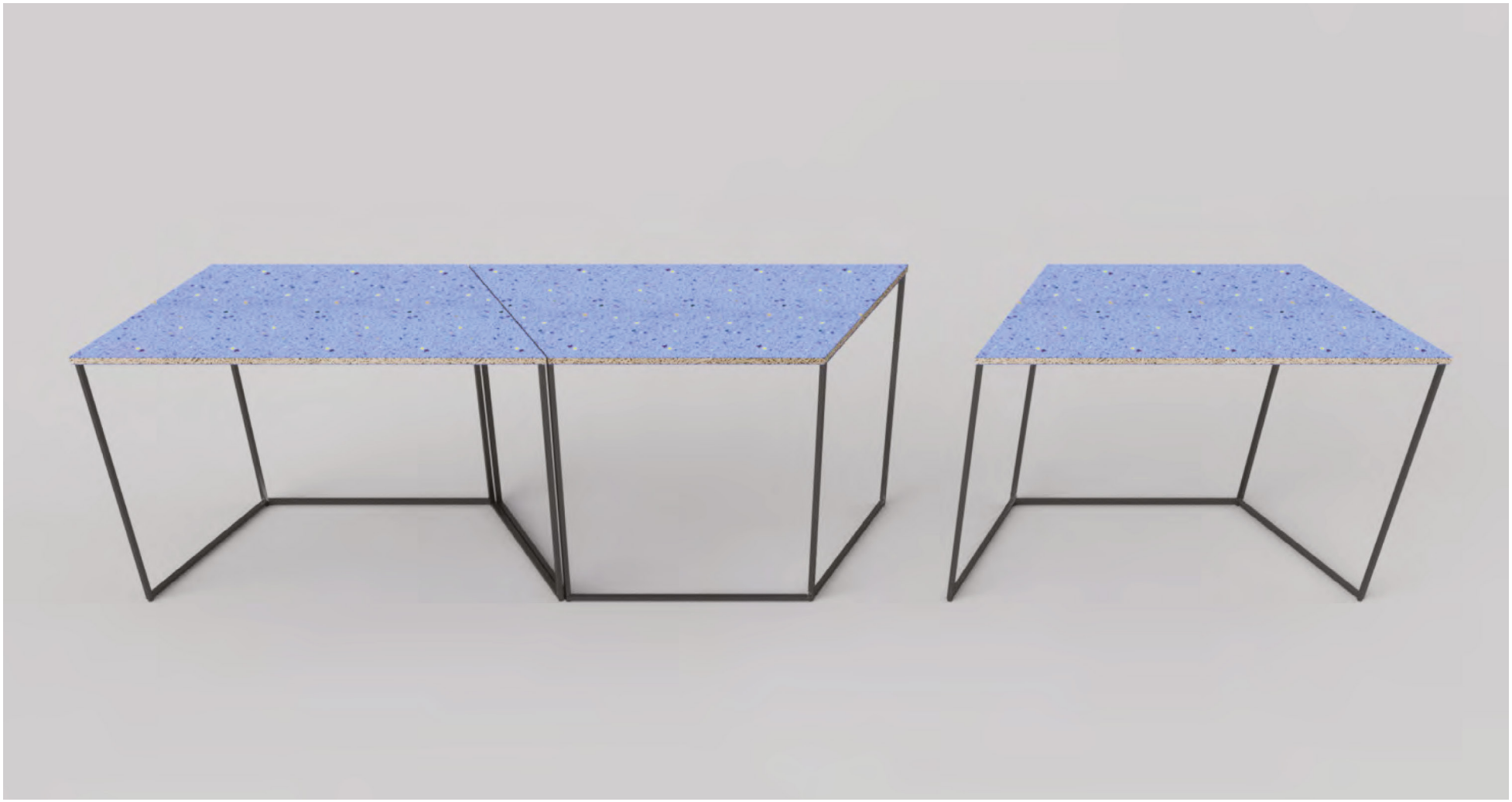


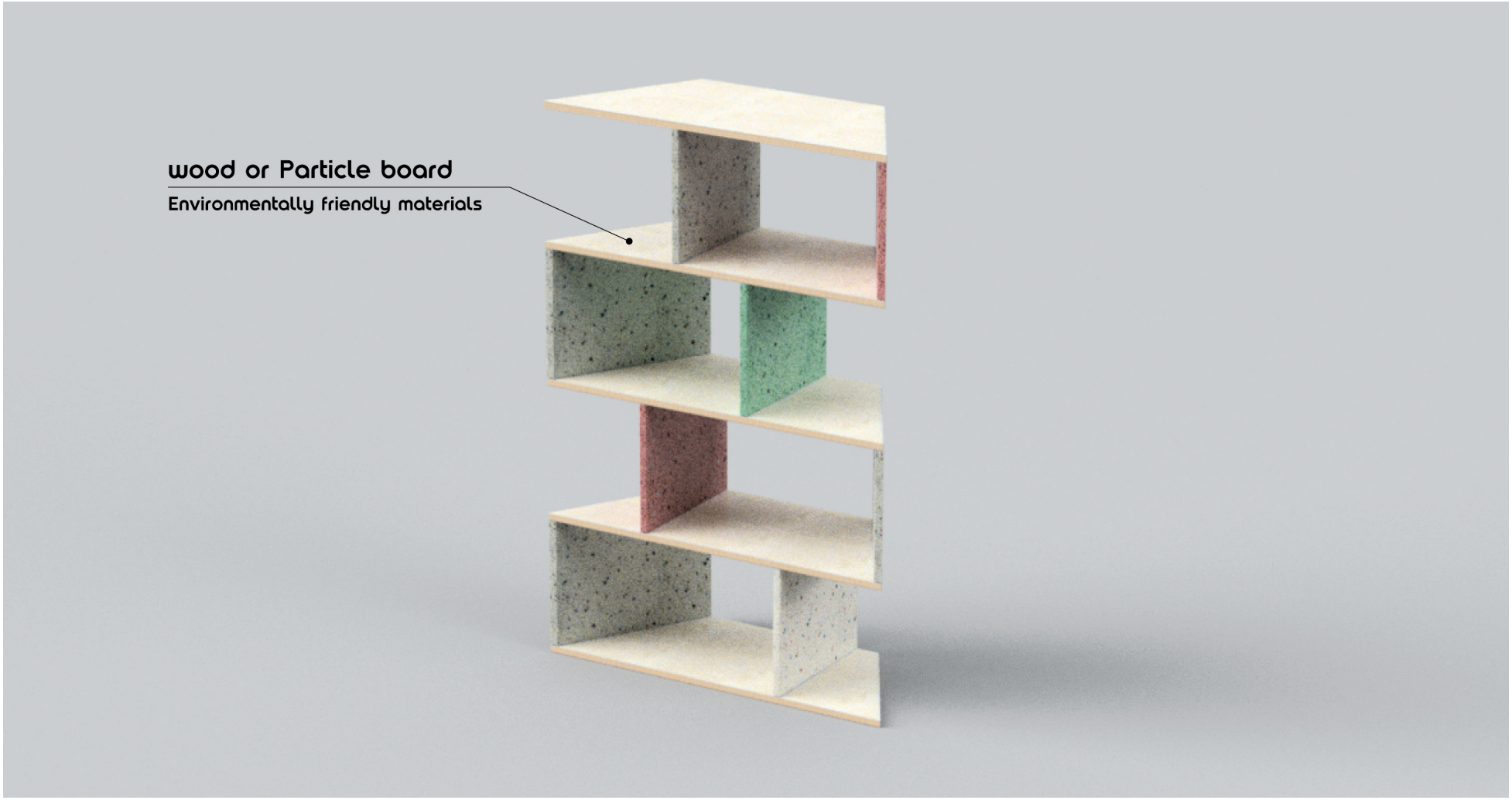
Table with metal legs

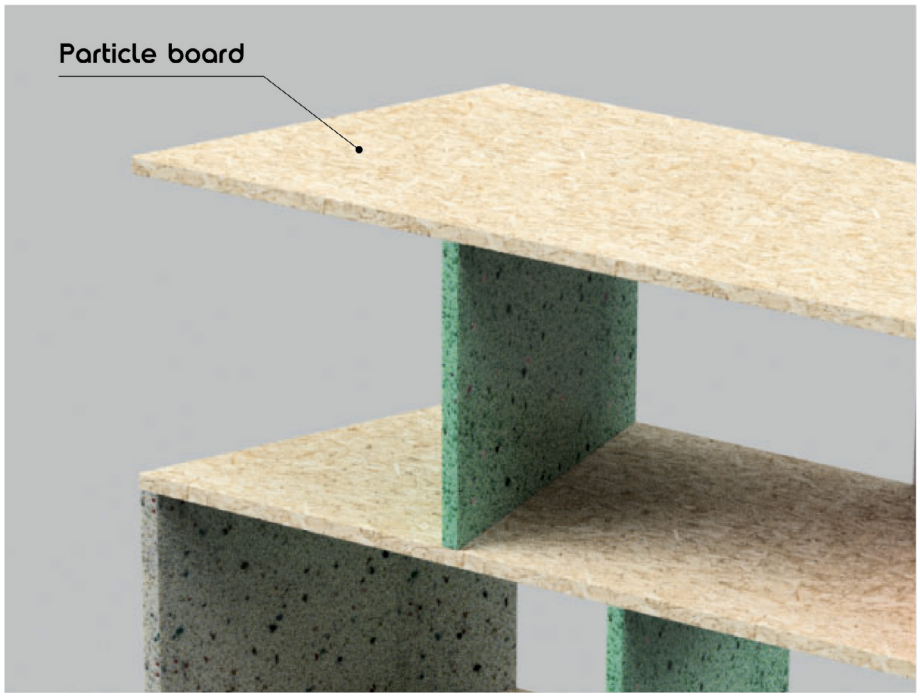
COMBINATION

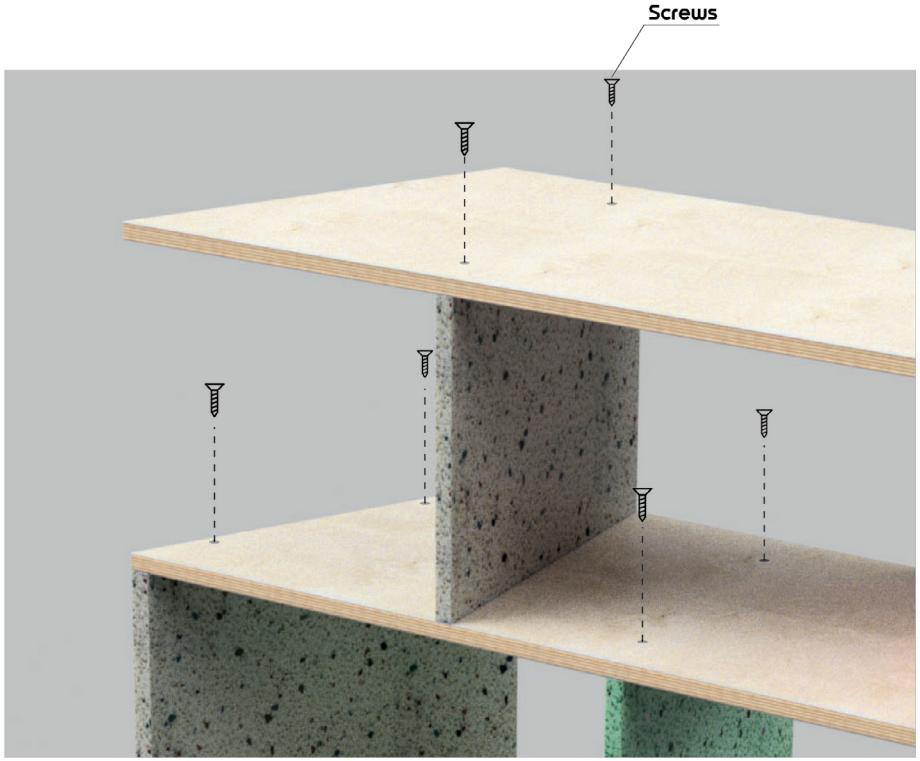


Shelf

COMBINATION

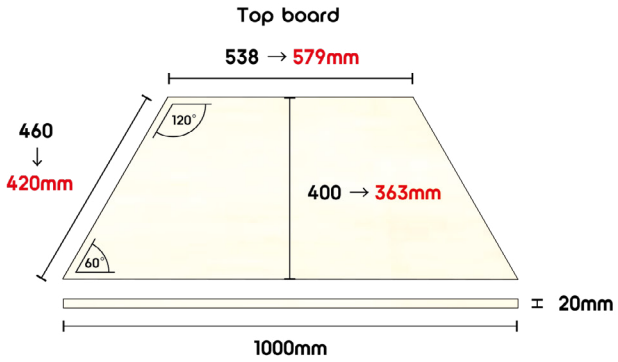


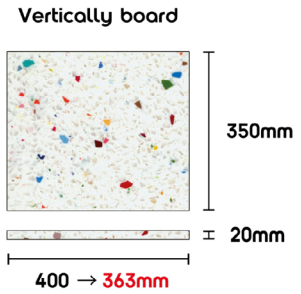


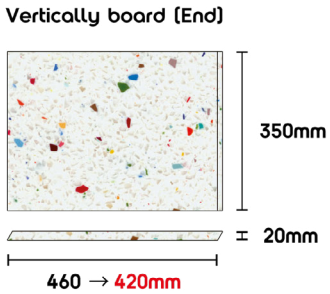


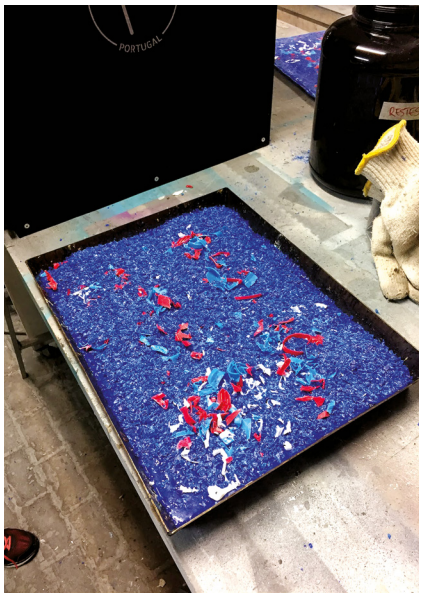
wood or Particle board

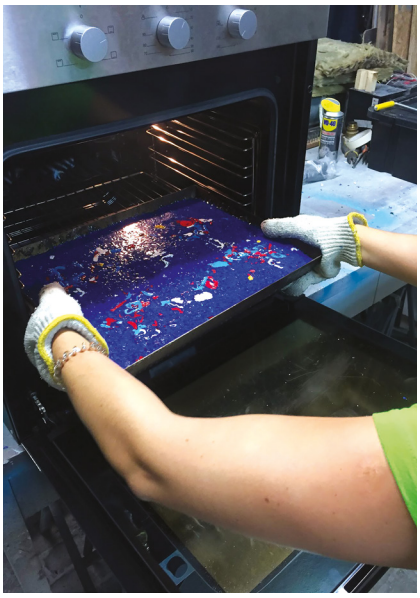
Choose Environmentally friendly materials

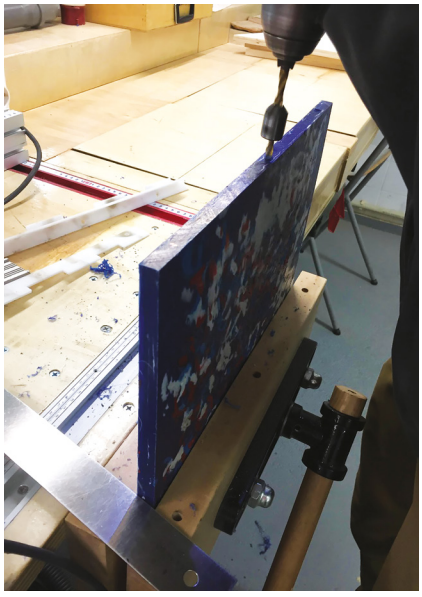




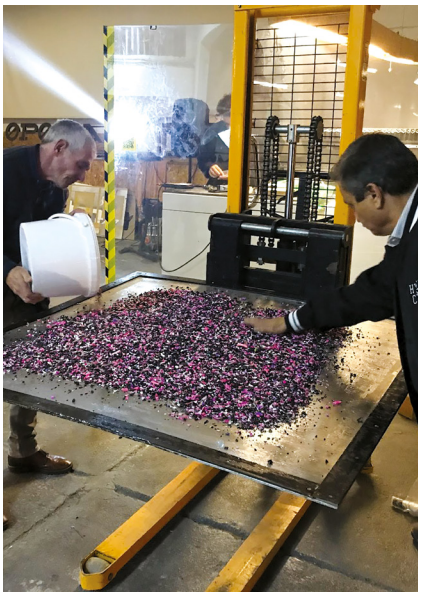
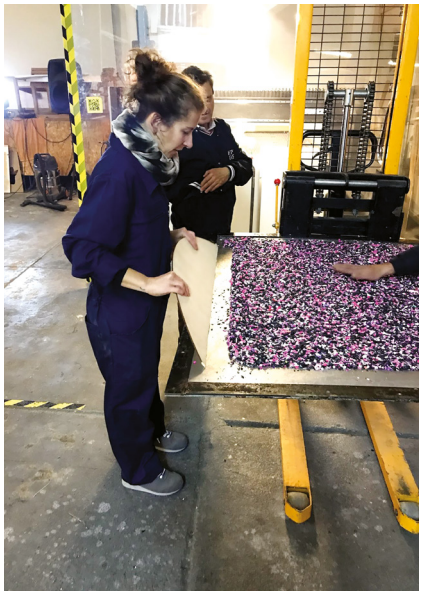



PORTUGAL

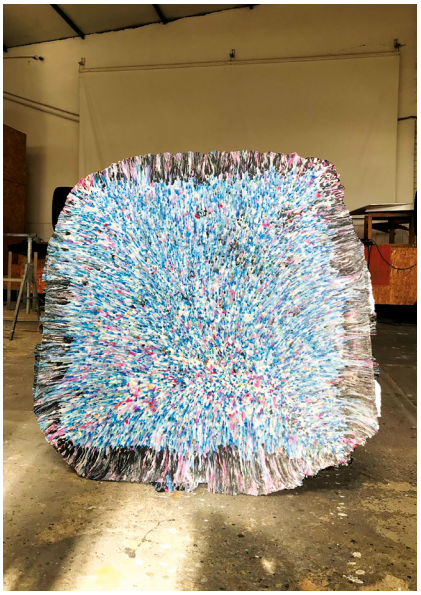






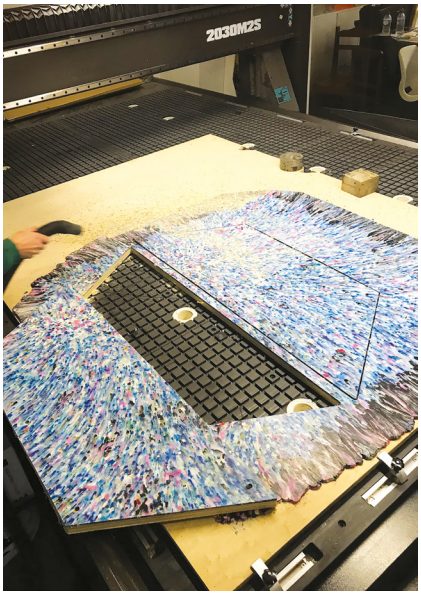









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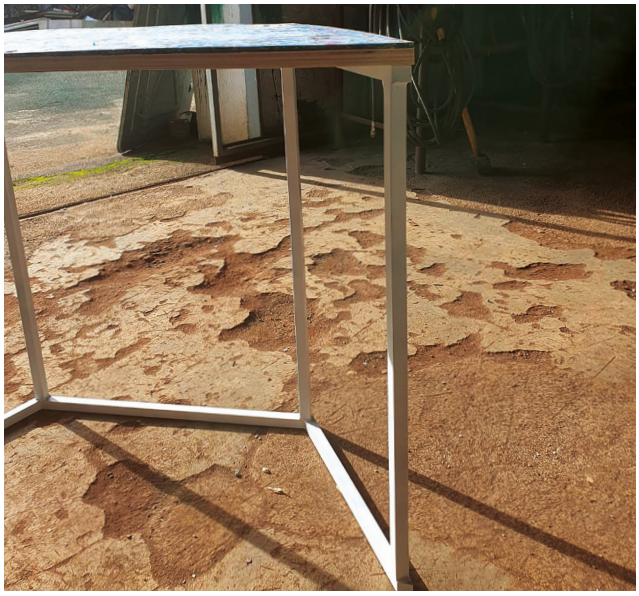
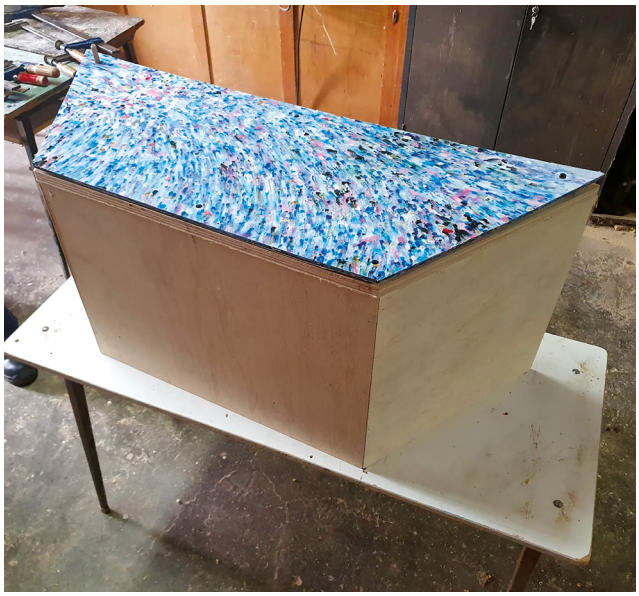


4.2 Guidelines and plans for setting-up a makerspace

Equipment Management Plan and Safety

1. Workspace[1]

The workspace needs to be organized and spacious enough to provide enough room to move around working makers freely and without danger. We have fire extinguishers, safety paths and signs, adequate lighting, and ventilation. The Fab Lab set up was verified and approved by local authorities for safety at work.

TOOL / EQUIPMENT	QUANTITY
Workbench	6
Worktables	6
Stools	10
Chairs	20
Board	1
Shelves	10

SAFETY EQUIPMENT	QUANTITY
Safety glasses	15
First aid kit	2
Fire extinguisher	2
Work gloves	15
Disposable gloves	100
Disposable respirators	10
Earmuffs	3
Foam ear plugs	10
Portable ventilation	4
Aprons and blouses	10
Safety shoes	5

1. Full list of equipment: https://docs.google.com/spreadsheets/d/1z17m_nNLFLdgokMqLjgo-vQtMEWht4ICGcalyfDD04I/edit?usp=sharing

2. General[1]

All power tools are used after training. Children and beginners can only use them with supervision. Glasses, masks or gloves are worn.

TOOL / EQUIPMENT	QUANTITY
Drill	2
Rotary tool	1
Screwdrivers	10
Wrenches	20
Pliers	20
Knifes	5
Saws	5
Scissors	30
Tape measures	5
Clamps	20
Staple gun	1
Hot glue guns	10
Brushes	30
Heat gun	1

3. Woodworking[1]

All power tools are used after training. Children and beginners are not allowed to use the circular saw. Glasses, masks or gloves are worn.

TOOL / EQUIPMENT	QUANTITY
Circular saw	1
Jig saw	1
Router	1
Sanding machine	1

4. Electronics[1]

The tip of a soldering iron is hot enough to cause burns and should be handled attentively.

Children can use soldering irons under supervision and in small groups. Ventilation is always ensured. Electronics at this level are low-power and safe.

TOOL / EQUIPMENT	QUANTITY
Soldering irons	15
Helping hands	10
Multimeters	3
Oscilloscope	1
Power supply	1
Wire stripper	10
Pliers	5
Solder vacuum	5
Solderless breadboard	15
USB cables	20

5. Textile[1]

Steam irons do get hot enough to cause burns and are used by children with supervision.

TOOL / EQUIPMENT	QUANTITY
Vinyl cutter	1
Sewing machine	1
Digital sewing machine	1
Embroidery scissors	2
Steam iron	1
Knitting machine	1

6. Laser cutting[1]

The primary risk when using a laser cutter is fire within the cutter itself. The laser cutter is never run unattended and the choice of material to cut must be approved by Fab Lab managers. A proper ventilation system is in place.

If the lid of the laser cutter is opened during operation the laser is turned off immediately. Only trained people can use the laser cutter.

TOOL / EQUIPMENT	QUANTITY
Laser cutter	1
Laser cutter for metals	1

7. CNC cutting[1]

Hearing protection and safety glasses must be worn for everyone in the closed area to protect from flying debris. Only trained people can use the CNC.

TOOL / EQUIPMENT	QUANTITY
CNC Shopbot	1
CNC desktop	2

8. BioLab[1]

Disposable gloves and safety glasses must be worn during operations. When dealing with bacteria, waste should be disposed of at a specific collect point. Cleaning hands is mandatory.

TOOL / EQUIPMENT	QUANTITY
Stove	1
Sink	1
Pans	5
Incubator	1
Glasses	50

9. 3D printing[1]

The print extruder does heat to several hundred degrees and should not be touched. PLA is the most used material as it is non toxic. When using the resin 3D printer, goggles, mask and disposable gloves are mandatory to wear.

TOOL / EQUIPMENT	QUANTITY
Filament 3D printers	4
Resin 3D printer	1
UV chamber	1
Food 3D printer	1

10. Computers[1]

TOOL / EQUIPMENT	QUANTITY
Laptops	5
Printer	1
Digital camera	1
Beamer	1

11. Moulding[1]

TOOL / EQUIPMENT	QUANTITY
Vacuum chamber	1
Thermomoulding machine	1

How to engage and support teachers developing pedagogical practices and activities using Fab Lab tools

LA CASEMATE

OSHub-FR is a collaboration between La Casemate – CCSTI Grenoble and the third place *La Machinerie* located at Villeneuve, a low socio-economic background neighbourhood from Grenoble. La Machinerie works as a concierge and meeting place in the heart of the neighbourhood, where it hosts an open space for meeting and learning by doing, promoting the exchange of know-how and local initiatives by residents and actors from the neighbourhood (DIY, repair, homemade, reuse, digital, etc.). In addition, it provides access to several digital fabrication tools, such as 3D printers or laser cutters, allowing to develop and prototype projects and to create all kinds of objects.

As such, the collaboration between La Casemate and La Machinerie works as an effective synergy, where La Machinerie brings the space and mindset for community collaboration, and La Casemate the open science framework, tools and resources, thus creating the conditions to develop projects based on relevant issues together with the local inhabitants (youngsters, families, associations, etc.), by using a multidisciplinary STEAM approach and digital fabrication skills and tools. Furthermore, this participatory space also provides training and resources for educators, and organises workshops, meetings and events, bringing together the different kinds of local actors.

To assist teachers in a Fab Lab project, facilitators can have different strategies, which will highly depend on the presence of a Fab Lab near the school. It is also possible to create a small Fab Lab space in collaboration with a local association or third place or at the school.

This document provides support on how to establish a small Fab Lab / Tinkering Lab, including information about materials, safety and troubleshooting.

1. What is needed to open an educational Fab Lab? Equipment Management Plan and Safety

The tools listed below are safe when used responsibly. All power tools require training and should be used with supervision, and only by students with enough strength to control the tools.

Specific rules and procedures on how to use the tools are explained below, and should be followed every time, even if it is not the first time. If needed, gloves, safety glasses, masks or other specific equipment should be provided.

List of materials

The workspace needs to be organized and spacious enough to provide enough room to move around working makers freely and without danger. We have fire extinguishers, safety paths and signs, adequate lighting, and ventilation. The Fab Lab set up was verified and approved by local authorities for safety at work.

WHAT?	HOW MANY?	WHAT DOES IT LOOK LIKE?	SPECIFICATIONS
Computers	6		Intel Core I5, GeForce GTX, 8GO de RAM, SSD 930 GO
Soldering iron	5		
Tin with lead	1		
Tin without lead	1		
Third hand	5		

Wire stripper	1	
Multimeter	1	
Multimeter measurement kit	1	
Smoke extractor	5	
Heat gun	1	
Glue gun	2	
Glue sticks – coloured and transparent	1 of each	
Scissors	1 of each	
Metal ruler	3 of 50 cm and 1 of 20 cm	

Metal square	2		
Cutter	2		
Glue	4		
Felt pen	1 of each		
Pencils	1 of each		
Erasers	1		
Transparent pockets	1		
Cutting mat	2 of each		
Smartphone	1		IPhone 8+

iPhone-Jack Adapter	1	
Lapel microphone	2	
Tripod	3	
IPhone-tripod clip	1	
Microphone	1	
Light	3	

Safety Rules and Troubleshooting

General instructions for power tools

Power tools need to be turned off whenever they are not being used, and, if possible, should be unplugged to avoid electric injury or voltage problems for the material.

Computers

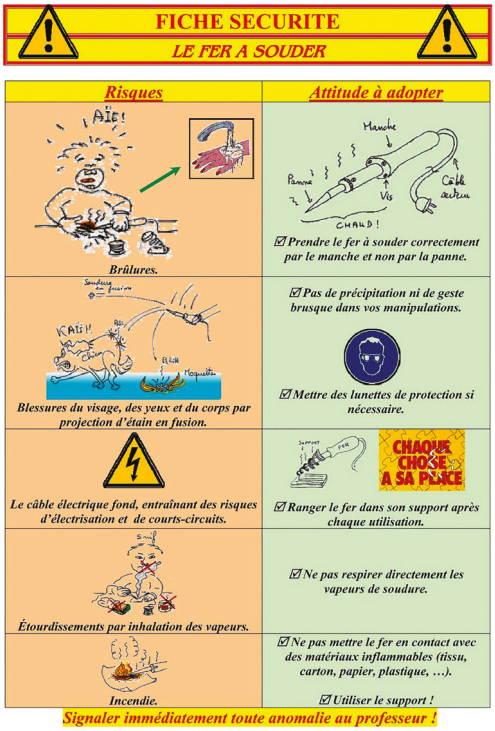
Using ergonomic workstations is important, as well as making sure that students adopt a healthy posture when working on the computers. Before using the Internet, students need to be aware that they should not disclose personal information, such as their city, school, address, phone number, email address or real names.

Soldering iron and smoke extractor

It is fundamental to have a full understanding about the procedures to use a soldering iron[2], with specific attention to the hot parts of the tool. Students should only use a soldering iron under adult supervision.

A smoke extractor must be used every time that the soldering iron is used to avoid inhalation of smoke or tin vapours. It has to be placed behind the working area.

Safety slides should be provided for each soldering station, in order to inform the users, in particular the students, about the risks and safety behaviours.



Heat Gun

Heat guns should only be used by students under adult supervision. Before using it, it is fundamental to explain to the students about all safety considerations, namely the following: heat guns should not be used near combustible or flammable materials/atmospheres; it is important to be aware about the presence and direction of the heat produced; the tool should be switched off before putting it down onto any surface; heat guns should only be stored after cooling down; the hot metal nozzle should never be touched with clothes or skin; air flow should never be directed towards one's body; while the gun is turned on, one should not look into the nozzle; any object should be inserted into the gun nozzle; and the inlet grill should not be blocked or the air obstructed while the tool is being operated.

2. Example of Digital Soldering Station Manufacturer's instructions

Glue Gun

The goal is always to prevent electric shock, skin burns and eye injuries. For that: the hot nozzle and hot glue must not be touched when working with the glue gun; the glue gun should not be pointed towards the direction of another person; the glue gun should be unplugged immediately after the user stops using it; the gun can not be left unattended while it is hot, otherwise it will become a fire hazard and become of danger for other people who may come in contact with the hot appliance; when the gun is not being used, it should to be set down upright on its metal rack and not lying on its side; only glue sticks appropriate for the glue gun should be used; the glue gun needs to be kept away from direct sunlight or moist conditions, in order to reduce any risk of electrical shock or fire.

Scissors, cutters

Safety tips should be explained to the students regarding the use of scissors and cutters, particularly: hands and body should be kept away from the tools and cutting lines; gloves should be used whenever necessary; maximum focus is fundamental while using the tools; the work should be performed on a flat and solid surface; whenever the tool is not being used, the blade should be retracted.

2. Fab Lab machines that can be easily moved and used by students

In addition to the various tools presented above, additional Fab Lab machines are recommended in order to develop a project that will lead to the manufacture of tangible objects with the students, like a 3D printer, vinyl cutter, scroll saw, sewing machine, manual engraving machine and programmable electronic boards. Nowadays, if schools have the possibility of acquiring them, there are already some accessible financial options that will allow developing creativity and technical skills with students.

As an alternative, at La Casemate, CCSTI developed an educational program with a mobile Fab Lab inside a motor vehicle that includes computers, a vinyl cutter, a 3D printer, a laser cutter and an engraving machine. This utility, created in 2018, can go to schools to facilitate the development of projects in areas that don't have access to Fab Labs, like rural areas.

Equipment, Tools, Materials and Safety

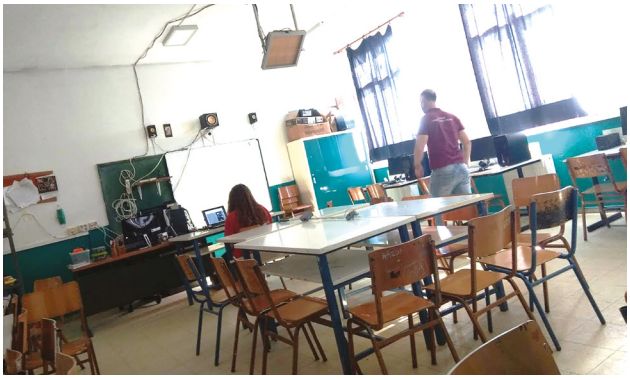
The current document depicts the basic materials, tools and equipment found in the SciCo Maker Labs. The first SciCo Maker Lab was established in the secondary school of Livadochori Limnos and was then reapplied to the Vocational School of Myrina.

The document also states the basic safety points which need to be taken into consideration by all participants and visitors of the Maker Space.

1. Workspace

The SciCo MakerLab was created as part of the European Project Open Science Hub and was first set up in the existing computer lab of the Livadochori High School in Limnos, Greece. It was then reapplied to the Vocational School of Myrina in Limnos.

The goal is to ensure a safe, comfortable and creative maker space for students within and outside school hours, by individuals and teams. Therefore, it has been created in order to have individual work desks, a common workspace in the centre of the room and enough space for people to move around freely, without danger.



2. General Workspace Safety

Initially, users should always ensure that:

- Pathways, exits and safety equipment are kept clear from tools, materials, furniture and equipment.
- The trash and debris should be removed regularly.
- The room should be lighted and ventilated adequately.
- Everyone should know where the first aid kits and fire extinguishers are.
- Safety goggles and gloves are worn when needed.

The remaining general safety procedures (eg, fire escape plan, earthquake "Drop-Cover-Hold" plan, etc) are common to the schools' safety procedures.

3. Inventory

The workspace needs to be organized and spacious enough to provide enough room to move around working makers freely and without danger. We have fire extinguishers, safety paths and signs, adequate lighting, and ventilation. The Fab Lab set up was verified and approved by local authorities for safety at work.

SAFETY TOOLS / EQUIPMENT / MATERIALS PER SPACE	QUANTITY
Fire Extinguisher	1
First Aid kit	1
Safety Goggles	5
Gloves	2
Containers	6
Broom and dust pan	1
Rubbish Bin	1

GENERAL PROJECT TOOLS / EQUIPMENT / MATERIALS PER SPACE	QUANTITY
Scissors	10
Hot Glue Guns	5
Hot Glue sticks	30
Sets of Rulers, Glue, Staplers, etc	5

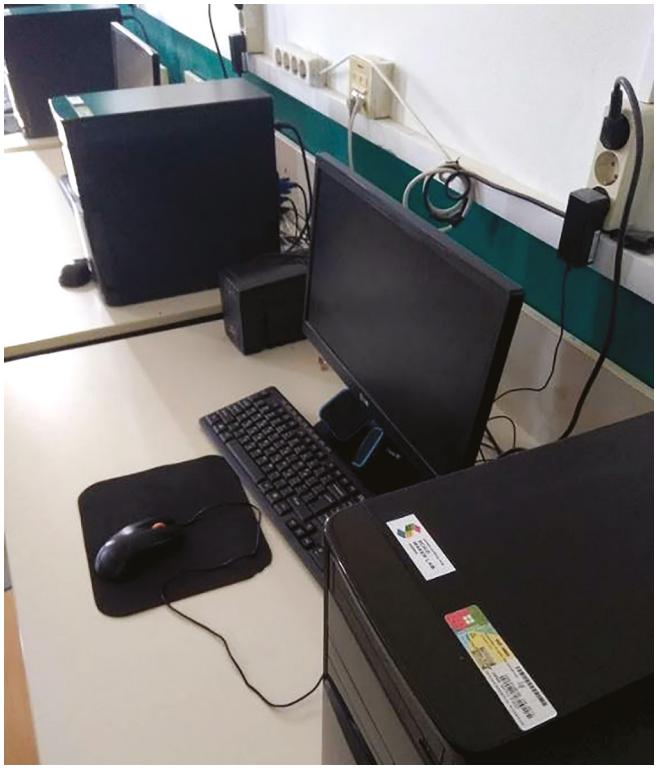
Sets of pens, paper, pencils, crayons, etc	5
Tape (duct tape, masking tape, copper tape, etc)	10
Paintbrushes and Paint	10
Cardboard	50
Popsicle sticks	100
Pipe cleaners	100

4. Computers

Personal computers (pc) are at the core of Scico Maker Lab, as there are used by students to:

- Access information and get inspiration.
- Access digital tools to design, create, and collaborate on projects.
- Programme and write code for their projects.
- Connect to 3D and normal printers to produce patterns, designs, project materials and mock-ups.
- Access tutorials, instructional videos.
- Document projects and learning.
- Connect via online platforms.
- Share projects and communicate work.

All computers run in a Windows or Linux environment and all software used are open accessible educational platforms, such as Tinkercad, Wordpress and App Inventor by MIT.



Computer Safety

Students should be aware of basic ergonomics at their workstations: correct posture and lighting and frequent breaks away from the screen. Additionally, students are trained in order to access age and content appropriate webpages and never disclose personal information (photos, name/surname, phone number, passwords, school, etc).

Inventory

TOOL / EQUIPMENT / MATERIALS	QUANTITY
Desktop computers	10
Printer	1
Laptop	1
Projector	1

5. Electronics

One of the basic tools used during the current academic year are microcontrollers (Arduino) and robotics kits (Lego Education). The former are used in order to introduce students to electricity, electronics, electric circuits, basic programming with ArduBlock and physical computing, whereas the latter include bith Ledo WeDo 2.0 and Lego EV3 kits, in order to introduce students to basic coding, robotics and building.

Microcontrollers & Robotics Microcontrollers allow makers to create advanced electronics and electromechanical systems including robots. This adds the capability to build and experiment with robotics, microcontrollers, and other electromechanical creations.

Apart from the basic Robotic kits and Microcontrollers (Arduino), SciCo MakerLab includes a range of sensors, electric cables, soldering irons, batteries, breadboards, usb cables, LEDs, Bluetooth connectors, copper tape and other materials which are needed to build the projects.

Electronics Safety

All electronic equipment is low-power and safe, however students are introduced to the basics of a short-circuit and safe handling of all tools.

The tip of a soldering iron heats to about 400°F, hot enough to cause burns and should be handled attentively. Under normal soldering conditions, solder containing lead poses no health risk, though makers should be encouraged to wash their hands after a long period of handling leaded solder. Any kind of soldering generates fumes from the flux core of the solder, so the area is ventilated when used. Alternatively, students mostly use solderless breadboards as they can explore circuits in a faster and safer way.

Inventory

TOOL / EQUIPMENT / MATERIALS	QUANTITY
Arduino Microcontrollers	60
Lego Education WeDo 2.0	4
Lego Education EV3	3
Soldering Irons	5
Sensors (temperature, pressure, CO_2, O_3, weight, distance, sound, etc)	100
Breadboards	20
Batteries (AA, 9V)	20
Jumper Cables	200
LEDs	100
Raspberry pi	20
Motors	10
Photoresistors	40
Resistors	100
Buzzers	10
Coin Batteries	10

6. 3D Printer

The SciCo Maker Lab is equipped with a MakerBot Sketch 3D Printer, with which students can print 3D objects from plastic through extrusion. The material used in this printer is PLA (a biodegradable plastic), whereas students create their 3D designs using the Tinkercad or Autodesk platform. They also have the option of searching from ready designs and freely downloading them from sites like Thingiverse.com.

The set up of the printer and basic training was run in collaboration with the provider (Decode Fabrication Lab), who is also responsible for its maintenance.

As an easy and quick activity to introduce students to 3D printing, the Maker Spaces were also equipped with 3D pens. These pens can also be used for mini creations for projects.

The second school already had a 3D printer, which was used in the Maker Lab.

3D Printer Safety

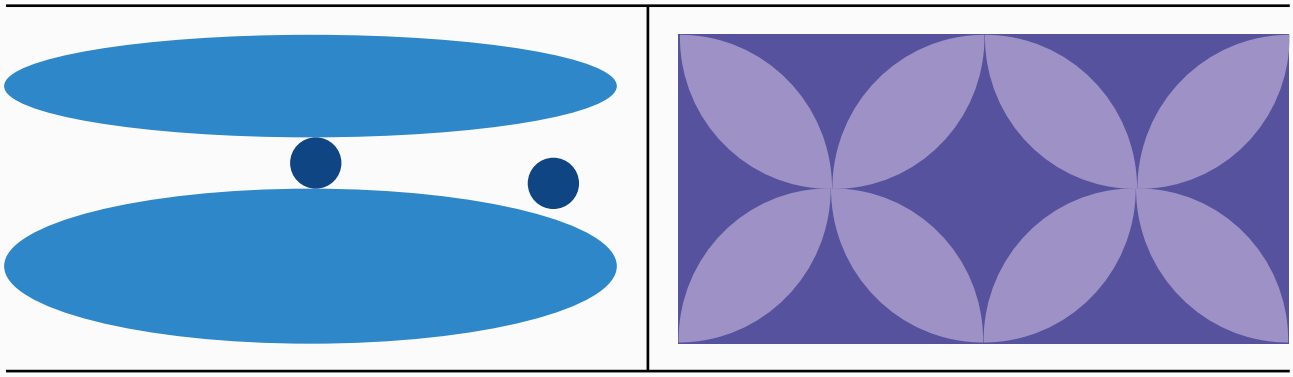
3D printers are generally very safe. The print extruder does heat to several hundred degrees and should not be touched.

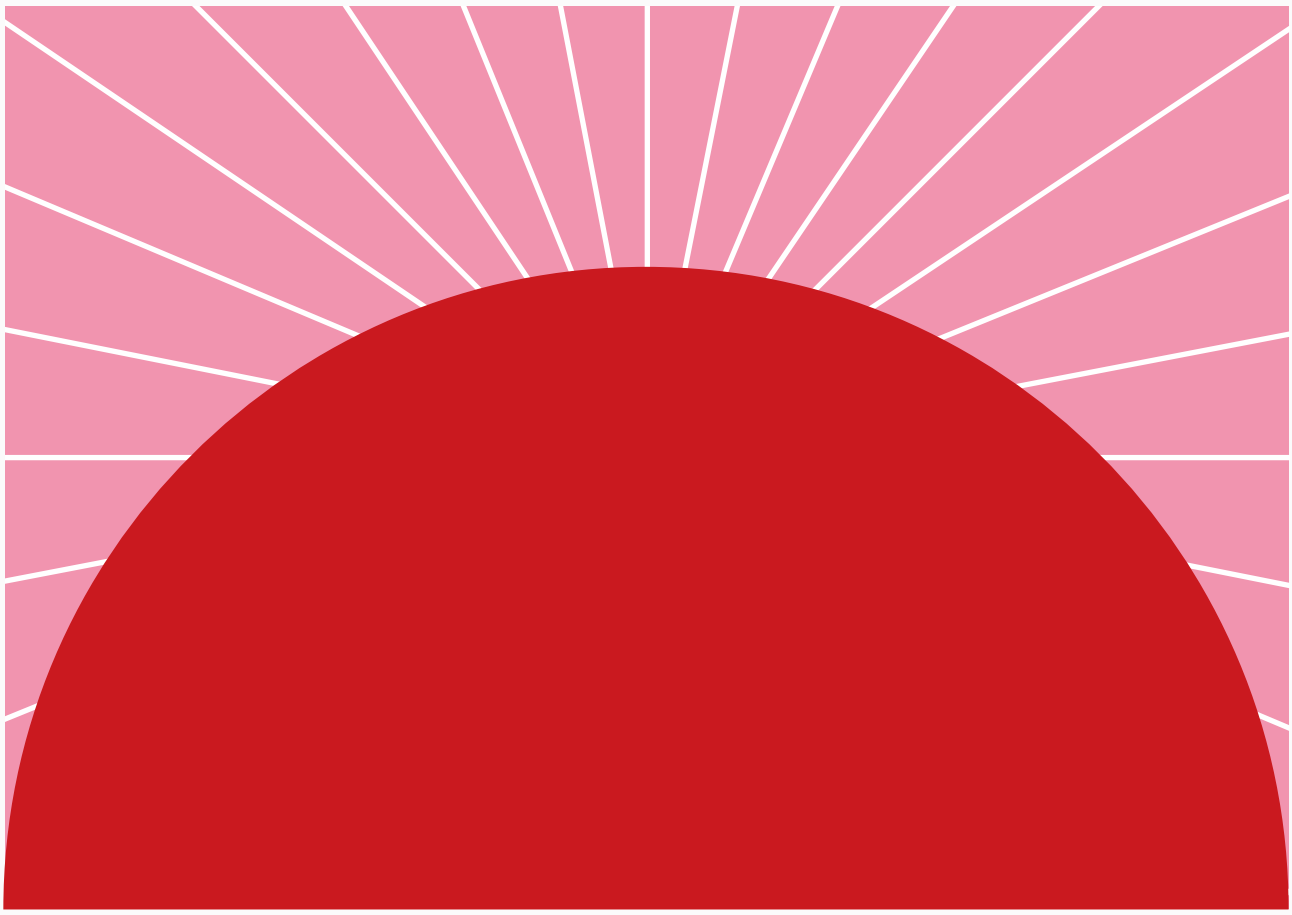
Inventory

TOOL / EQUIPMENT / MATERIALS MATERIALS PER SPACE	QUANTITY
3D Printer	1
PLA Spools	6
Build Plates	2
Snip	1
USB for transferring files	1
3D pens	5

The Activity Handbook

05





This handbook contains a list of activities and workshops that were developed and implemented by hubs across the OSHub network. These activities explore STEAM topics through an interdisciplinary lens that embody the practices of Open Schooling. They promote co-creation and collaboration with stakeholders outside of the school network, inspire active citizenship within students, and provide a means for teachers, facilitators and other community members to implement open schooling practices in a way that is relevant for their own context.

5.1 Content

The activities and workshops are separated into various categories:

- **Inspiration Workshops**

  Inspiration workshops were developed and implemented by TCD in Dublin, Ireland to spark curiosity and active citizenship through STEAM subjects within students aged 15-16. These workshops encourage the inclusion of experts within the specific topics covered, providing students with real-world examples of somewhat abstract problems.

  For the educators leading these sessions, it is very important to note that they are primarily in the role of 'facilitator' – working with the students as opposed for them. Although there is some knowledge dissemination and context setting in each workshop, the majority of time is dedicated to activities and discussions.

  These workshops can be carried out as a once-off activity, or can be used to open students up to different perspectives and topics which can be used in the last of these workshops, the Ideation sessions. This is a series of up to three co-creation sessions designed to collaboratively select a challenge, topic or initial project idea for an Open Schooling project.

  For more context and information surrounding these Inspiration Workshops, you can visit the *Open Science Hub Ireland Teacher Handbook 2022/23*.

- **Learner Activities**

  A number of activities showcased here allow learners to explore scientific and technological topics from multidisciplinary perspectives, such as understanding biodiversity through sound, learning electronics to help the local community, or considering the ethics of research. They focus on skill building and the applicability of science to everyday life, and are easy to implement (with the right equipment).

  Two activities can be done in any learning location, while the other three require equipment found in a workshop, makerspace or Fab Lab (see 5.2 Useful Definitions). As these activities were developed in the context of local OS Hubs, some instructional material may need translating from the original language.

- **Reflection and Evaluation Tools**

  Reflecting on an educational journey is important, not just for the learner but also for the educator. It allows the learner to look further than just the topic they have encountered , but to consider the entire learning process, and how they felt during this process, allowing for an emotional response to be explored. Reflecting allows the educator to consider what they felt went well, and what could be improved for the next session.

Reflections by learners can also be utilised by educators as a form of evaluation, which is crucial in Open Schooling due to dynamical partnerships being formed and investigations into unexplored societal topics. It is beneficial to evaluate how things went in a project to ensure improved success the next time round.

In this section, we present four activities that can be utilised for reflection and evaluation of lessons, workshops and activities, but can also be adapted into activities of their own for exploration of a brand new topic.

- **Educator Trainings**

  The final two activities/workshops are aimed to empower educators to foster open-schooling practices within their community. They introduce educators to the concept of Open Schooling, demonstrate how to facilitate co-creation and innovation sessions, and provide them with the skills and knowledge to foster collaborations between their school, their learners and local community.

  One is a board game, which can be used as an easy introduction to all stakeholders, not just educators. The other is a 10-lesson module, focused more towards teachers and informal learning educators. Educators may use the skills gained from these activities to then successfully implement the activities outlined in this handbook.

- **Adaptation**

  In the spirit of Open Science, links to resources are found within the handbook and are open-access. However many of these resources were developed within a specific context, due to the nature of the OSHub project. Therefore activities should be used as inspiration but can also be adapted to fit any context. Language translations may also be necessary as these were developed in the local language of multiple different EU countries.

5.1.1 Useful definitions

Throughout the handbook you will see references that may not be familiar to you. To help with this, we have compiled a list of definitions to improve your user experience.

PHRASE	DEFINITION
Co-creation	The act of creating together. An approach to design, attempting to actively involve all participants in the process to ensure the result meets their needs and is usable.
Fab Lab	A Fab Lab (sometimes written FabLab/Fablab) is a workspace where visitors have access to skills, materials and technology to explore, learn and invent in the realm of digital.

Maker Movement	The Maker Movement is a movement towards artisan culture, fostering creative and collaborative communities where people build, make, tinker and share skills and ideas to solve problems. Facilities have been developed with this culture in mind, such as Makerspaces. These are open laboratories or workshops that provide the equipment, technology and open space required for innovation.
Miro Board / Jamboard	Virtual whiteboard tools that can be used for brainstorming, collaborational activities and presenting of ideas.
Sustainable Development Goals (SDGs)	The United Nations' Sustainable Development Goals are a call to action for all nations of Earth to work towards creating a better, sustainable future for our planet and for society. The 17 goals cover different challenge areas such as poverty, climate change and inequality, and recognise that strategies to combat such issues are not discreet, but overlap and are often multidisciplinary.
Stakeholder	A party that has an interest in or connection to a particular project or programme, and can be affected by the outcomes of such.
Tinkering	Tinkering can be thought of as a way of 'thinking with your hands', where learners explore topics and challenges through the process of design, creation and collaboration.
Third Place	An open space where individuals can meet to work, appropriate knowledge and/or skills, to meet or simply exchange informally.

5.2 Inspiration Workshops

SESSION TITLE

Diversity and Astronomy

ACTIVITY IN A SENTENCE:

An exploration of how diversity affects decision making and the selective sharing of knowledge based on dominant cultural identities, all through the lens of astronomy.

DISCIPLINES INVOLVED IN ACTIVITIES:

Diversity, Astronomy, Science Communication, Art, Cultural Studies, Activism

RECOMMENDED AGES:

14+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Classroom, informal learning environment

LEARNING OUTCOMES:

- Able to reflect on one's own identity in relation to others
- Understanding of the impact diversity has on decision making
- Understanding the influence of storytelling on science communication
- Able to express one's own cultural identity through storytelling

Cultural diversity forms and shapes trust, bias and activism in society. When activating a project it is vital to understand the culture you are working with and know what cultural shift you may create, intentionally or otherwise.

RECOMMENDED EXPERTISE:

Experience with facilitation is recommended.

SDG LINKS:

- **Goal 5:** Achieve gender equality and empower all women and girls
- **Goal 10:** Reduce inequality within and among countries

TIME IT TAKES TO COMPLETE:

45 – 60 minutes

MATERIALS / RESOURCES NEEDED:

- Presentation Slides
- 3x A4 paper, pencil and ruler per learner
- Cardboard box per learner and tape (OPTIONAL – if choosing Part 3, Option 2)
- Web-enabled device, preferably laptop/computer per learner (OPTIONAL)

CONTENT FOR LEARNERS:

- Presentation – *Activity Handbook – Diversity and Astronomy.pptx*

Note: *Copy the presentation into your own folder before editing.*

Activity

Introduction:

Part 1: Empathy Map

To lay the foundation for this workshop, start by asking learners to divide a page in four with a pencil and write 'learner' in the middle and in each corner write: SEE (top left), DO (top right), THINK (bottom left), FEEL (bottom right). See Figure 5.1 for an example. A version of this can also be found in the slides linked above.

This is an empathy map for a typical learner where the person 'steps into' the shoes of another to build a picture of their likes, dislikes, wants and needs – a persona.

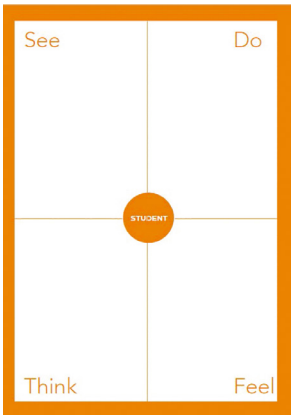


Figure 5.1: Empathy Map. Credit: Open Science Hub Ireland Teacher Handbook 2022/23

Explain that the persona is a 'learner' and ask them to write as many things as come to mind for each of the four categories. As they are learners themselves they should have plenty of experience to draw from, but it may be useful for them to think of another person other than themselves. If it helps, the learner can be in primary school, secondary school or University.

Next, ask learners to make the same layout again on a new page, but pick one of the professions seen on the relevant presentation slide (Empathy Map For Another). They should put this persona (e.g. 'astronomer') in the middle and write as many things that come to mind for each of the see/ do/ think/ feel categories.

Learners do not need to have been introduced to the professions on the slide – just what they think a person in that profession might typically see, do, think and feel.

Ask the following prompts to open discussion about perceptions of careers and people in those careers:

- Do you associate a particular gender with the profession you chose for the second empathy map? Why or why not?
- Do you associate a particular age with that profession? Why or why not?
- Do you associate a particular country or culture with that profession? Why or why not?

Optionally, you can ask learners to use the other side of their A4 page to sketch a cartoon of what a person typical of the profession looks like (clothes, gender, accessories all come into play). This can be done before the prompts above or instead of them, both with the goal of opening up conversations around perceptions of what a scientist/ artist/ civil servant etc 'should' look like.

Show learners the gender breakdown pie chart and explain that this is representative of all the professional astronomers operating worldwide. This is an approximate 80/20 male/ female split with 0.1 percent of astronomers under the category 'other'.

- Is this gender breakdown what you would expect for this profession? Why or why not?
- If we were measuring how 'diverse' the global population of astronomers is, what other demographics could you report on?
- Is the way gender is reported here good enough? (Think about someone forced to choose 'other' as their gender identity).

Part 2: Decisions and Diversity

2.1 Background information

Since people around the world could look up at the stars and talk about them, they have named them and drawn imaginary lines between them to make stories to tell around campfires. The names and stories varied from country to country, but dominant countries and empires spread their stories far and wide. Astronomers call these star patterns constellations.

Fast forward to the early 20th century and astronomers are working together across the world from many different countries and cultures. In 1919 an organisation called the International Astronomical Union was formed to decide on standard naming conventions for professional astronomers to use consistently worldwide. This meant one starmap for all to use with commonly recognised star patterns and names for stars, planets, moons, asteroids, and more.

All professions involve a level of decision making and some decision makers are doing so on behalf of a diverse population – locally, nationally or even internationally. The decision makers often don't reflect the diversity of the population their decisions are affecting. Today astronomers use constellations that don't necessarily

reflect their own cultural identity and yet open any popular astronomy app today and you'll be presented with depictions of Greek stories of animals, people and objects.

2.2 Activity instructions

If learners have access to the Internet, direct them to Stellarium Web on their devices, otherwise you can display this on a screen in the classroom. Along the bottom, the first two icons can be clicked to reveal constellations and their associated artwork.

- Ask learners if they recognise any of the characters/stories.
- Ask learners to find a star name beginning with 'Al' (they will need to zoom in).
- When everyone has found an example they can share what one they've found and then you can explain that those star names are latinised versions of arabic star names (Al – being the arabic for 'the').

Although there are alternative names for all these stars these are the primary names used across the world and show the influence of the work and writings of Arabic astronomer Al-Sufi who produced a famous star catalogue called 'The Book of Fixed Stars' in 964 CE.

The stories represented by these star names and constellations are of their time and place and are like a 'hall of fame' in the sky. Ask learners which person, animal or object would they want represented in the night sky so that they are honoured for centuries to come.

Part 3: Decisions and Diversity

3.1 Background information

Explain to learners that the digital planetarium they (or you) used was created in part thanks to data from a space telescope built by the European Space Agency (ESA) called GAIA.

GAIA measures the positions and motions of more than one billion stars in our galaxy, the Milky Way. All the stars in our galaxy (including the Sun) are moving through space – very fast – but space is very big and seeing any change in their position takes a long time. We call this movement the 'proper motion' of stars.

Playback the video in the presentation ideas in *Stellarium Web* explaining that they are seeing where stars will move over the course of the next two million years. As can be seen, the constellations lose their shape and the stories they had assigned to them become meaningless.

3.2 Activity Instructions

For this concluding activity learners can construct their own constellation in two ways. The concept is that learners are creating a time capsule of new constellations that could be presented to the IAU for use in the distant future to replace the constellations as they warp and make their original star stories redundant.

What are learners' star stories for the year 2 million?

Option 1: Simple drawing

- Ask learners to take a sheet of paper or card and randomly dot it with 10-15 points using a pencil.

- Ask learners to try to come up with a pattern that represents something they would want represented in a constellation to replace the old Greek legend – something that speaks to their cultural identity, something they would want others to celebrate.
- Ask around for learners to share back to the group.

Option 2: Crafting a light box

- Ask learners to take their cereal boxes and carefully separate the seams so it can be turned inside out and taped on the side and at just one end.
- Ask learners to dot one face of the box with 10-15 points using a pencil.
- Ask learners to try to come up with a pattern that represents something they would want represented in a constellation to replace the old Greek legend – something that speaks to their cultural identity, something they wish others would celebrate.
- When they are satisfied with their pattern, ask them to draw pictures around their patterns and write any notes nearby like the name of this new constellation and any story notes.
- Ask around for learners to share back to the group.
- Finish by asking learners to use their pencil to carefully punch holes where their dots are. Learners can then use a light source such as their phone torch and place it in the box so that the light passes through the holes to represent the stars.
- The lights can be turned off and blinds closed to see the constellation light boxes at their best. If possible all the light boxes can be combined to form a 'class star chart' representing the mixed cultural identities of the group.

USEFUL LINKS:

- *IAU Springboard to Action: Recommendations for improving equity, inclusion and diversity in Astronomy*

Credits: This activity session was developed by Trinity College Dublin, OSHub Ireland.

SESSION TITLE

Sustainability and Future Cities

ACTIVITY IN A SENTENCE:

An exploration into sustainable living and current and potential future challenges our world faces, how we can come together to tackle these challenges as local communities and a global society.

DISCIPLINES INVOLVED IN ACTIVITIES:

Climate Change, Sustainability, Citizenship, Technology, Science, Equity

RECOMMENDED AGES:

14+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Classroom, informal learning situation

LEARNING OUTCOMES:

Learners will:

- Explore the current and future global challenges our world faces.
- Gain an understanding of the 3 pillars of sustainability.
- Creatively design for a future society that tackles some of the challenges our world faces.

Sustainability is a theme that intersects with almost every UN Sustainable Development Goal. In the face of a climate crisis, sustainable living is a crucial goal for societies around the globe. This activity supports learners to think critically about what it means, and what we can do, to live sustainably.

RECOMMENDED EXPERTISE:

Facilitation experience is recommended.

SDG LINKS:

- **Goal 1:** End poverty in all its forms everywhere
- **Goal 17:** Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

TIME IT TAKES TO COMPLETE:

45 – 60 mins

MATERIALS / RESOURCES NEEDED:

- Presentation slides: *presenttion*

Options for Design Section (Part 3)

- Option 1: Large paper (A2) / Pens, pencils or markers to draw or colour
- Option 2: Large paper (A2), magazines and glue for collage
- Option 3: A computer with internet connection for each group

CONTENT FOR LEARNERS:

- Presentation – *Activity Handbook: Sustainability and Future Cities*

Note: *Copy the presentation into your own folder before editing.*

Activity

Introduction:

Part 1: The Challenges We Face

1.1 Challenges we see in media

Note: This is the hook for the lesson so give plenty of time for learners to talk and become invested in each other's thoughts.

- Ask the group the question presented on the slide "What is your current favourite movie/book/tv show or piece of media?" Allow each member of the group time to say their answer.
- Ask the group if they see any pattern in the answers provided, do they have anything in common. In most of the shows you will see that the main character(s) have faced some type of challenges and throughout the show they try to make it right.
- Discuss what happens in one of their shows, or choose your own favourite show to speak about. If this is uncomfortable for you an example is provided below.

In show writing, the protagonist(s) usually gets agency from some sort of problem, issue or tragedy. The world of the protagonists(s) has fallen into chaos and has been disrupted from the normal balance of things. We live in a world that is in constant need of re-balancing. We need to make smart decisions to keep things from falling into chaos as we move forward. This can be referred to as sustainability.

Most of a protagonist's journey is them searching for a sustainable, less chaotic life. It also shows that love for drama is founded upon an innate curiosity for overcoming challenges. We will investigate some of the challenges in today's class.

Example Provided — Attack On Titan

- The protagonists within this story live within three large ringed sets of walls the smallest of which is 3 feet high. The poorest folk live within the first wall (Maria), the upper class live within the second wall (Rose) and the highest most noble class live within the 3rd (Sinah).

- These walls are constructed to protect from the dangers beyond the wall known as titans. These are giant sized humanoid like creatures whose only goal is to eat people. The protagonists have no choice but to live inside the walls to protect themselves from the titans.
- With a growing population and crumbling walls, tragedy could strike at any minute. This is not a sustainable way to live, so they must find a more sustainable way.

1.2 Challenges of the future

Through open discussion or a whiteboard tool, ask learners to come up with the biggest challenges we face for our future.

- Allow them to examine the answers and see if there are any overlaps or patterns in them? Is there a way that we could group them?
- Optional activity: Pick one of the challenges given (it might be the most frequent) and list the things (sub-topics, sub-challenges) that contribute to this?
    - E.g. Challenge given: Climate Change. Subtopics: Land Use, Education, Paris Agreement, Clean Energy, The Ocean, Fossil Fuels, Biodiversity Loss, Justice and Laws.

1.3 Global risks

There is a group, whose job is to look at what could be the biggest challenges of the future, and to plan strategically for them. They are called The World Economic Forum.

- This is what they think are the highest risks the world faces (show slide 5)
- 'By likelihood' means how likely these things are to happen, therefore it's most likely that the biggest challenge the world will face in the future is extreme weather (eg. extreme flooding and record high temperatures).
- By impact means how much devastation they could cause. Therefore although infectious disease might not be as likely as extreme weather, if it does happen it will be the most devastating and difficult to deal with.
- Discuss how similar or different they are to previously given answers. Now change the slide to the connection map.

As you may have already figured out, these issues/challenges don't just exist by themselves, they are all linked and influenced by one another in some way. You can explore all this on *WEF: Strategic Intelligence Maps*.

Part 2: Living for the future

2.1 The 3 Pillars of Sustainability

Ask the question "Does anybody know what sustainability means?" Allow the class 5 minutes to Think/Pair/Share. Gauge the learners previous knowledge of sustainability.

This will inform how fast or slow to move on the next couple of slides.

2.2 What does sustainability mean?

Discuss the following with your learners.

- When we think about sustainability, we need to think of these 3 things.
  - **Environmental Preservation:** Keeping our environment safe and strong
  - **Social Equity:** Keeping our society fair for all
  - **Economic Viability:** Keeping our economies functioning.
- In 1983 sustainability was defined in the Rutland Report "Sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs" – Rutland Report 1983
- A simple way of thinking about this is, do what you need to do without harming anyone else.

2.3 Living Sustainably

Here are some videos to watch. They show different approaches to being sustainable.

- *Living Waste Free*
- *The Great Pacific Garbage Patch*
- *Lobster Plastic*

Once you watch two or three of the videos you can ask the following questions to prompt a class discussion.

- Do you think any of these methods are sustainable? Why/Why not?
- Is there anything that they can do to improve?
- Do you think this is available for everyone?
- What else can we do to live sustainably?

Part 3: Design a Sustainable City for the Future

"The year is 2321, the earth is a very different place. You and your team must design a sustainable city where future generations can live peacefully. Now you are in charge! You all get to make the decisions, and we want you to design a city for the future"

- Use pens and paper, crafts, or presentations with pictures or lego or arkit.
- Your design must balance the 3 pillars of sustainability. Therefore think of the elements that keep your city environmentally friendly (its nature is protected), social (there are things for people to do and enjoy), and economical (brings in money).
- Be creative, think outside the box, don't be afraid to get wild and wacky with your ideas.
  - The class will be split into 5 groups.
  - Depending on the number of learners, you can increase or decrease the group number.
  - Each group will be provided with a scenario/brief below that will inform their build.
  - It is each group's job to read their brief and design their city. They must decide where the city is located, and create amenities, work, travel, resources etc.

— They must have a city name, flag and a motto. Think about what the goals are for your society?

— Optional: After the build, assign each group a pillar (environment, social, economic), they can grade the other groups out of 5.

Sustainable City: Scenarios

1. Environmental Breakdown — Trash Earth

In this reality, the world has done very little to combat the waste crisis which we once faced. The world over produced waste for hundreds of years and now there is trash everywhere. Our major waterways have been contaminated, there are numerous giant landfills around the planet. The earth has gotten warmer and a blue sky is rare due to the pollutants and we have seen a dramatic loss in biodiversity.

How do we live on a planet so contaminated with trash and lacking biodiversity? Can we somehow use this to our advantage or is there a way to start building again? Think about the world you want to see in the future. How will you provide people with housing, energy, resources and amenities?

2. Geopolitical Collapse

In this reality the world has just finished a devastating world war, which resulted in a nuclear fallout. Billions of people still survived, however the earth itself is tarnished. The pollution and radiation is too dangerous for society to live on the surface of the earth anymore.

The only safe havens are underground, the deep open ocean or somewhere off earth.

With no governments in power the people are divided, you must lead them to their new home. How will you bring your societies together and provide them with new resources, entertainment, jobs and housing.

3. Technological Uprising

In this future Artificial Intelligence has grown dramatically. Nobody expected it to have the power it has today. Many people are uncomfortable with its control and do not want to live close to any major cities. To build such a powerful A.I was environmentally and socially damaging to many areas.

Technology has advanced so quickly that cities are all powered off the one computer. The lights, the transport, the operating systems, the shops, the law, the schools, living quarters etc. are all automated near the big cities.

There is a citizen ranking system in place to "assist" people in being the best citizens they can, this is monitored by the A.I – Big Bird.

Technology has an infinite potential, but people want to move away from the big cities and take control back themselves. With your team, build a new city, use as much or as little technology as you wish, the people will be sceptical.

Credits: This activity session was developed by Trinity College Dublin, OSHub Ireland.

SESSION TITLE

Innovation and Ethics

ACTIVITY IN A SENTENCE:

This workshop expands learners' perception of what is considered ethically appropriate when engaging the public through art practices and scientific research, and how to innovate responsibly.

DISCIPLINES INVOLVED IN ACTIVITIES:

Ethics, Biology, Chemistry, Astronomy, Technology, Society, Research

RECOMMENDED AGES:

14+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Classroom, informal learning situation

LEARNING OUTCOMES:

- Able to reflect on ethics in decision making
- Understanding the difference between inspiration and plagiarism
- Recognising unethical research practices
- Able to participate in ethical debates and discussions

When creating solutions for global challenges it is important to understand that innovation goes hand in hand with good ethics. To responsibly innovate we need to be aware of the fact that a lack of integrity can harm others even if there are some positive outcomes (e.g. something novel or something fast).

RECOMMENDED EXPERTISE:

Facilitation experience is recommended.

SDG LINKS:

- **Goal 9:** Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- **Goal 11:** Make cities and human settlements inclusive, safe, resilient and sustainable
- **Goal 16:** Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

TIME IT TAKES TO COMPLETE:

45 – 60 minutes

MATERIALS / RESOURCES NEEDED:

- Presentation Slides: *Presentation*
- Paper and writing materials

CONTENT FOR LEARNERS:

- Presentation – *Activitiy Handbook – Innovation and Ethics.pptx*

Note: *Copy the presentation into your own folder before editing.*

Activity

Introduction:

Most of the following activities and concepts are adapted from the EU Horizon 2020 project *INTEGRITY*[3]. As part of this project, resources were developed to empower learners at second and third level with an evidence-based understanding of responsible conduct in research.

Part 1: Innovation Game

1.1 Playing the game

Ask learners in pairs to choose one of the four activities below:

- Browsing the internet
- Shopping on the highstreet
- Travelling to work on a bus
- Being interviewed for a job

Tell learners that they will be given a pair of obligations depending on their choice. Assign the relevant pair of obligations as seen below:

- Browsing the internet = Privacy and Security
- Shopping on the high street = Happiness and Efficiency
- Travelling to work on a bus = Safety and Sustainability
- Being interviewed for a job = Efficiency and Confidentiality

3. INTEGRITY received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 824586.

Give learners 5 minutes to come up with a bad idea where they focus all their attention on just one of the obligations and completely sacrifice the other. For example with browsing the internet learners could neglect privacy and focus entirely on security, which would potentially lead to a large invasion of privacy. Ask them to share their ideas.

Then give the same learners 10 minutes to come up with a redesign that gives equal priority to both obligations. Ask them afterwards if anyone can share back and whether or not they felt that this second task was more difficult and why.

Discussion

The obligations learners were assigned are real world examples of ethical or moral values that when upheld are great case studies in responsible innovation. In the past, many organisations disregarded some of these values for prosperity or sacrificed a value of equal importance which resulted in harm to society.

Many organisations are now in the process of reshaping their practices and by upholding values that might seem at odds with each other, it actually forces innovation to meet the needs of society.

This may also lead to a discussion on who makes these decisions and who gets to be involved in developing ethical and moral codes, and who should be present in making these decisions now in our society.

Part 2: Walking Debate

To bring learners further into the complexity of research ethics, this activity will present them with research situations for them to judge. Ask learners to form a single file line in the classroom, preferably with backs to one wall. The leftmost end of the line will represent a position of strongly disagree, while the rightmost end of the line will represent a position of strongly agree.

For the following statements learners can reposition themselves depending on how they agree or disagree with them. Also if someone is unsure or does not feel strongly either way they can put themselves in the middle.

Warm up statements – these should be used to demonstrate how the activity works before diving into content:

'Pineapple should never go on pizza'

Or

'Cats are better than dogs'

Moving on from this warm up, present learners with three or four of the following statements:

Space Ethics:

- Space tourism should be banned
- Mining asteroids for rare Earth metals like platinum should remain legal
- It is ethically acceptable to create artworks in space
- Humans should have a 'leave no trace' policy for planetary exploration
- If we find life on another planet it is ethically acceptable to take it back to Earth for research
- Human colonisation on other planets is unethical

- It is unethical to allow using sacred land to build telescopes on

Animal Experimentation:

- Animal experimentation is acceptable for producing cosmetics
- Animal experimentation is acceptable to produce drugs that treat human illnesses
- Animal experimentation is acceptable when it's carried out in space e.g. sending animals to space
- It is more acceptable when the animal is perceived to be
- Less 'intelligent' or very small (e.g. a fruit fly instead of a mouse)

Each time learners have chosen their positions on an issue, ask for shareback from different parts of the agreement spectrum. As a final reflection for this part, ask if any measures could be taken to change their opinion on any of the statements.

For example: for animal experimentation in space would it make a difference if one of the crew was an independent monitor for animal welfare? For animal experimentation on Earth, would it make a difference if the animal was old and only had a certain short time to live?

Note: *On page 48, more questions on different topics for the Walking Debate activity can be found.*

Part 3: AI Popstar

In the previous section learners were introduced to lines of research and innovation that are either taking place right now or have been considered. For this last activity learners will be introduced via the slides to something that blurs the line between science fact and science fiction in the arts and culture space.

3.1 Miquela the AI popstar

By giving learners as little introduction as possible, show them the video clip found in the slides (02:28-02:42) of Miquaela performing in her music video. Ask if there was anything unusual about the Performance?

Hopefully most learners will recognise that the performer is completely animated. This is not unheard of as performers sometimes have animated avatars such as the band Gorillaz.

Again with little introduction say that they are going to see an interview with the performer. Play the interview video clip (01:45 to 02:31).

Ask learners what they thought of what they just saw and heard. In the video the interviewer appears to be interviewing Miquela live. It is revealed in that interview that she is an Artificial Intelligence programmed to believe that she is a real person.

Depending on how lively the conversation with learners is, you may want to pose the following questions:

- Is Miquela's AI music as 'real' as a humans?
- If Miquela was programmed by someone, who should be credited with her performances?
- Is this interview a performance in itself? Do you think she was really there? Do you think she as an AI really believes she is a person – is that level of technology (self-awareness) possible yet?
- If Miquela was all CGI, the dialogue scripted and recorded by a voice artist, the songs written by a human and sung by a human artist – what is Miquela? Why pretend that all of this is real and share it with people?

There are not necessarily right or wrong answers here, the media at large are still trying to confirm details around the nature of the performance/ performer and the company behind them. It seems that there is little if any direct evidence that Miquela is anything beyond a digital character with no mind of their own and fully scripted/ animated.

Background information

The company pulling the strings *(Brud)* has received significant investment as Miquela is a popular online celebrity with lucrative sponsorship deals and more. Many have voiced concern over a company using a fabricated character with a false narrative to create a money spinner that takes advantage of race, gender and age representation. Others see this as a way of coming to terms with moral dilemmas around AI, citizenship and copyright before they really do become issues.

3.2 Design your own AI popstar

To conclude, ask learners to design their own AI popstar. This can be done on paper or using an online platform such as Google *Jamboard*.

They should include the name of their AI popstar, their music genre, background information (gender/ethnicity/etc).

As well as this learners will need to write a short explanation of one of the two speculative headlines (distributed as you choose):

Scandal for ai popstar

Or

Triumph for ai popstar

Ask learners to write a few ideas down explaining a story behind the headline. learners should work in small groups or pairs and have 10 minutes maximum for creating their AI popstar and explaining the headline they are given. The session can end with a final shareback of learners' creations and final thoughts from the group.

Conclusion

Through teasing out positive and negative storylines associated with this new technology we can further understand ethical and moral issues, what learners perceive as 'good' or bad' and what influences these decisions, imagining how these questions and dilemmas might evolve in an imaginative technological future that we aim to shape and predict.

FURTHER READING:

- Ethical Innovation Means Giving Society a Say, WIRED, 2017 article

Credits: This workshop was developed by Trinity College Dublin, OSHub Ireland.

SESSION TITLE

Ideation Session

ACTIVITY IN A SENTENCE:

This is a series of up to three co-creation sessions designed to collaboratively select a challenge, topic or initial project idea for an Open Schooling project.

DISCIPLINES INVOLVED IN ACTIVITIES:

Design Thinking, Citizenship

RECOMMENDED AGES:

14+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Classroom, informal learning setting, university

LEARNING OUTCOMES:

Learners will:

- Select a challenge topic related to an area of the sustainable development goals
- Decide on a specific challenge to be addressed (who/what/why/where?)
- Develop initial ideas and solutions (sketches for later development)

Active citizenship within the local community will be encouraged, and learners will see the importance of working with different stakeholders, including multiple experts from different disciplines, when working to solve challenges. This feeds directly into the goal of open schooling.

RECOMMENDED EXPERTISE:

There is no specific expertise needed for this session. Participation in design thinking, collaborative work may be of some help.

SDG LINKS:

- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

TIME IT TAKES TO COMPLETE:

Approximately 2 hours 30 minutes

MATERIALS / RESOURCES NEEDED:

- *Presentation slides*
- Google Jamboard templates or printable templates
- Pencils/markers and 1 sheet of A4 paper per learner
- Some A1 or A2 paper and sticky notes (if not using the Google Jamboard option)

CONTENT FOR LEARNERS:

- Presentation – *Activity Handbook: Ideation Sessions*

Note: *Copy the presentation into your own folder before editing.*

Activity

Introduction:

The Ideation Sessions are made up of these three elements:

- **Asking questions to drive the process forward**

  (e.g., Who are the people most affected by this issue in the local area?)

- **Ideating & reaching consensus through design thinking tools**

  (e.g., posting sticky notes of ideas to a graph of positive impact vs feasibility)

- **Ensuring that decisions are leading to useful next steps**

  (e.g., a consensus of Chelsea fans being a problem to be dealt with is a co-creation dead-end, but a theme of soccer/sport/competition can be carried forward)

Most importantly – the learners are the decision makers. Although there will necessarily be some synthesising of ideas with others (you, the open science hub, external societal actors), it should be possible to trace back the leaves (project outputs) to the branch (final concept or challenge) to the trunk (mix of ideas that turns into the final concept) to the roots (learner ideas and input that are the main part of the mix).

Finally, it is important to note that learners are not expected to reach a fully formed project idea by the end of these sessions. The rough sketches of ideas they come up with towards the end of these sessions will feed into the OSHub Accelerator Session and subsequent research phase. More information on these sessions can be found in the *Open Science Hub Ireland Interactive Handbook*.

Part 1: Co-creation Introduction

1.1 A manifesto for co-creation

Co-creation is the act of creating together. It's an approach to design that attempts to actively involve all participants in the process to ensure the result meets their needs and is usable.

Ask learners what they think is important in order to create a good, happy space for collaboration. Learners should write these up using post-it notes, an online whiteboard or on a poster space in the classroom under the title "OUR MANIFESTO FOR COLLABORATION" see Figure 5.2 (a).

Figure 5.1 (a): Example of 'Our Manifesto for Collaboration' Board. Credit: TCD.

1.2 Choosing a goal (Sustainable Development Goals)

To start the challenge decision making process, we have grouped the SDGs into three broad areas: Climate Action, Reduced Inequality and Sustainability. These groupings can be found in the complimentary presentation (Slide 10). The following three questions begin the ideation journey. Responses can be noted physically with sticky notes or digitally on the provided Google Jamboard.

- If you had to choose only one of those broad areas (climate action / reduced inequalities / sustainability) to tackle, which would it be?
- Is there an issue in your local area linked to what you chose?
- Who is worst affected by this issue?

Now take time to open discussion around what learners have contributed including questioning any choices that you feel may not have been made in all seriousness or need more clarification.

Part 2: Decision-making

Learners will now rank these topics generated in Part 1 in terms of positive impact on the community (is there high or low benefit to the community by tackling this problem?) and relevance (is this an urgent or timely issue?). See Figure 5.2(b) for an example of such a graph. As the facilitator, feel free to edit this sorting graph with different axis labels if they are more relevant.

Ask learners to individually copy the map on paper and use it to choose their top preferred topics from the previous step. This ensures that the learners don't follow a herd mentality. Once they've marked their own choices on their own paper, they can fill in a Jamboard or large sheet of paper with their choices so that everyone's opinions are visualised together.

If there is more than one dissimilar topic in the top right section of the graph (high impact and high relevance) open up a brief discussion so that learners can speak about why they chose a particular topic. Finish with a vote to decide the top challenge area to take forward to the next stages.

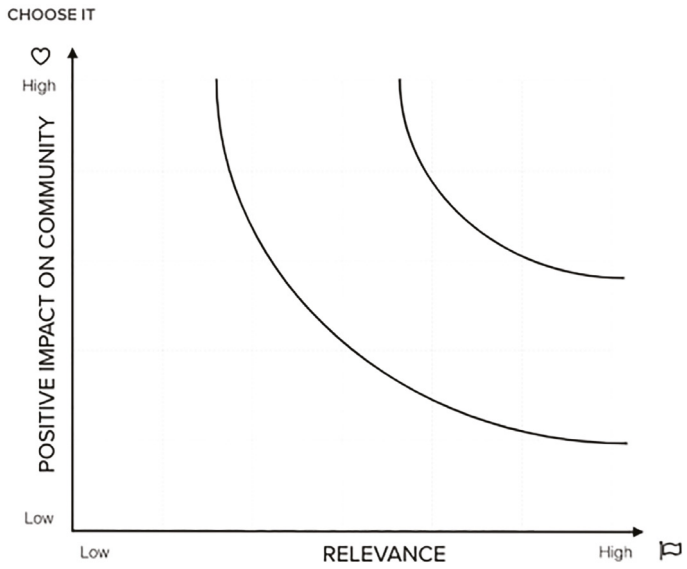


Figure 5.1 (b): Example of sorting graph outlined in Part 2. Axes of the graph can be edited for relevance. Credit: TCD

2.1 Understanding stakeholders

Now that one topic has been decided use the provided Google Jamboard Venn diagram titled 'THINK OF EVERYONE' (see Slide 23) to ask for learners to fill in who they think is affected by the issue and who can affect the issue (e.g. who has influence to make a difference – positive or negative). These may be individuals, communities, organisations, government departments etc. As a facilitator you may want to provide some suggestions to get the ball rolling. When thinking of those affected, think of particular demographics (gender, age, ethnicity etc).

2.2 Idea generation

In the presentation slides use the 'scribbly mess' slide (slide 25) to illustrate that making a prototype is not a straight A to B line. There is a lot of discussion and debating, and new information could change the course of the project later. To this point we only know what challenge we want to tackle, but now we will discuss ways of actually tackling the challenge.

Explain to learners that these next activities could get a bit wild and wonderful. Welcome exploration and creative ideas at this stage.

2.3 Rapid Ideation

Another way we can do this is through a pick and mix of ISSUE + USER + FORMAT.

- Select some of the issues that have already been discussed either in inspiration sessions or the topics voted on previously
- Ask learners to think of various types of users (ability, gender, age)
- Ask learners to provide various formats of art, design, or technology (poster, AR, app etc)
- After randomly grouping an issue with a user and a format, ask learners to take ten minutes to come up with a concept that uses their given combination – a concept in the format provided aimed at the user provided that deals with the issue provided (e.g., water pollution + old-aged pensioners + virtual reality).

Make sure there is enough time to do another round of rapid ideation with a combination given to all groups of: the chosen challenge + a user identified as being affected by the challenge + a format.

This time choose formats from: survey, poster, advertisement, coding, community initiative, prototype, monitoring device, website, artwork, robotics, video. These ideas will be carried forward to the last ideation session for discussion and refinement.

Part 3: Choosing a project

3.1 Idea ranking

Sort ideas by using the grids (impact v creativity and impact v feasibility) provided. Learners should individually copy the graph before adding it to a communal version. This time only the lowest priority ideas (bottom left) should be discarded, if the class is unanimous in agreement. The top ideas (top right) can be banked and brought forward.

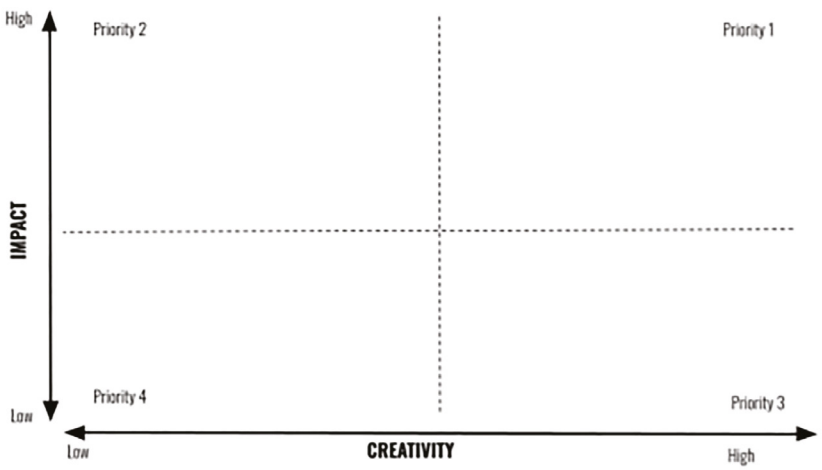


Figure 5.1 (c): Impact vs Creativity grid. Credit: TCD.

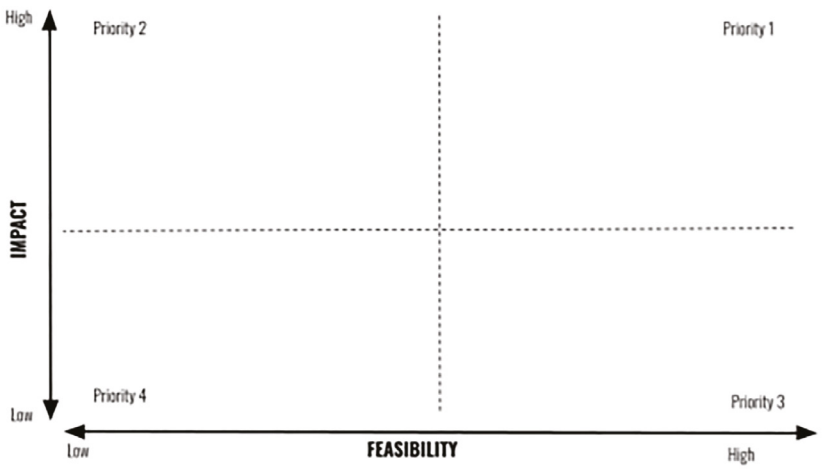


Figure 5.1 (d): Impact vs Feasibility grid. Credit: TCD.

3.2 Problem definition

Using the provided problem definition canvas, go through each of the panels as a group. Talk and walk through each panel, filling in as much information as is possible at this time. Depending on the complexity and existing knowledge of the chosen challenge, this process may take a short time or longer. This will be a living document which can be added to as more research is carried out. Part of the session could be used for learners to do some web research on laptops to gather information for the problem definition canvas.

Credits: This activity was developed by Trinity College Dublin, OSHub Ireland.

5.3 Learner Activities

5.3.1 Any context

SESSION TITLE

Sound of Insects

ACTIVITY IN A SENTENCE:

Through the process of creating a film with sound, learners understand the value of insects within our ecosystem by sharpening their senses for their auditive and visual appearance.

DISCIPLINES INVOLVED IN ACTIVITIES:

Biology, Ecology, Sound, Music, Fine Arts, Film

RECOMMENDED AGES:

7 – 11

LEARNING ENVIRONMENT (CONTEXT SETTING):

Classroom, outdoor area around school, children's homes

LEARNING OUTCOMES:

- Encourages listening to the surrounding sounds
- Learn to abstract sounds and get into a creative process
- Get to know many insects and their anatomy
- Know about the importance of insects for our ecosystem

"Sound of Insects" provides an interdisciplinary approach to this topic by combining biology, music and visual arts. This creative approach makes this important topic accessible and tangible to children on an emotional level. They get a very personal connection through the way they explore it. The concept makes an important contribution to species conservation according to the motto "You can only protect what you love". In order to be able to love something, the knowledge about it and the intensive perception of it are the most important prerequisites.

RECOMMENDED EXPERTISE:

No special expertise is necessary

SDG LINKS:

- **Goal 15:** Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss

TIME IT TAKES TO COMPLETE:

150 – 180 minutes

MATERIALS / RESOURCES NEEDED:

- Everyday objects for sound samples
- A3 paper and drawing utensils
- Smart phone
- Projector

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

The aim of the workshop is to perceive and investigate objects from a certain angle. With a different focus, the workshop could be adapted for older learners. It could, for example, serve as preparation for a product design exercise which has a sound aspect.

Activity

Introduction:

The workshop is targeted at children of ages 7-11 who are still very playful and have a creative approach towards learning. The learners are encouraged to learn more about the role of insects in our ecosystem. In the first part of the workshop, the children get to know several insects by observing and listening to them. In the second part, they draw several insects in order to create a film. In the third part, they try to find sounds of daily objects that are similar to the sound of the drawn insects. Finally, the children compose an audio track with the collected sounds and perform their composition simultaneously with the film.

Part 1

1.1 The World of insects

The learners are introduced to the world of insects. They are encouraged to talk about their knowledge of insects. Give some guidance and suggestions (see Material 1-2).

MATERIAL:

- Listening to insects
    - Download Free Insect Sound Effects | Mixkit
    - Listening to insects
- Watching insects:
    - What's that chirping?

1.2 Talking about insects

- **Which insects do you know?**
    - How many insects were mentioned in total?
- **Why are insects so important for our ecosystem?**
    - Insects help to keep the balance in our ecosystem. They loosen the soil so that plants can survive. They pollinate a wide variety of fruits and vegetables, allowing them to grow.
    - Insects help to create the perfect balance in forest ecosystems by eating fallen leaves and shredding old tree barks. This material becomes soil after a while.

Ask the learners to think of more reasons to protect insects.

- **What can we do to protect insects?**
    - There are several ways to protect insects:
        - Leave areas and margins in the garden where the grass is not cut. Insects can thrive in these areas.
        - Create an insect hotel where insects have a protected area to survive and procreate.
        - Grow wild plants that are not cultured. Insects will more likely visit these plants than cultured plants.
        - Reduce use of insecticides in the garden and for agriculture.

Ask the learners for more suggestions.

- **Do insects have ears?**
    - Yes, they have 'ears' with which they can feel vibrations.
    - For example, the cicada has ears on the abdomen, the cricket on the forelegs, the praying mantis on the belly. Insects feel high and low vibrations like we feel the vibrations of a musical instrument.

Part 2

2.1 Creating an insect film

In the next step each child draws an insect they like. They can use one of the insects mentioned in the

workshop already or they could find inspiration and pictures in biology books or on the internet. The pictures can be drawn with ink, coloured pencils or crayon.

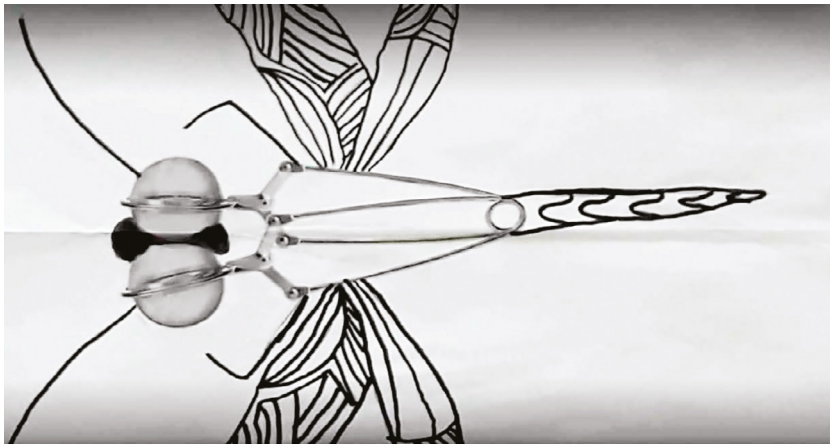


Figure 5.2: Example of an insect drawing, assisted by the use of household objects. Credit: VS Abtenau.

Afterwards the children stick the drawings together on the back with tape so that all the pictures become a film strip.

Figure 5.3: Example of an insect drawing, assisted by the use of household objects. Credit: VS Abtenau.

With your help, the children now produce the film: one person points the smartphone steadily at the floor where the film strip is located. When the recording team gives a sign, two children pull the film strip under the camera so that the pictures are slowly moved – 3-4 seconds for every picture; total length 2-3 minutes.

Part 3

3.1 Discovering insect sounds

The learners are encouraged to find and collect daily objects that make the following sounds: buzzing, rattling, chattering, humming, scratching, cracking.

They can also imitate sounds from nature: wind, water, rustling of leaves etc.

Give advice on how to find these objects. A kitchen or a garage can be a wonderful place of inspiration to discover sounds. Tools from the classroom such as a ruler or pencil are possible instruments. Tools from the arts and crafts room can be especially suitable. Possible objects could be a kitchen grater, sandpaper, ripped paper, a measuring tape, a file, a plastic bag, water etc. Materials from nature like leaves, branches or stones can also be used.

Maybe the learners can also make insect sounds with their voice. Children often have great ideas themselves to find suitable sounds.

The workshop can be linked to other subjects like arts, crafts and biology.

3.2 Composing an insect piece

First, the learners sit in a circle and present their sound ideas in turn. Next, they compose an insect piece out of the collected sounds (around 2-3 minutes, depending on the length of the film). Encourage them to differentiate between long and short sounds.

With your help, the learners now find out how to structure the sounds. Some "instruments" which make long sounds can be used as a permanent sound layer during a long part of the piece (like wind or water) while others can produce short sounds like insects do in a certain rhythmical structure. Short sounds can be repeated in a pattern. The class may decide that one pattern will be repeated four times during the piece, the other pattern maybe five times (see Figure 9 below).

Now decide which sounds fit together well. It is important to discuss when to play soft sounds so that they are not "overrun" by very strong sounds.

The learners can draw a draft of the composition if necessary (see Figure 9 below). After some rehearsals the composition can be recorded. The learners listen to the recording and discuss if they want to change anything.

Part 4

4.1 Presenting the film with live sound

The film will now be presented on a screen while the children are playing the composition as a live performance.

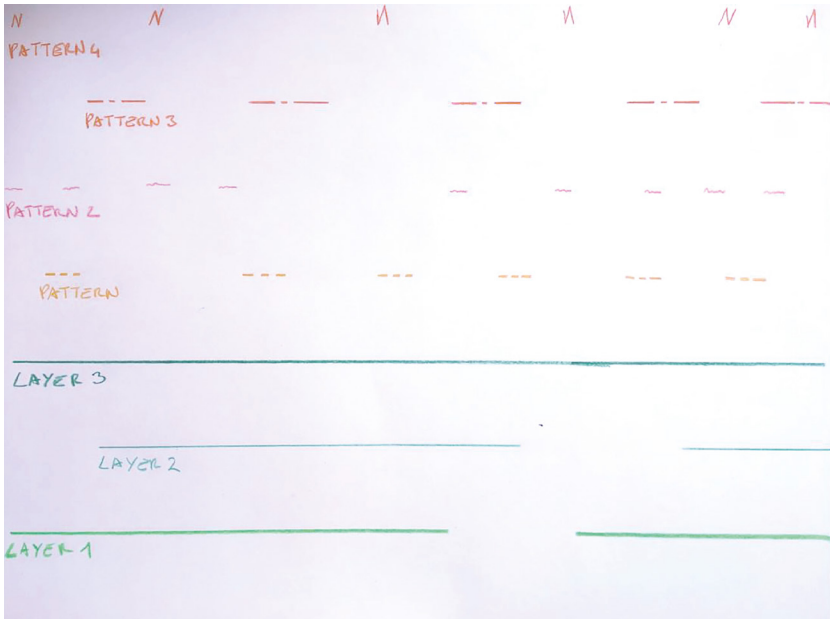


Figure 5.4: A composition of sound patterns.Credit: Veronika Groissberger.

Credits: This workshop was provided by Ars Electronica, OSHub Austria.

SESSION TITLE

Ethics Walking Debate Workshop

ACTIVITY IN A SENTENCE:

The goal of this workshop is to provide an open and supportive space in which learners can voice their opinions and insights on societal topics that often pose challenging ethical questions.

DISCIPLINES INVOLVED IN ACTIVITIES:

Science, Art, Culture, Religion, Diversity, Equity

RECOMMENDED AGES:

14+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Open space (if classroom, then move tables and chairs to the side)

LEARNING OUTCOMES:

- Able to reflect on ethics in decision making
- Understanding the difference between inspiration and plagiarism
- Recognising unethical research practices
- Able to participate in ethical debates and discussions

RECOMMENDED EXPERTISE:

Preferably learners would have worked with facilitators prior to carrying out this workshop. Facilitators should also be sensitive to cultural, social and religious differences amongst the group.

SDG LINKS:

- **Goal 11:** Make cities and human settlements inclusive, safe, resilient and sustainable
- **Goal 16:** Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

TIME IT TAKES TO COMPLETE:

60 – 90 minutes

MATERIALS / RESOURCES NEEDED:

- Open space
- List of questions (provided)

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

Questions may be modified to suit other age groups, however please consider questions that are age appropriate.

Activity

Introduction:

The goal of this workshop is to provide an open and supportive space in which learners can voice their opinions and insights. This workshop is usually held at the end of a week with facilitators when the learners are most comfortable with each other and the facilitators.

The facilitators should use their discretion as to what questions should be posed, below is a list of questions that have worked well in the past but every group is different.

When a question is posed learners are invited to move to either side of the room. One side is "Strongly agree" the other side is "Strongly disagree". learners can stand anywhere on the spectrum.

Part 1: Delivery

1.1 Room setup

Move all tables and chairs to the side of the room. This workshop works best when learners can move across the length of the room.

1.2 Introduce workshops

Ask learners what they know about ethics.

Explain to learners that they are going to be asked questions and are welcome to give their opinions. The questions don't necessarily have a right answer and every perspective is welcome and valued. The questions cover ethics across both science and art.

1.3 Ground rules

Before any questions are posed to the learners, facilitators should reiterate that learners are expected to be kind, respectful and listen when others are talking. Facilitators need to be especially sensitive to cultural, social and religious differences amongst the group.

Part 2: Questions

Here is a list of questions we have asked. Not all of these questions have to be asked, omit or add questions depending on your group. Some learners might not be familiar with all of the concepts so be sure to explain the question.

Intro Questions:

- **Pineapple or pizza?**
- **Cats or dogs?**
- **Coke or Pepsi?**

Science Questions:

- **Should vaccines be mandatory?**
  - Herd immunity is a form of indirect protection from infectious disease that occurs when a large percentage of a population has become immune
  - Should it be mandatory for some vaccines, but not all vaccines?
  - What should happen if someone refuses to get a vaccine? Should it be a criminal offence?
  - Is bodily autonomy a priority?
  - A nanny state is when the government or its policies are overprotective or interfering unduly with personal choice.
  - Do you think people would feel social pressure to get the vaccine anyway?
  - Should unvaccinated children be allowed into schools, etc.

- **Should parents be allowed to pierce their baby's ears?**
  - Should parents always be able to make decisions about their baby's body?
  - Are we sexualising young girls by adorning them in jewellery?
  - A child can just take it out when they get older?
  - Is it important to follow traditions and culture?

- **Should parents have the right to circumcise their children for non-medical reasons?**
  - If it is part of religion or culture does that always make it ok?
  - Should parents be able to make permanent changes to the body?
  - Should it be more regulated?
  - Should spiritual leaders need medical training?
  - No procedure is guaranteed safe, so should we take the risk?

- **What about for female circumcision/Female genital mutilation?**
  - If it is part of religion or culture does that always make it ok?
  - If it is hard to give birth, it is dangerous for the woman?
  - It is still wrong if it is not dangerous but affects you sexually?

- **Are zoos unethical?**
  - Are Zoos important for conservation or are there alternatives?
  - Is it safer?
  - Is it ok to profit monetarily from animals?
  - Is it ok to keep non-native species in Ireland?
  - How do we regulate zoos to keep them accountable?

- **Is it ethical to use animals for research and testing?**
  - Is it ok to research and test for cosmetics?
  - When we research and test for medical reasons is it ok?
  - Is human life more important than animal life?
  - Is it problematic that animals can't consent?
  - Can humans really consent when there is a monetary incentive? Eg. does this encourages people in low economic positions to participate in a potentially dangerous situation

- **Should we be genetically testing or altering embryos?**
  - If we can alter an embryo to not have a chronic or painful illness should we?
  - Is it ok to make changes to achieve preferable qualities? Eg. Eye color, beauty, strength, intelligence.
  - What characteristics should be allowed to be altered?
  - Could this cause population issues? Eg. sustaining longer lifespans.
  - If wealthy people can afford genetic modification, would there be drastic genetic differences between the wealthy and the rest of the population?

- **Should we allow euthanasia/ assisted suicide?**
  - Should people have the right to end their life because of their physical health?
  - Should people have the right to end their life because of their mental health?
  - Should it be criminalised?
  - How could we regulate it so it won't be abused?

Art Questions:

Note that most bullet points below contain background information on the piece under discussion, not further questions such as in the previous section.

- **Is Santiago Sierra's piece, 160 cm Line Tattooed on 4 People, ethical?**
  - 160 cm Line Tattooed on 4 People (2000).
  - 'Four prostitutes addicted to heroin were hired for the price of a shot of heroin to give their consent to be tattooed. Normally they charge 2,000 or 3,000 pesetas, between 15 and 17 dollars, for fellatio, while the price of a shot of heroin is around 12,000 pesetas, about 67 dollars.' – Santiago Sierra.
  - His works highlight the exploitation of human labour taking place in systems of economic exchange.
  - Sierra focuses on those sections of the community who are most exploited and yet who remain least 'visible' in official terms: illegal immigrants, asylum seekers, prostitutes, drug addicts and the urban poor, unemployed and homeless.

- **Does Marina Abramovic's piece, Rhythm 0, raise any ethical concerns?**
  - Rhythm 0 (1974).
  - Her instructions were placed on the table:
  - There are 72 objects on the table that one can use on me as desired. Performance. I am the object. During this period I take full responsibility. Duration: 6 hours (8 pm – 2 am).
  - These included a rose, feather, perfume, honey, bread, grapes, wine, scissors, a scalpel, nails, a metal bar, and a gun loaded with one bullet.

- **Was the United Colours of Benetton advertising campaign, La pieta, ethical?**
  - La pieta (1991).
  - The photo of AIDS activist David Kirby was taken in his room in the Ohio State University Hospital in May 1990.
  - Benetton approached the photographer and Kirby family, gaining consent for the use of the photograph and contributing to an acquired immunodeficiency syndrome (AIDS) foundation.
  - In 2003 the photo was included in the Life magazine collection '100 Photos that changed the world'.
  - A number of AIDS activists believed that the photograph and its use in advertising actually painted AIDS victims in a negative light, spreading fear rather than acceptance. Others perceived the campaign as a vindication of homosexuality.
  - The visual similarity between David Kirby and Jesus.

- **Was it unethical to photograph the girl in "the vulture and the little girl"?**
  - The vulture and the little girl (1993).
  - The photo was taken during the Sudanese famine, it was published in the New York Times in 1993. Some people said that Kevin Carter, the photojournalist who took this photo, was inhumane and profiting from the child's suffering.
  - The child was reported to be attempting to reach a United Nations feeding centre about a half mile away.
  - Would it be unethical for him not to photograph this? Then how would we have a record of this to help us stop it happening again?
  - Carter won the Pulitzer Prize for the photo.
  - Carter took his own life in 1994.

- **Should ORLAN be able to physically manipulate her body for art?**
  - ORLAN is a contemporary French artist known for the radical act of changing her appearance with plastic surgery in the name of art, she is the first artist to use plastic surgery as part of her arts practice.
  - "I have been the first artist to use aesthetic surgery in another context—not to appear younger or better according to the designated pattern. I wanted to disrupt the standards of beauty"
  - Should doctors perform procedures like this?
  - Is cosmetic surgery generally ethical?
  - *https://www.irishtimes.com/life-and-style/bones-of-contention-1.736882* – Seamos Nolan dog art

Credits: This activity was developed by Trinity College Dublin, OSHub Ireland.

5.3.2 Context specific (Fab Lab / Makerspace / Workshop)

SESSION TITLE

MAKE YOUR OWN KITE

ACTIVITY IN A SENTENCE:

Discover air and its properties and learn how to make your own kite with recycled materials and tools in a Fab Lab.

DISCIPLINES INVOLVED IN ACTIVITIES:

Physics, Technology, Tinkering

RECOMMENDED AGES:

9+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Fab Lab / Third place

LEARNING OUTCOMES:

- Understand how a kite can fly
- Understand the role of air in human life
- Arouse wonder and curiosity to discover the world of kites
- Learn to stay focused on an activity
- Acquire tinkering skills in a Fab Lab and learn to use tools
- Develop creativity

RECOMMENDED EXPERTISE:

Facilitators will have experience in Fab Lab tinkering activities and will need to know how to use a sewing machine and a 3D printer.

SDG LINKS:

- **Goal 12:** Ensure sustainable consumption and production patterns

TIME IT TAKES TO COMPLETE:

Two sessions of 3 hours

MATERIALS / RESOURCES NEEDED:

- Wood sticks
- Scraps of fabric (polyester or nylon fabric is best)
- Material for decorating like sticker
- 5mm strips of wood
- Kite string
- Scissors
- Markers
- Connectors (may be printed using 3d printer, see content for learners)
- Sewing machine and if possible a vinyl cutter
- Handles for the kite string can be cut in advance or during the workshop using a laser cutter or a saw

CONTENT FOR LEARNERS:

Resources may be found *here*, including instruction for the prototype connector to be created with a 3D printer [French].

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

The workshops targets children of 9 years and older because of the need to handle tools. Therefore scaling down to reach a younger age group is not advised.

Activity

Introduction:
First session (180 min)

Part 1: Welcome (20 min)

Welcome the children to the workshop room and talk to them about what a Fab Lab is. Give a quick tour of the Fab Lab space and show how the 3D printer, vinyl cutter and laser cutter work (cut a handle and print a connector).

Establishing the children's pre-existing knowledge (10min)

Arouse the children's curiosity about air through questioning. This will help to identify their level of knowledge.

Some questions to ask:

- What is wind?
- Are wind and air the same thing?
- Can we touch the wind?
- Can we see the wind?
- Can we make wind?
- What objects can fly? How does technology mimic nature eg. planes vs birds?
- What everyday experiences allow us to perceive the existence of wind? What experiments can be done? What objects can be made?
- Air is everywhere around us. How can we notice it? How can we make it obvious?
- When the wind blows: Is it windy? How do you know?
- Is air important for human beings? Why is it important?

Part 2: Building a paper plane (10 min)

Carry out small experiments to introduce the subject and ask the children about it.

Make a paper plane fly. Ask questions: Why can the paper plane fly? What is the difference between air and wind? Let the pupils participate actively.

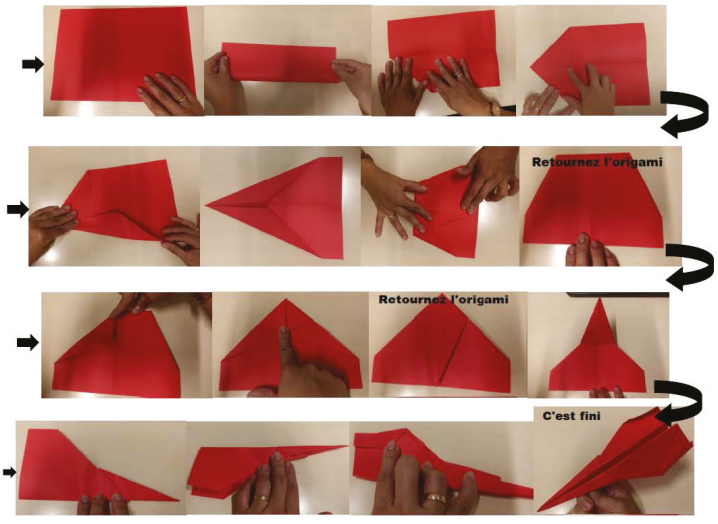


Figure 5.5: Step-by-step guide on how to build a paper aeroplane. Credit: CCSTI.

It is also possible to carry out other experiments with air:

- Inflate and deflate a balloon
- Make a small parachute out of a plastic bag

Part 3: Making a diamond kite (140 min)

Each child should have a kit with the following materials:

- A connector (3D printing instructions provided)
- A piece of fabric to make the canopy (preferably nylon or polyester)
- Two sticks or rods, preferably 105cm in length
- Kite handle
- String

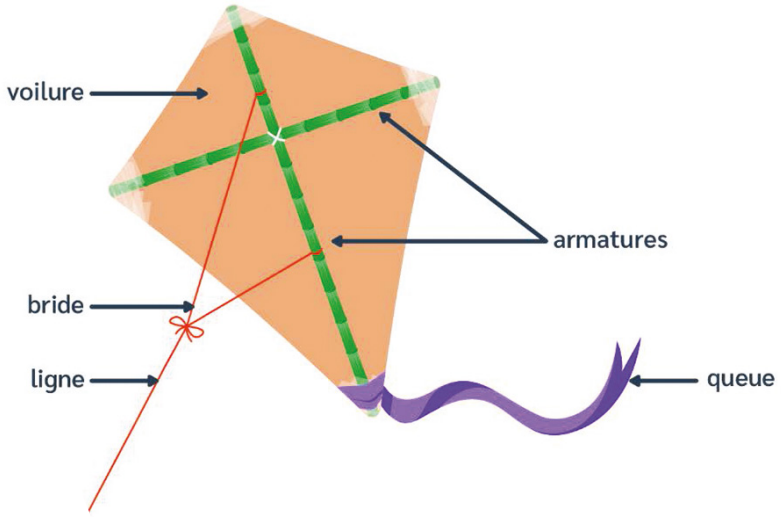


Figure 5.6: Components of a kite. Credit: CCSTI.

3.1 Crossing the two rods perpendicularly

Each rod is 105cm long. The crossing should be done as shown in the diagram: 1/5th of the vertical rod from the top (25cm) and 1/2 of the horizontal rond (52,5cm).

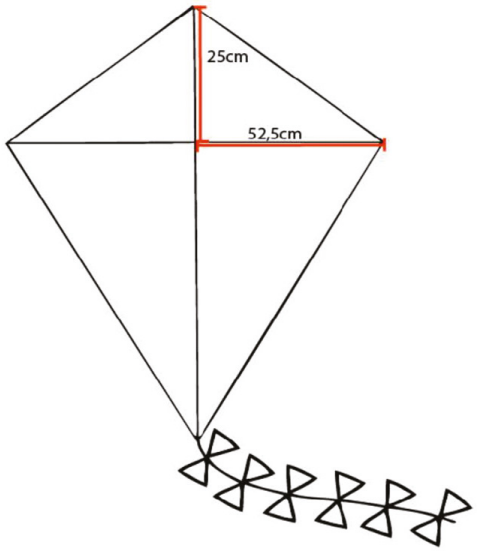


Figure 5.7: Location of rod crossings. Credit: CCSTI.

3.2 Creating the sail

The fabric for the sail should be cut to the size of the sticks and in the shape of a diamond. To help the children cut the sail to the correct size, you can prepare a cardboard model in advance.

Figure 5.8: Creating the sail. Credit: CCSTI.

3.3 Sewing the canopy and making the decoration

Divide the group in two. The first group will use the sewing machine to hem the canopy while the second group will make the decoration for the kite. It may be possible to make decorations with predefined images and the vinyl cutter.

Second session (180 min)

Part 1: Feedback (20 min)

Welcome the children and ask for feedback on what was covered in the first session. Recall scientific knowledge if necessary.

Part 2: Completing a diamond kite (160 min)

2.1 Making the tail and the handle (80 min)

Divide the children into three teams.

First team: Cut four pieces of fabric (6cm x 3cm) and make a braid in each corner of the canopy using the sewing machine.

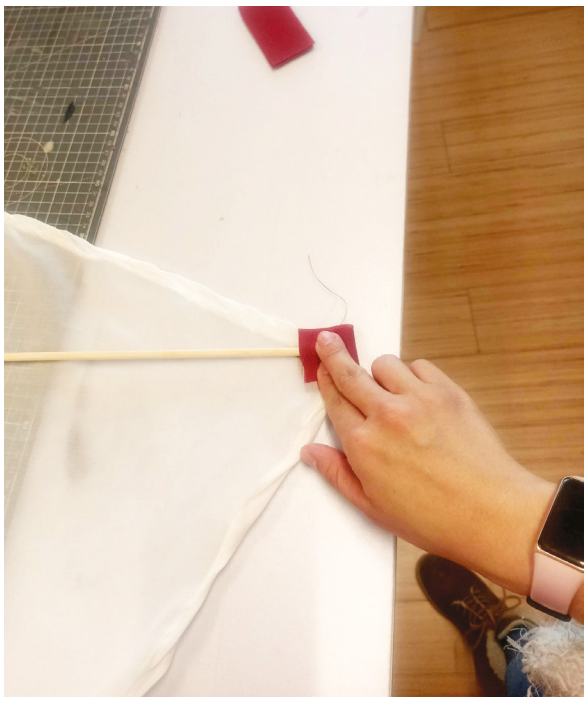


Figure 5.9: Creating the braids. Credit: CCSTI.

Second team: Build the tail of the kite from plastic bags or fabric scraps. The tail should be long and light enough to provide a stabilising swing, about 150cm.

Third team: Wrap the string around the handle to create a coil.

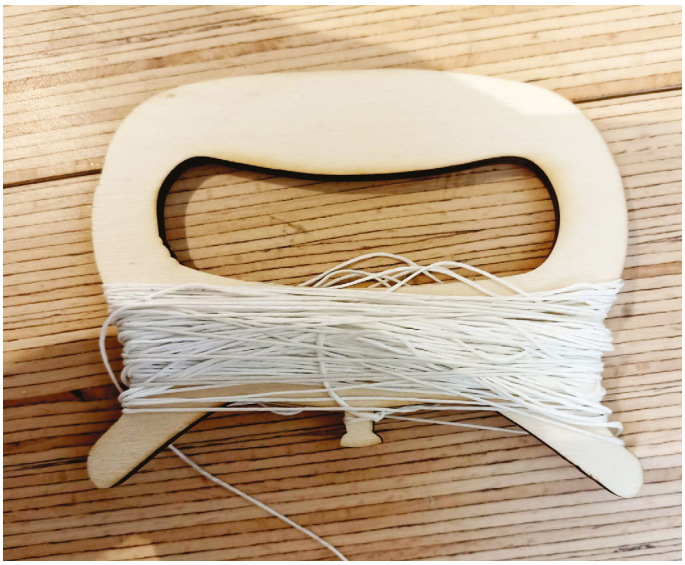


Figure 5.10: A handle with coiled string. Credit: CCSTI.

When each team has finished its work, swap groups.

2.2 Making the bridle and tying the tail (80min)

The children will now make the bridle for the kite. The bridle is an arrangement of strings that hold the kite at a specific angle while it is flying. Following the diagram below, the strings are attached to the kite at points A and B. The strings are then brought together and attached to the handle at C.

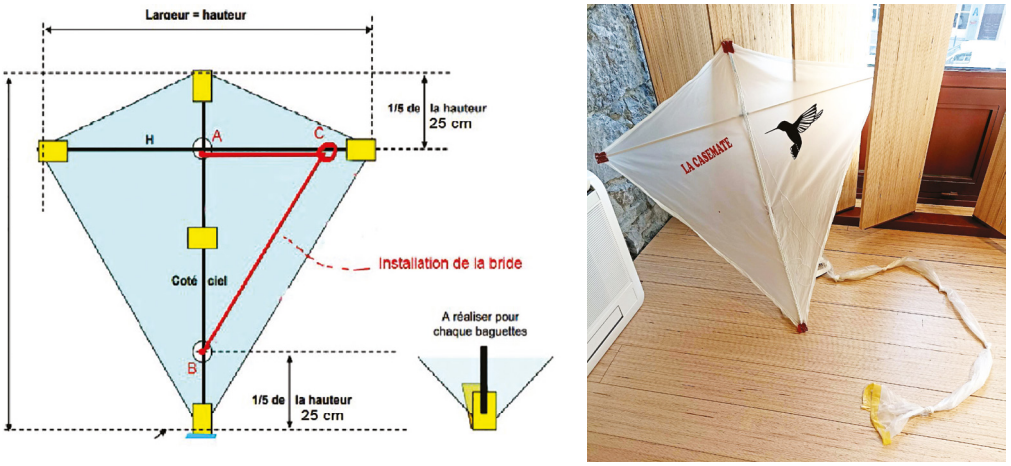


Figure 5.11: (Left) Schematics of the kite and (Right) a finished kite. Credit: CCSTI.

Finally, go out to test the kite!

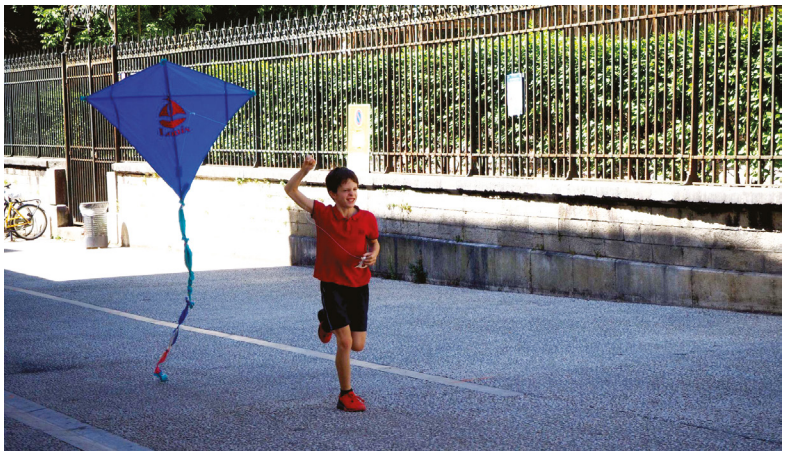


Figure 5.12: A child flying a kite. Credit: CCSTI.

Conclusion

This workshop will provide young people with an introduction to air and its properties, allowing them to learn how to make an object using DIY tools and to discover the machines in the Fab Lab: laser cutter, vinyl cutter, 3D printer, sewing machine.

Credits: This activity was developed by Fab Lab at Centre de Culture Scientifique Technique et Industrielle de Grenoble, La Casemate (OSHub France).

SESSION TITLE

Building a CO_2 sensor

ACTIVITY IN A SENTENCE:

Assemble a CO_2 sensor and understand why the measure of CO_2 is important on a local and global scale.

DISCIPLINES INVOLVED IN ACTIVITIES:

Physics, Biology, Environmental Science

RECOMMENDED AGES:

14+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Makerspace, class, outdoor, university

LEARNING OUTCOMES:

- Learn about basic electronic circuits
- Collect and interpret data (understand variables, draw graphs)
- Understand the role CO_2 plays in human physiology and climate change

The topic was chosen by teachers and learners during a session about the most concerning issues on both local and global scales. Climate change and the pandemic scored the highest among the learners of our group. It was then decided to build CO_2 sensors to be distributed in the classrooms to know when to aerate, and to measure the emission of CO_2 in different contexts. In parallel, university researchers were invited to present their research related to CO_2 in climate change. A local company awarded the learners water bottles that were produced during an awareness campaign about climate change. Finally, the project and results were presented to the general public at the Natural History Museum of Geneva.

RECOMMENDED EXPERTISE:

Basic electronics and soldering

SDG LINKS:

- **Goal 3:** Ensure healthy lives and promote well-being for all at all ages
- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- **Goal 13:** Take urgent action to combat climate change and its impacts

TIME IT TAKES TO COMPLETE:

- Co-creation session: 1.5 – 2 hours
- Assembling: 1.5 – 7.5 hours based on the level of explanation of different components and use of machines for the sensor case (plastic and wood)
- Installing the sensors and measuring: 2 – 4 hours
- Interpretation of the data: 2 hours
- Session with the experts: 1.5 – 2 hours x 2
- Preparation of the mini-expo: 2-6 hours
- Mini-expo: 6 hours
- Evaluation: 2 – 4 hours

MATERIALS / RESOURCES NEEDED:

- CO_2 sensor MH-Z19B
- Microcontroller Arduino Nano (with USB cable)
- Light Emitting Diode (LED) display 7 segments TM1637
- 12 jumper cables female-female
- Heat shrink tubes
- 40g PLA for 3D printing
- 3 LED (red, green, yellow)
- 50x50x3mm plywood
- 3D printer
- Laser cutter
- Computer
- Soldering irons

CONTENT FOR LEARNERS:

Wiki converts the instructions into a *printable PDF* [French]

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

The activity can be adapted to younger audiences by not explaining the function of each component and avoiding the analysis of the data.

The activity can be adapted to learners of electronics or informatics by programming the Arduino to show messages on the display based on the "live" measurements.

Activity

Introduction: Co-creation

- Start the activity with a presentation about Open Schooling. Use examples of local issues that are tackled with smart solutions developed by the youth and citizens. Show examples of technology for sustainability.
- Divide the class in smaller groups and distribute cards with a list of issues (traffic, climate change, etc). Ask the group to rank them from the most concerning to the least and to add one more issue specific to their community. Let the learners justify their choice and find a consensus to select the topic to work on.
- Once the topic has been chosen, you can decide to propose an idea (more or less defined) or facilitate a second session to come up with a technological solution.

(In our case the chosen topics were Covid-19 and climate change and we proposed to build CO_2 sensors)

Part 1: Assembling

Below is a step-by-step guide on how to assemble the CO_2 sensors. More photos and detailed instructions are available in the link below, however instructions are in French. *(Drawing files and instructions (in French))*

1. **Make the box.** To mount the sensor, you will need to download and then print the 3 elements of the box. One face has to be laser cut and the box 3D printed. See 'Step 2' in the linked instruction manual for 3D printing files [French].

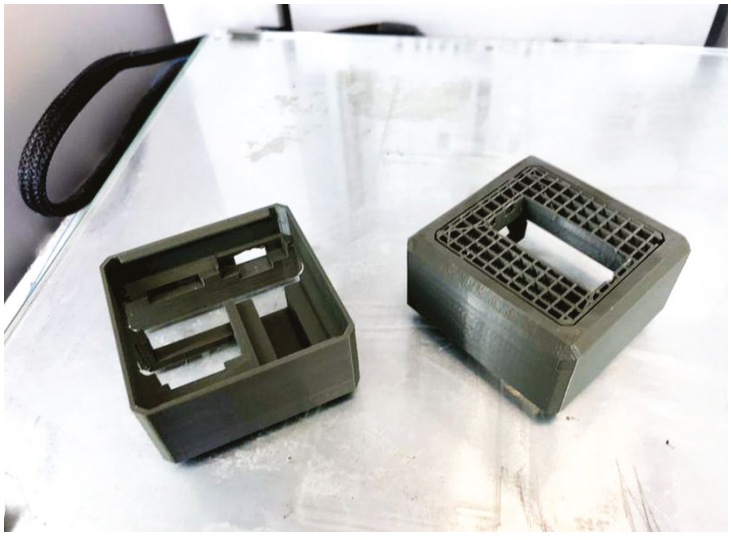


Figure 5.13: 3D printed sensor box. Credit: FAB.

2. **Place the electronics in the box.**

3. **Wiring.** Since the Arduino has a 5V output, you will need to prepare Y wires, with female-female jumper cables wire to power both components. Solder the wires and protect them with heat shrink tubes.

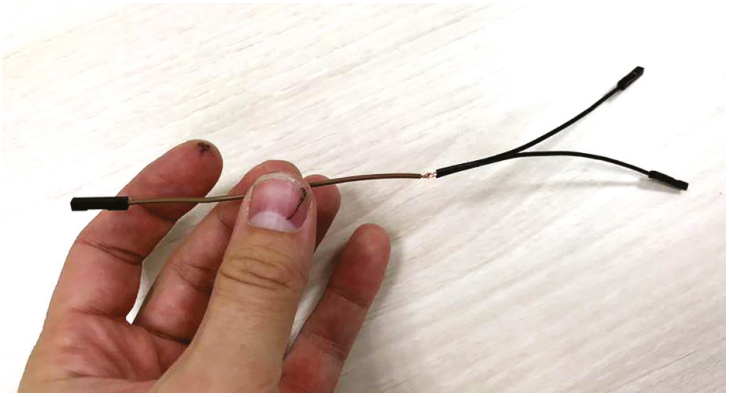


Figure 5.14: Prepared Y wires. Credit: FAB.

4. **Mounting the LED.** Solder the 3 cathodes of the LEDs and solder a 680 Ohm resistor to the anode.

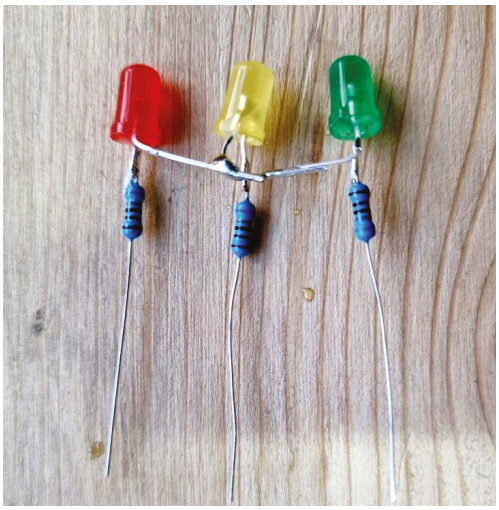


Figure 5.15: Soldered LEDs and Ohm resistors. Credit: FAB.

5. **Make the connections.** Follow the plan to connect Pins:

- Pin D11 (Arduino) > Pin RX (CO_2 sensor)
- Pin D10 (Arduino) > Pin TX (CO_2 sensor)
- Pin D4 (Arduino) > Pin CLK (7 sec display)
- Pin D5 (Arduino) > Pin DIO (7 sec display)
- Pin D6 (Arduino) > + side of the red LED
- Pin D7 (Arduino) > + side of the yellow LED
- Pin D8 (Arduino) > + side of green LED
- Pin 5v (Arduino) > Pin V+ (CO_2 sensor), Pin Vcc (7 sec display)
- Pin GND (Arduino) > Pin V – (CO_2 sensor), Pin Gnd (7 sec display)

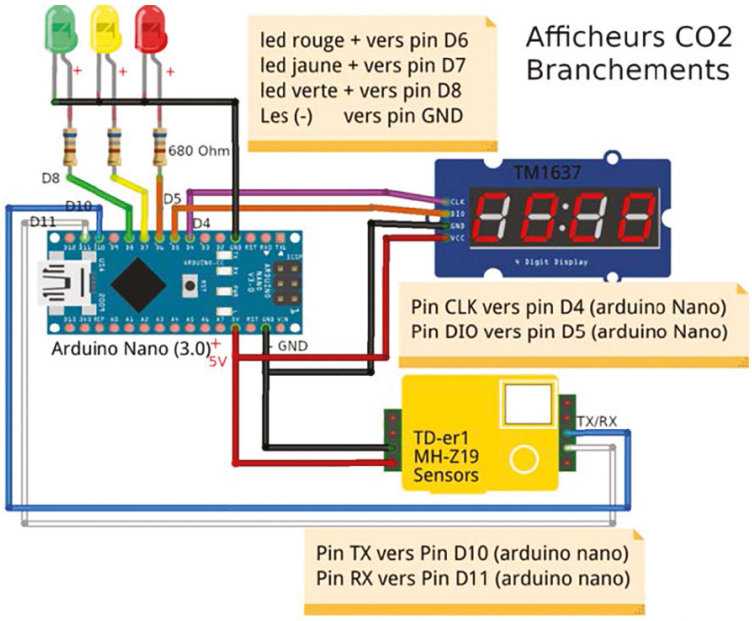


Figure 5.16: Overview of connections [French]. Credit: FAB.

6. Close the box.

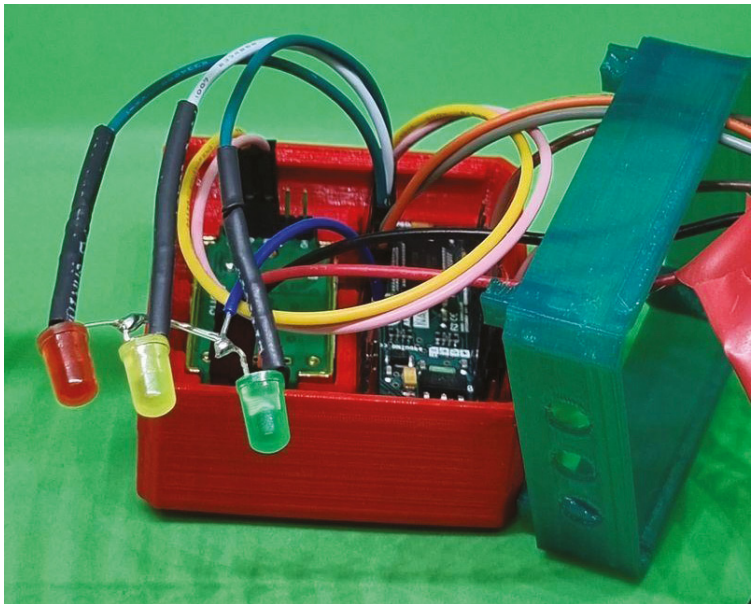


Figure 5.17: Inside the box before closure. Credit: FAB.

7. Download the Arduino code. Connect the sensor to your computer with a USB cable. Copy the code made available in the documentation then, with the Arduino software, upload it to the Arduino Nano. Once uploaded, the sensor should work properly and display the live CO_2 level on the display.

Figure 5.18: Finalised sensor showing CO_2 level. Credit: FAB.

8. **Save measurements to a csv file.** When the box is connected to a PC, the python script datalogger.py allows you to save the readings in a log_CO2.csv file which will contain the time and the CO_2 level in PPM. You can then open it in a spreadsheet to view and analyse the results. Remember to modify the script to adapt it to the serial port to read the data (for example ‚/dev/ttyUSB0' for Linux and ‚COM0' for Windows).

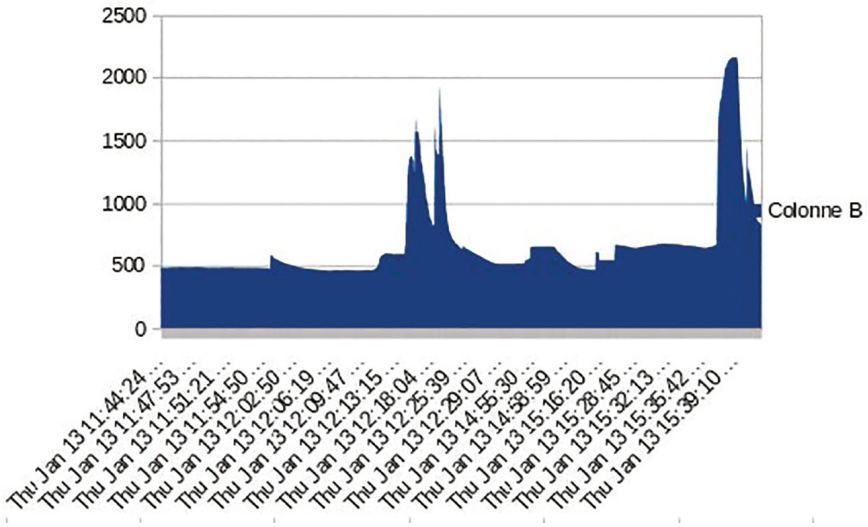


Figure 5.19: CO_2 level measurements taken from sensor. Credit: FAB.

Part 2: Measuring

Install the sensors and take measurements in different conditions to compare results.

Examples: indoor, outdoor, before and after opening a window, next to a flame, close to the mouth, etc.

Part 3: Researchers

Invite researchers and experts to present the scientific research related to the chosen topic (such as a researcher in climate change, or a doctor, nurse or expert in health issues. They can be invited at the beginning of the project (to help set the scientific objectives), in the middle (to advise and exchange) or at the end (to allow learners to first master the topic so they can ask meaningful questions)

Part 4: Presentation

Prepare posters and an interactive stand to present the project to the other school learners or to the general public. It's important to show the whole process, not only the sensor.

Part 5: Evaluation

Use the zines at the beginning and during the project to help learners reflect on the bigger picture related to the measurement of CO_2 .

Credits: The sensor was designed by Tony Vanpoucke l'Edulab – Université Rennes 2, and modified for this activity by Onl'Fait Makerspace, OSHub Switzerland.

SESSION TITLE

Raspberry Pi Gaming Console

ACTIVITY IN A SENTENCE:

Creating a gaming console with retro games by using open source technologies.

DISCIPLINES INVOLVED IN ACTIVITIES:

ICT, Coding, Engineering

RECOMMENDED AGES:

12 – 18

LEARNING ENVIRONMENT (CONTEXT SETTING):

Ideally the activity is run in a Makers lab – IT lab. However, it can also be carried out in an ordinary classroom with just the essentials needed (see Resources Needed).

LEARNING OUTCOMES:

- Internet researching
- Setting up and use of raspberry pi
- Introduction to coding
- Trial and error method

RECOMMENDED EXPERTISE:

IT teacher with Open Schooling knowledge.

SDG LINKS:

- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- **Goal 17:** Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

TIME IT TAKES TO COMPLETE:

4 hours

MATERIALS / RESOURCES NEEDED:

- Raspberry pi
- SD card, Computer
- MicroSD card reader (a method to connect your SD card to your computer or laptop)
- Internet connection
- Screen (to connect the raspberry pi)
- Game controller of your choice (keyboard also works)

CONTENT FOR LEARNERS:

Detailed instructions can be found *here*.

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

For younger learners, the necessary files could be already loaded into the SD card.

Activity

Introduction:

Create a gaming console by using open technologies with the use of Raspberry pis.

This activity is an easy, introductory activity that learners can work on with the correct technologies. *The raspberry – pi platform* includes many ideas and teaching material for open source community projects and can be combined with *the arduino space* for more complex and automated issues.

Within Open Schooling, students need to be introduced to the basics of these tools, a process which can take from a few hours to many weeks and can then implement their knowledge and creativity in a vast range of different projects, using science and technology to solve local issues.

Part 1

1. Download the necessary files (OS) on your computer from *RetroPie*, depending on your raspberry pi version.
2. Then, you have to download a program to import the files to the raspberry pi through the SD card. For Windows you can use: *Raspberry Pi Imager* or *Etcher*. Once the program's image/OS and SD card have been chosen, write it to the SD card and wait until the operation completes.
3. Insert the SD card onto the raspberry pi so you can start using it.

Part 2

1. Turn on the raspberry pi. A menu should pop up. On this menu, configure the connected controllers and an unused button or key as your Hotkey Enable button. When you get to "OK" at the end, press the button you have configured as "A" (East) to complete this step.

2. Then you have to enter Game ROMs into your system. ROM stands for *Read Only Memory*, and in this context are digital copies of a game. You have plenty of ROMs to choose from. More on transferring ROMs to your system can be found *here*.

Part 3

After you've transferred your ROMs, you need to restart EmulationStation in order for them to show up. You can restart EmulationStation by pressing Start > Quit > Restart EmulationStation, or with SSH access by rebooting your pi with sudo reboot. Once rebooted, you should see the game systems appear on the system list.

An emulator is a software that acts like an old gaming device console.

USEFUL LINKS:

- *More on transferring ROMS*
- *The whole procedure on youtube*

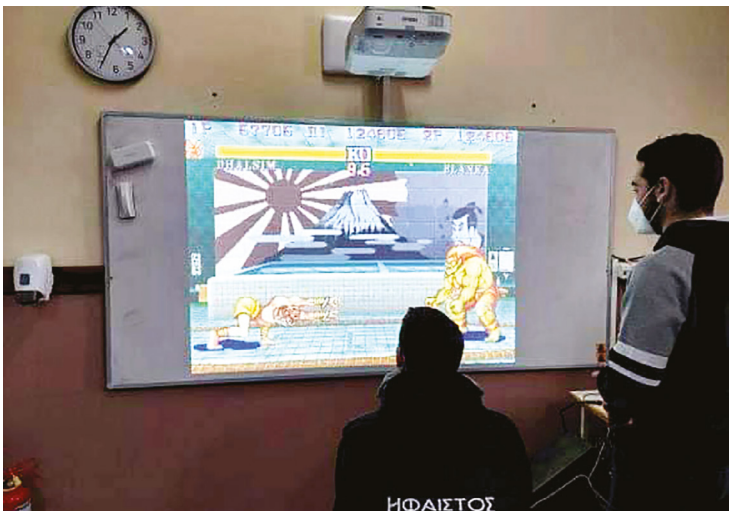


Figure 5.20: Students playing with their Raspberry Pi Retro Gaming Console. Credit: Vocational School of Myrina.

Credit: This activity was developed by the Vocational School of Myrina (EPAL Myrinas) using raspberry pi configurations from RetroPie.org and was run in collaboration with SciCo, OSHub Greece.

SESSION TITLE

Food waste and biomaterials

ACTIVITY IN A SENTENCE:

Give a second life to food waste and fabricate biomaterials that can be used to produce small objects and accessories.

DISCIPLINES INVOLVED IN ACTIVITIES:

Chemistry

RECOMMENDED AGES:

12+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Makerspace, class, restaurants and bars

LEARNING OUTCOMES:

Learners will:

- Learn about organic waste
- Discover how much it is produced in restaurants and bars
- Understand how it is treated in their municipality after disposal
- Measure quantities
- Follow procedures
- Be introduced to the chemistry of biomaterials.

The topic was chosen by students during a session facilitated by the teacher at school. Students were interested to learn more about food waste and how it could be turned into a resource. They visited a bar and a restaurant in their neighbourhood to collect food waste (eggshells, coffee grounds and orange peels) and talk to the owners about disposal of organic waste. After having produced biomaterials at Onl'fait, the students continued to explore the topic in class and another group worked on a compost bin fed by the school cafeteria to grow aromatic plants.

RECOMMENDED EXPERTISE:

- Chemist
- Cook, bar owner, food expert

SDG LINKS:

- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- **Goal 11:** Make cities and human settlements inclusive, safe, resilient and sustainable
- **Goal 12:** Ensure sustainable consumption and production patterns

TIME IT TAKES TO COMPLETE:

- Co-creation session: 1.5 – 2 hours
- Waste collection: 1 – 3 hours
- Introduction about biomaterials and their advantages: 1 hour
- Producing biomaterials: 3 x 2 hours
- Fabricating objects: 3 hours
- Preparation of the miniexpo: 2 – 6 hours
- Mini-expo: 6 hours
- Evaluation: 2 – 4 hours

MATERIALS / RESOURCES NEEDED:

- Eggshell
    - 15 ml water
    - 24 g eggshell
    - 7 g gelatin
    - A saucepan
    - Heating plate
    - Grinder
    - Spoon
    - Moulds (eg. Ice tray)
    - High precision balance
- Coffee
    - 35 ml water
    - 5 g glycerin
    - 5 g coffee ground
    - 5 g sodium alginate
    - 5 g olive oil
    - 100 ml water
    - 10 g of calcium chloride
    - High precision balance
    - Bowl to mix
    - Frame
    - Spoon

    - Spray bottle
    - Heating plate
    - Saucepan
- Orange
    - 5 Litres water
    - 420 g glycerin
    - 120 g orange peels
    - 125 g sodium alginate
    - 55 g olive oil
    - 20 g wool fibre
    - 100 ml water
    - 10 g calcium chloride
    - High precision balance
    - Bowl to mix
    - Frame
    - Spoon
    - Spray bottle
    - Heating plate
    - Grinder or mixer
    - Heating plate
    - Saucepan

CONTENT FOR LEARNERS:

External resources can be found later on within the activity description

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

The activity can be adapted to primary school students by simplifying the object to create.

Activity

Introduction: Co-creation

Start the activity with a presentation about Open Schooling (check out 5. Educator Training to learn more about Open Schooling). Use examples of local issues that are tackled with smart solutions developed by the youth and citizens. Show examples of technology for sustainability.

Divide the class in smaller groups and distribute A3 cards with a list of issues (traffic, climate change, etc…) and ask the group to rank them from the most concerning to the least and to add one more issue specific to their community. Let the students motivate their choice and find a consensus to select the topic to work on.

Once the topic has been chosen, you can decide to propose an idea (more or less defined) or facilitate a second session to come up with a technological solution.

Part 1: Waste collection

Contact restaurants, bars or a supermarket in your neighbourhood to organise a visit to collect food waste, explain the project (motivation and objectives) and interview the food professionals regarding food waste.

Part 2: Introduction to biomaterials

Prepare a presentation to explain the sustainability issues related to the overproduction of fabrics for textile and the fabrication of synthetic composites for furniture and buildings. Explain the potential of biomaterials for manufacturing and the fashion industry and the limits that researchers are trying to overcome. Inspiration may be taken from here.

Part 3: Producing biomaterials: Eggshell composite

- Boil eggshells to kill bacteria and work safely
- Dry the eggshells (either naturally or in the oven for 10 mins)
- Grind the eggshells with a grinder to obtain a fine powder
- Pour the gelatin powder in hot water in a saucepan.
- Add the eggshell powder and mix until you have a slightly viscous and granulous paste. Note: gelatin molecules break more easily when the water is hot, so be sure to pour in the eggshell powder before the mixture is too runny.
- Pour the eggshell mixture into a mould and let it dry and voila!

Part 4: Producing biomaterials: Coffee grounds bioplastic

- Weigh all the ingredients with a precision scale.
- Mix the ground coffee and the sodium alginate with the glycerin and olive oil.
- Add the warm water and mix well to obtain a homogeneous solution.
- Cast the liquid in a frame (you can make your own using any waterproof textile for the base and wood for the frame – see External Resources for assistance)
- Mix calcium chloride with water in a spray bottle. Then spray the material surface with the calcium chloride solution.
- Let the calcium chloride act for 5 minutes and rinse with clear water.
- Let the composite sample dry in a dry, warm place for one week. Depending on the thickness and size of the sample, this may take longer. It will also vary due to local temperature and humidity.
- When the product is dry, you can remove it from the frame.

Part 5: Producing biomaterials: Orange peel bioplastic

- Dry the orange peels
- Grind the orange peel with a shredder or blender then sift it into a powder
- Mix the warm water, gelatin, sodium alginate, oil and orange peel powder in a saucepan
- Let the mixture rest in a cool environment to avoid bubbles for 24 hours.
- Add the wool fibre to the mixture and mix
- Pour the mixture into a frame (you can make your own using any waterproof textile for the base and wood for the base – see External Resources for assistance)
- Mix calcium chloride with water in a spray bottle and spray the surface of the material
- Let the bioplastic dry for 3-7 days in a dry environment to avoid mould and when the product is dry you can remove it from the frame.

Part 6: Fabricating objects

- Use silicon moulds to make small objects (i.e. small pots) with the eggshell composite
- You can use the coffee fabric to make objects like a keyholder, a foldable bag or a notebook cover
- You can use the orange peel fabric to make objects like a keyholder, a bag or a notebook cover and you can use a sewing machine to assemble the object

EXTERNAL RESOURCES:

These resources will assist with the biomaterial fabrication process

- *Biomaterial Design Casting*
- *Bioplastic Cook Book by anastasia pistofidou – Issuu*
- *Bioplastics – materiability*

Part 7: Conclusion

Show the artefacts in the school or in a local science museum. Contact the bar, supermarket or restaurants to explain what you did and explore further collaboration.

Credits: This activity was developed by Fab Textile – IAAC Barcelona, Fabricademy and Materiom, and was submitted by Onl'Fait Makerspace, OSHub Switzerland.

5.4 Evaluation Tools

SESSION TITLE

AN INTRODUCTION TO ZINES

ACTIVITY IN A SENTENCE:

Overview of how to make and implement zines as a creative and personal way for learners to reflect on their learning experience of any activity/workshop undertaken.

DISCIPLINES INVOLVED IN ACTIVITIES:

Art, Mindfulness and disciplines related to activity/workshop under analysis

RECOMMENDED AGES:

14+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Formal and informal learning environment, can be adapted to online

LEARNING OUTCOMES:

- Familiarity with zine culture and construction
- Warm up and blind drawing skills
- Practice reflection
- Explore emotional response to scientific topics
- Creative confidence
- Learning Journal

Zines allow learners to reflect on a learning experience in a creative and personal way. For topics explored in Open Schooling, such reflection is vital as it allows learners the opportunity to connect with and form an emotional response to a topic, and provides facilitators with a form of evaluation.

SDG LINKS:

- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

TIME IT TAKES TO COMPLETE:

45 – 60 minutes

MATERIALS / RESOURCES NEEDED:

- **Required:**
    - Paper
    - Pen/pencil
- **Optional:**
    - Markers
    - Newspapers, magazines and/or photos
    - Scrap materials
    - Scissors and glue
    - Needle and thread
    - Post-its

CONTENT FOR LEARNERS:

- Presentation – *Activity Handbook: Zine Makeshop.pptx*

Note: *Copy the presentation into your own folder before editing.*

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

Provide assistance with making the zines and simplify prompts for younger participants.

Activity

Introduction: What is a zine?

A zine is a small, short handmade pamphlet/magazine which contains multiple pages, often filled with text, drawings, and collages. They can be made by a single person or a small group, and are a unique way to communicate topics, thoughts and ideas.

This activity will focus on how to build and utilise a zine as a means of evaluation, as well as a way for learners to document and reflect on their learning.This reflection should include their emotional response to the topic eg. how they felt, what inspired them.

Figure 5.21: Creator looking through their own zine.

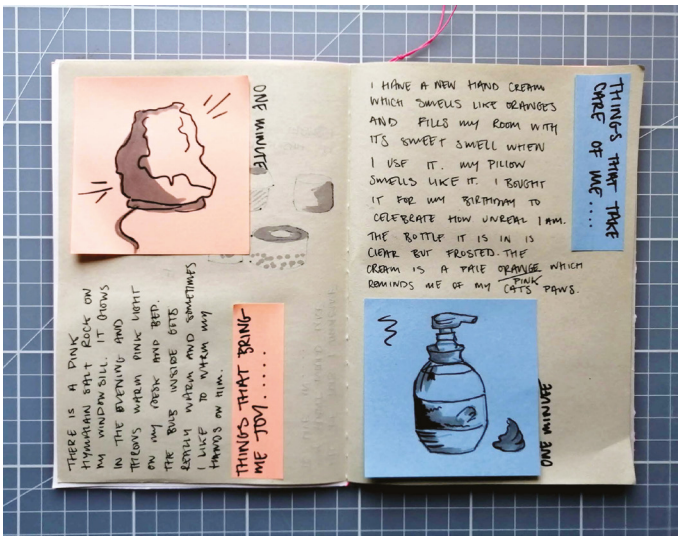


Figure 5.22: Example of a zine. Credit: SySTEM 2020[4].

Part 1: Building the zine

1.1 Playing the game

There are multiple ways to build a zine, but the simplest involves folding and cutting a single sheet of paper. Follow the steps in the image below to create a zine.

The zine can also be made by binding multiple pieces of paper using staples, or a needle and thread.

4. SySTEM 2020 received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 788317

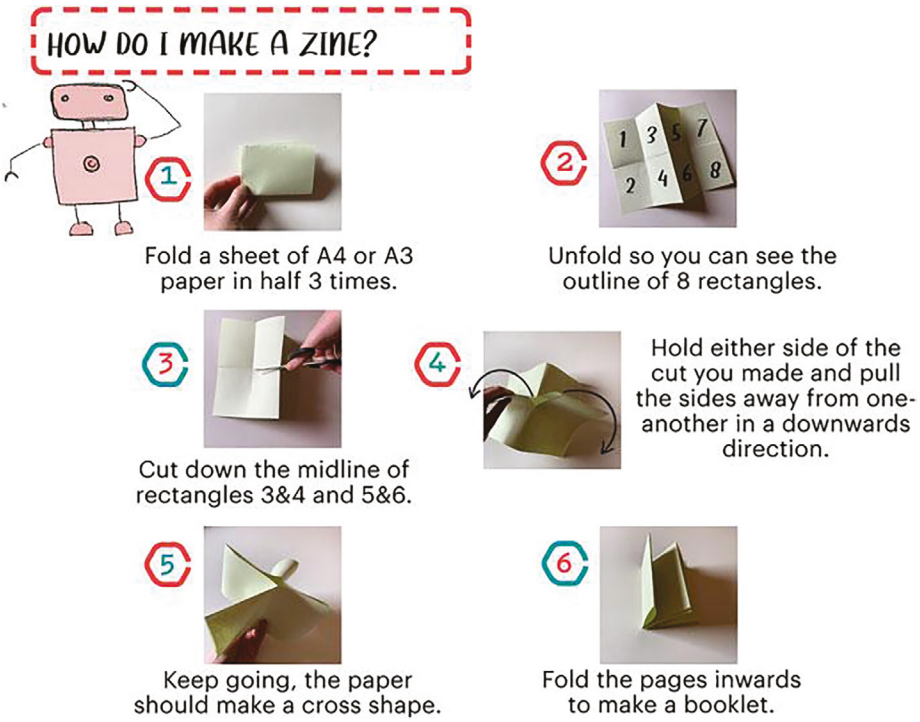


Figure 5.23: Step by step guide of 'How to make a zine'. Credit: Brown et al., 2021[5].

Part 2: Adding content to the zine

To guide the participants through creating their own zine, it is best to first assign a theme or topic that will be explored. For this activity, we will focus on zines used for evaluation of a project or as a learning journal for a topic. However zines can be adapted for many different contexts, including introducing a lesson or brainstorming.

Content ideas should come from the participant, but they can be guided by the facilitator using prompts as a form of scaffolding. These prompts can vary in detail depending on the participants and the aim of the zines.

The prompts should ask the participants to reflect on their learning journey, both exploring what they have learned and how they have learned it, but also how they felt. Did they enjoy the process? Was anything difficult? Did a particular part inspire new perspectives?

An example of a topic and prompts can be found in the *attached slides*. These slides focus on documenting the learning journey as participants explore the theme of plastic.

Encourage participants to get creative with their zines, to use the materials provided and think outside of the box. The zine is a personal reflection of their learning experience, and we are asking them to express this creatively.

5. Brown, A., Hurley, M., Perry, S., & Roche, J. (2021). Zines as Reflective Evaluation Within Interdisciplinary Learning Programmes. Frontiers in Education, 6

Part 3: Showcase (Optional)

Zines are a form of self-published work and are mainly created to communicate topics or ideas with others. Therefore it is a nice addition to ask participants to share their zines with each other. This could be done through a simple presentation, but could also be done with a showcase for both the participants and the public. Zines can also be shared with the local community (and wider) using online platforms, selling them or submitting them to local libraries and art festivals.

After this activity, participants should be aware of zine culture and feel empowered to explore topics using a creative process.

USEFUL LINKS:

- *SySTEM 2020 Learning portfolios – Zines*
- *Brown, A., Hurley, M., Perry, S., & Roche, J. (2021). Zines as Reflective Evaluation Within Interdisciplinary Learning Programmes. Frontiers in Education, 6*

Credits: This activity was developed by Science Gallery Dublin and Trinity College Dublin, OSHub Ireland, and inspired by the SySTEM 2020 project (2018 – 2021).

SESSION TITLE

Art-based mapping

ACTIVITY IN A SENTENCE:

Art-based mapping is a participatory evaluation method during which learners express their thoughts, opinions and emotions, by making a creative map of their experiences – in a safe environment, led by the learner – , while engaging in a conversation with the educator.

DISCIPLINES INVOLVED IN ACTIVITIES:

It can be integrated into any discipline

RECOMMENDED AGES:

6+

It can also be performed with younger ages, however, the experience will be more meaningful for older learners, in terms of self-awareness and self-expression of their experiences and thoughts, as well as regarding the development of a trust relationship with the educator.

LEARNING ENVIRONMENT (CONTEXT SETTING):

It can be integrated into any learning environment, however it is fundamental to take place in a quiet and familiar environment, where the learner feels safe and comfortable.

LEARNING OUTCOMES:

Learners will:

- Gain insight into their perceptions, experiences and emotions, which promotes self awareness, self-confidence and wellbeing. These are crucial for learners' learning processes and overall academic progress.
- Become equipped with the tools and mechanisms to express these, in particular, through the development of art-based skills.

Educators will:

- Get acquainted with research practices, which allows them to get insight into learners' stories, perceptions and experiences and to strengthen their relationship with them.
- Receive insights into how they can tailor and improve the education for the learner.

Importantly, this participatory evaluation method also leads to more equality between the researcher (the educator) and the participant (the learner), by empowering the learner with the tools to express themselves and steering the creation of their own maps. It also fosters equity by creating opportunities for participants with language difficulties.

This is an evaluation method where learners take centre stage, by giving them the agency to decide what to share and how to share, while, at the same time, equipping them with the tools to gain access to and give

voice to their perceptions, experiences and emotions. In addition, it is a participatory tool that promotes the collaboration between researchers, educators and learners. On one hand, it allows educators to take the role of the researcher, thus promoting their sense of ownership and sparking their interest in research, while providing them with the tools and skills to become more aware about the thoughts and emotions of their learners and to directly improve their education in a tailored way. On the other hand, it fosters equality between the researcher (in this case, the educator) and the participant (the learner) and strengthens a trust relationship between them.

RECOMMENDED EXPERTISE:

Basic training in creating art-based mappings with learners and analysing them is recommended. In the Content for Learners section we make available a set of guidelines and other relevant documents (e.g. examples of Conversation and Process Reports) created by the researchers from the Centre of Expertise in Global and Inclusive Learning at *The Hague University of Applied Sciences* and by previous tutors, that were created in the context of the project *Studenten voor Educatie* project from the *Open Science Hub – The Netherlands*.

SDG LINKS:

- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- **Goal 5:** Achieve gender equality and empower all women and girls
- **Goal 17:** Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

TIME IT TAKES TO COMPLETE:

30 – 60 minutes, depending on the age of the learner.

This is the estimated time for a group of up to 3 participants.

- for younger learners (5/6 year olds), we recommend a 30 minutes session
- for older learners (7+), a session can take up to 60 minutes

MATERIALS / RESOURCES NEEDED:

- Paper
- Markers / colored pencils / crayons
- Magazines, newspapers, scrap paper (in case participants want to cut out pictures, make collages)
- Scissors
- Glue

CONTENT FOR LEARNERS:

In the *art-based mapping folder*, learners will find guidelines on how to implement this participatory evaluation method and other relevant documents, such as examples of Conversation and Process Reports developed by previous tutors.

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

The activity is already written in a way that can be applied to different kinds of audiences.

Activity

Introduction:

The art-based mapping evaluation method was implemented in the context of the Studenten voor Educatie project from the Open Science Hub – The Netherlands as one of the research instruments of the Monitoring and Evaluation Program developed by the Centre of Expertise in Global and Inclusive Learning at The Hague University of Applied Science.

The Studenten voor Educatie project aimed at supporting primary schools in overcoming current and unfolding challenges engendered and/or exacerbated by the COVID-19 pandemic with long-lasting effects, such as: 1) many pupils are increasingly falling behind in their academic, creative and emotional development, and 2) the workload for teachers, concomitantly, increases sharply. For that, learneren voor Educatie consisted of a professional program targeted at university learners, that ran parallel to their studies, where learners (tutors) were matched to primary schools based on their assets and on the school's needs.

Considering this context, the Monitoring and Evaluation Program was aimed at testing the overarching objectives of the project, and simultaneously making sure that it would be implemented in the classroom in an organic, playful, non-disruptive and non-time consuming way. Through this, we also hoped to strengthen the trust relationship between the tutor and the primary learner, amongst primary learners as well as between tutors.

As such, tutors were trained and guided to become co-researchers and to create the art-based mappings with the primary learners as part of their tutoring activities, thus not entailing extra work-time for primary learners, teachers nor tutors. The role of the university learners was vital since they were closer in age than (most) teachers and, through their close guidance, could offer trust and recognition to the primary learners, thus further enhancing the boost in confidence. Each exercise was conducted by two tutors (where possible) with a group of up to three participants. Also, since we wanted to understand the impact of the project throughout time, we performed an initial baseline that was followed by several assessment timepoints throughout the school year.

Below you can see some of the maps created by primary schools in the context of the Studenten voor Educatie project.

Figure 5.24: Art-based maps created as part of the Studenten voor Educatie project. Credit: ULEI.

Part 1

The first step is to define the objectives and the research question of your project. What would you like to understand by using the art-based mapping evaluation method? In the case of Studenten voor Educatie, we wanted to evaluate the impact of this tailored tutoring program on the educational opportunities of primary learners, namely on skill development and academic progress, self-confidence, well-being and motivation. Then, based on these objectives and on the defined research question, we designed our research plan.

- What are the objectives and research questions of your project?
- And what will be your research plan?

Part 2

The next step is then the creation of the actual maps by the learners.

Please find below some guidelines that will help you prepare the activity.

2.1 Preparation

1. Think of a few open-ended questions related to your project objectives and research questions to kick-off the conversation. In the case of the learneren voor Educatie project, some of these questions were:
   - We have been doing activity X over the last few weeks, what do you think of it?
   - Could you describe activity X to me?
   - Could you describe what you are learning during activity X?
   - What do you think of the place where we do activity X?
   - What do you like to do / find interesting?
   - How do you think activity X is going?
   - What do you think about doing activity X in a group / alone?
   - What would you like to change about activity X?
2. Find a space where participants feel safe and comfortable.
3. Gather all the supplies and make sure they are ready to use.
4. Prepare consent forms. Bear in mind that in the case of minors, you will need to ask for the consent of their guardians prior to the session.

2.2 During the activity

1. Start by asking the participant's consent (this only applies to non-minor children, in the case of minors, you will need the guardian's consent – please see above), and if there are any questions/concerns. Also, ensure that participants are aware that they can stop the exercise at any time.

2. Give participants a piece of paper and a variety of writing tools, e.g. markers, colored pencils, crayons, as well as newspapers, magazines, scrap paper, scissors, in case they want to cut out a picture, make collages, etc.

3. Once you feel that the participants are ready to start, choose your first question and kindly ask them to express themselves (by drawing, using words, cutting out pictures). Throughout the mapping exercise, keep in mind the following golden tips:

   — Your role during this exercise is to listen and to facilitate the mapping but without biassing the participant in any particular way. It is the learner that will lead the conversation about the mapping.

   — Ask open-ended questions and keep your theme in mind, but don't explicitly tell your theme and objectives; don't steer too much;

   — It is important that you also share something, so that it becomes a dialogue and the conversation flows organically. However, never forget that the participant is the one leading the conversation;

   — Map along with the participant, if you want to. This can promote the dialogue between the educator and the learner and, at the same time, it will allow you to take notes during the mapping exercise in an informal way;

   — Make clear that mapping is not just about drawing. Participants can also use words, cut out pictures, etc.

4. Now that the mapping exercise is running, please pay attention to the following elements, which will provide valuable information in order to help you asking follow-up questions and facilitating the mapping process:

   — What is drawn, pasted, written and/or what is left out

   — How: shape / size / colours, composition and interrelationships

   — Symbols

   — Details

   — What has not been recorded / written down

   — Other elements that you find relevant

5. Throughout the mapping, please make a record of the conversation, for example, by:

   — Recording the audio – in this case, do not forget to include this in the consent forms.

   — Or by taking written notes, e.g. specific phrases, comments about something that was drawn. Please try to keep as close as possible from the original sentences. If you decide to map along with the participant, you can use your map to take notes as well.

Part 3

After having finalised the mapping exercise, it's time to analyse the data.

At the end of the exercise, you will have two products: a Map and a Conversation Report (produced from the audio record and/or written notes).

Based on these products, you will then write a Process Report, which will include first impressions, responses and answers to your research questions.

Below we provide an example of an art-based map and a brief Process Report (from the report Studenten voor Educatie – Evaluation Report, 2021[6], which can be found in the Art-based mapping folder – please see Content for Learners).

3.1 Example

Figure 5.25: Art-based mapping example drawing. Credit: ULEI.

This drawing made with black felt-tip pen shows how the student experienced the support of the student tutor. The learner chose black to make the drawing look like a manga drawing. The Conversation and Process Report clarify the drawing. We see a full drawing containing bounded planes/circles, figures and letters. The student begins by drawing the letters Kring [‚Kring' is the circle the class makes in the morning to start the day together and to go through the planning of the day or through a central topic for the class], next to it in a non-bounded space next to it, in an undefined area, a top view of a group of six pupils (her tribal group).

Then, below that, a figure with a tear and ‚10 hours later' written. This refers to the length of a school day and the emotions of the pupil. School takes a long time and creates sad feelings. The student draws the second circle clockwise, you see the letters L.K.P. [which refers to Learning Opportunities Profilem, a programme developed for primary school where large groups of pupils have fewer development opportunities], which

6. Studenten voor Educatie – Evaluation Report, 2021: https://drive.google.com/drive/folders/1hJnFQZGqjt3PkwIwxG5tT8UuOIU6i5wO?usp=sharing

is a reference to school. Furthermore, in this plane you see two figures and a ball. The student says that this refers to a moment during gym class when another student had thrown a ball against her head. As she recounted this, the student drew a cross through the scene because it hurt her to remember it. In the other circles drawn, the student shows school subjects such as maths, language, reading, writing, automation. The circles vary in size, which indicates the heaviness of importance to the student, and the individual drawings also depict different emotions. There are also circles that show the relationship with other children. Sometimes sadness or negative feelings dominate. What is striking is that the student draws herself especially happy when she is alone or with her best friend or when she is working 1-on-1 with the student tutor or teacher for a while, even if this is in the classroom.

The student noted during the mapping that the tutor and herself have not read together yet this year. When questioned by the tutor "What do you most enjoy doing together"?, the student answered, "Reading in the hallway.". This is reflected in the drawing, in the middle. The student ends the conversation by saying she would like the tutor to be there all week.

Credit: This activity was developed by Leiden University for the Studenten voor Educatie Program, OSHub The Netherlands.

SESSION TITLE

Free Flow Writing

ACTIVITY IN A SENTENCE:

A creative way of getting started and finding unique approaches.

DISCIPLINES INVOLVED IN ACTIVITIES:

Citizenship and Philosophy
(The workshop can be applied as a creative tool in order to deal with any subject area)

RECOMMENDED AGES:

14+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Classroom, informal learning space
This activity/method can be applied for two different purposes:

- A) The activity describes a process to find a unique and personal approach to transform a topic, a prompt, an experience or an input into a creative piece of work which deepens the elaboration and serves to start exploring a topic in depth.

Or

- B) This activity can be applied as a method for any context in which students are asked to create a project that engages with their environment on their own. It serves to gather a pool of ideas and find a personal approach that is aligned with their personal interest, stance and concern.

LEARNING OUTCOMES:

- Overcoming writer's block or simply getting started with a project
- Attuning to one's personal involvement and interest in a topic
- Finding ideas for a project and editing them afterwards
- Recapitulating after a session of input in order to reflect on the learner's' experience of the class, about its impact and relevance for them, which open questions or further thoughts and/or how to investigate the topic further.
- Demarcation to other brainstorming or ideation methods: The process of free writing does not allow one to stay in a mental mode of full control. Therefore, unexpected and valuable approaches can evolve.

- A) Inputs from activities undertaken by school students with stakeholders engaged in open schooling programs can be "digested" and further developed and converted into the personal projects of the students.

The activity can either serve to create the connection between what is done in school and the experiences that are made together with others or in extraordinary open schooling events – through developing the starting point for creating a "piece" that builds up on the input/experience. This piece can be realised in different mediums: It can be a theatre play, a graphically designed Zine, a stop motion movie, a scientific text or an essay – to list only a few examples of possible final outcomes.

- B) This activity will help students to map the issues that concerns them and their local community and to form the basis for formulating an open schooling project.

RECOMMENDED EXPERTISE:

No specific expertise is mandatory. Experience in writing or free flow writing can be helpful.

SDG LINKS:

- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

TIME IT TAKES TO COMPLETE:

30 – 45 minutes

MATERIALS / RESOURCES NEEDED:

- A few blank sheets of paper (or notebook) per student
- Pens
- Timer
- Three open questions fitting to the subject matter
- A bell (optional)

CONTENT FOR LEARNERS:

- *Free Flow Writing Rules*
- *Topic Layout Template A Topic Layout Template B*

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

This module makes a creative method of project development accessible to many different disciplines. See examples below.

Activity

Introduction: About Free Flow Writing

The technique of Automatic Writing or Free Flow Writing became popular under the name "Écriture automatique" by the Surrealists – an art movement of the 1920s who tried to get into practice by giving up intentional control and connecting to the subconscious. While it can have many forms, the method described here invites

the students to answer three questions posed by the teacher, by writing down whatever comes to their mind after listening to the question for a certain amount of time (approximately 3 – 5 minutes per question). Correct grammar or a good style are not important, and any judgement should be suspended during those few minutes. The exercise can be compared to a so-called brainstorming process, in which all ideas are considered equally valid, so one is also encouraged to write down what could be considered one's 'worst ideas'.

The scope of this exercise is to let one's thoughts evolve during the writing process (not to think about the question first and then write those thoughts down). It is important to keep on writing without pausing or even lifting the pen for too long from the paper, until an acoustic tone (like an alarm bell) signals the end of the writing time. This low-threshold approach not only fills the paper with written text quite quickly and effortlessly, which can help to deal with anxieties around perfectionism or being confronted with a blank page and not knowing how to even get started. It also leads to surprising, unforeseeable outcomes, which helps to connect with one's own innovative creativity and personal (maybe even private) interests in a topic. The written pages stay with the students who decide what they want to do with them – sharing them or keeping them to themselves. The free flow of writing should be followed by a process of sorting out specific ideas and arranging them for the purpose of the class's task.

Part 1: Let it flow

1.1 Introduction of frame and goal

First the students should be introduced to the general project of the class.Does it refer to an activity or input from the past? Or is the goal to develop a new project and find the starting point?

Introduce the output-medium

The teacher explains what medium it is that the students are going to use to create their outcome – based on the activity described in this guide. This could be a magazine, a fictional story, a documentary, a speech, a multimedia presentation, etc.

For this activity handbook, we will use the example of creating a Zine to the topic "Self-Care" as the output.

The teacher gives insights to the (historical) background, the purpose and use of the selected medium. Some already existing examples can be presented.

LINKS RELATED TO THE EXAMPLE OF ZINES:

- *What are Zines? Examples of Zines.*
- *What are self-care zines?*

1.2 Explain Free Writing

Every student is asked to get a pen, a few sheets of blank paper and a copy of the *Automatic Writing Exercise* with its 'rules' is explained to them as followed:

- "I am going to ask you three questions all in all and for every question you will get ~4 minutes to answer it in written form."
- "Immediately after hearing the question, you should start writing. Don't think about your answer first

and then write it down but try to be in a constant writing flow without thinking too much. This might feel as if your hand or the pen has a life of its own and is writing the answers, not you. So afterwards you might even be surprised what 'you' have written down. Try to never lift the pen from the paper for too long. If you don't know what to write about, just try to keep on writing. You can even write 'I don't know what to write about' or 'blah blah blah' and trust that full sentences will come as if by themselves soon."

- "Mistakes are welcome, as well as weirdness and imperfections. Don't worry about grammar, commas, style, beautiful handwriting or the like. Don't judge or censor what you are writing down – your supposedly worst as well as your best ideas or conclusions are equally important."
- "I am not going to collect your texts or ask you to read it. Whatever you are writing down stays with yourself and you decide what you are going to do with it: keeping it or throwing it away or showing it to somebody – as you wish. Since you are writing only for yourself you don't need to impress anybody or restrict your writing."
- "Your answers can be serious or silly, realistic or fantastic, true or false, authentic or pretending, small or big, humorous or earnest. Wherever your flow leads you to and whatever you find more interesting."

1.3 Free Writing

The teacher can then set the timer for 3 – 5 minutes and ask the first question.

- **How to formulate the three questions in dependency of the topic:**

  Depending on the topic the three questions for the Free Flow Writing should highlight different perspectives which help the students to dig deeper into the topic by first getting a feeling for its full spectrum, which can also contain contradictions. A typical triple would be to ask about the pro and the contra or the positive and the negative aspects regarding a subject matter and finally about some form of conclusion, synthesis or next steps and actions. One can also ask about easy or pleasurable aspects and then about difficult or problematic ones. The first two questions then serve as some form of overview, while the last question can be about more specific, pragmatic or hands-on aspects in order to collect ideas to get into practice afterwards or in order to see one's personal relevance of the topic.

- **Example: Self-Care Zine:**

  In a workshop that aims at creating small handmade magazines about self-care, the writing exercise could help the students to find out what kind of self-care topic is so accessible to them that they could make a whole magazine about it. Here the first question could be about certain problems, worries or difficulties – because the final zine could help to address those problems and investigate how to deal with them. The question (or set of questions which all aim at the same direction that students can choose one from to focus on) could then sound something like:

  — First Question: "Ask yourself: 'What has been on your mind lately? What was annoying or worrying? What is a problem that you could need answers or advice for?'.

  — The second question would then be about solutions the students have already found for certain difficult situations, e.g.: "Ask yourself: 'What can you do quite well? What could you teach to others? For what problems have you found good solutions? When do other people come to you to ask for advice?'".

  — The final question would then get back to the workshop outcome and simply use the answers for the first two questions as inspiration for the third question: "Ask yourself: 'What should your zine be about? For whom would you write this Zine? What title could it have and what would be its content?'"

- **Application to other topics:**

  In science or humanities classes, the opening questions could, for example, ask the students about their current knowledge about a certain topic (e.g., global warming), secondly what they find confusing about the topic or what they would like to learn more about, and thirdly, how the topic is connected to or represented in their own lives. Exemplary questions could be:

  — "What comes to your mind when you hear the term 'global warming' or 'climate change'? What have you learned about it so far?"

  — "What would you be curious about regarding this topic? What questions come to your mind that you would like to ask regarding climate change?"

  — "Do you feel the topic has an impact on you beyond learning about it in school? Where do you see how issues around the climate are already embedded in your everyday life? Why could it be interesting or relevant for you to learn more about the topic?"

  In order to retrospectively evaluate a class or workshop – be it about philosophy, biology, a sports event, literature club, a visit to the museum or any other form or discipline – the Automatic Writing questions can also help to reflect on the students' experiences and their take-aways. It can also help them to prepare for possibly upcoming tests, dissertations, projects or next level classes. The questions could either focus more on the taught content or on personal experiences.

- **Transition between questions**

  When the alarm of the timer rings after the first few minutes of focused free writing, depending on the size of the group the teacher might amplify the sound with a bell, so everybody hears it. They can also tell the students to finish their last sentence and prepare for the next question, maybe by rotating their wrists in between or shaking their hands since handwriting can be exhausting. The timer can then be set again, and the second question can be posed. All of this is repeated for the third and final round.

1.4 Distil

The students then have time (~5-10 minutes) to read what they've written down and are welcome to work with their text by underlining or encircling certain words or sentences they find interesting, by adding comments, symbols, pictures or by crossing out certain words or sentences. They can be reminded that there is no right or wrong in this process, but that they should follow their intuition in order to find their unique approach.

This process of reading and editing helps to intuitively decide on one of all the possible approaches. It usually shows what interests the most, what appears to be most urgent, or where the most subjective potential lies. This part of the process is very crucial. It serves as a bridge from "letting it flow" to making a conscious plan.

Part 2: Harvest

The written texts serve as a pool of ideas and personal reflections that now need to be narrowed down and sorted out to continue a working process.

The texts can then either be a base to decide for the topic and design of their self-care zine, stop-motion--animation or whatever the output medium is. Or it is the source to find a research question that can be

investigated further in a dissertation, essay, documentary, symposium, debate club or any other project the students engage in.

2.1 Sorting out and making a plan

To bring some order into the free writing the students take another piece of paper and a pen and divide the paper into five parts by drawing a circle in the middle and then four lines from the circle to every corner of the paper, like this (see Figure 10).

The attached document "Topic Layout Template A" can be used to facilitate this exercise.

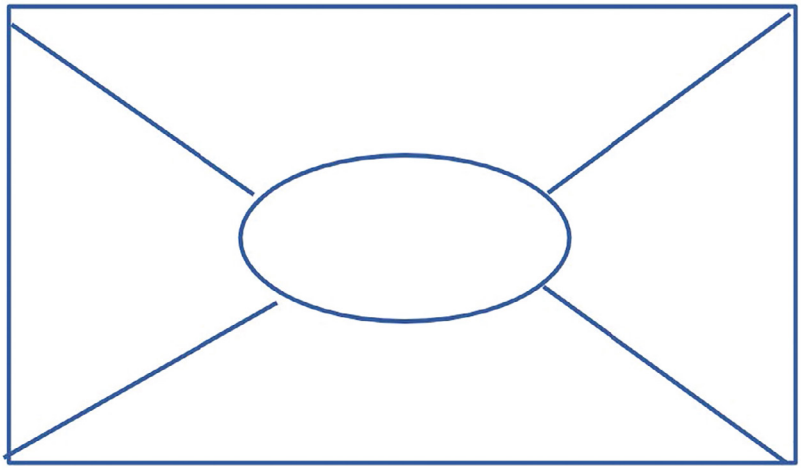


Figure 5.26: Template for Part 2.1. Credit: Beate Absalon.

- In the middle of the circle they can write down one topic – for their self-care zine (e.g., "smartphone addiction", "favourite friendship activities"), for their essay on global warming (e.g., "posters used at Friday for Future demos", "recycling"), or for their wishes or expectations regarding a new class (e.g., "more female authors", "inclusion of introverted students").
- In the upper field they can write down "Questions" and take a few minutes to write down any question that their zine, essay, etc, could tackle – regarding their topic (e.g. "What else could I do to distract myself from boredom than being on my phone?"; "What does a slogan on a demonstration need in order to get the message about global warming across?"; "Why do we read so many men in philosophy?")
- In the next field they can write down "Answers" and try to collect answers for some of their questions (e.g., "Instead of scrolling through social media I could write a letter or learn to juggle" etc.).
- While the first two gather ideas around the content – the "What?" –, the next two fields are more about the form a further dealing with those questions could take. In one field the students can write down "How?". If we take the example of the self-care zines they can then collect ideas about its specific genre (e.g., do they want to write it like a journalistic report, as a letter or a recipe book? Will it contain interviews, comics or lists of recommendations or journaling questions?). The ideas in filling in the "How" section can be greatly enriched by the appropriate input on the different forms and possibilities of the target medium. Similar approaches can be applied for any other artistic outcome as well as research papers (e.g., by asking about its methods, structure, material and resources).

- The last field gives space to collect ideas about the "Style", "Design" or the "Aesthetics" of the project. Here the students can, for example, write down anything about their Zine's looks (e.g., if it should be purely in black and white or what other colours and materials they want to use; if they want to make a very small micro-magazine or a huge one; if they want to create a collage, etc.) Same can be applied to any other artistic project and research paper (e.g., by asking about its rhetorical style, length, audience, etc.).

Adaptation:

This process of decision-making, sorting out and specifying one's project, topic or involvement can be adapted for different needs and aims. If it is less about crafting and more about problem-solving it could be possible to write the problem into the middle. In one field, the student tries to formulate a precise question for the problem. In another field they could collect ideas about certain needs or reasons behind the problem, and in the next one possible solution. In the final corner they will write down ideas for realistic actions and next steps of how to get closer to the solution.

The attached document "Topic Layout Template B" can be used to facilitate this exercise.

Part 3: Transformation into a project

The creative writing process, which serves as a preparation for the students to get into a work-in-progress and start with their project, ends here. They can use their Automatic Writing or Sorting Out-Diagram to orient themselves about what to do next. When creating their self-care Zine, for example, they serve as a blueprint or a plan, reminding them of their ideas and approaches in order to not get lost or doing things arbitrarily. Now they have a direction when starting to gather their needed materials, writing their texts within a certain congruent design they decided for. The students learn to prepare for a task while making their own choices which make most sense for them and their idea, which can raise their motivation to work on the project and feeling attuned to it.

Credit: This activity was developed by Beate Absalon, and submitted by Ars Electronica, OSHub Austria.

SESSION TITLE

Story-Telling and Content Revision

ACTIVITY IN A SENTENCE:

Learners use story-telling methods to structure, revise and engage with learnt content.

DISCIPLINES INVOLVED IN ACTIVITIES:

This activity can be used with all subjects and can be adapted to compile, work with, and revise content as well as to suit teachers' and learners' needs and preferences.

The activity is also very suitable for language teaching, especially also in the context of Content and Language Integrated Learning (CLIL).

RECOMMENDED AGES:

Can be adjusted to most ages.

LEARNING ENVIRONMENT (CONTEXT SETTING):

Groups of 3 to 4 students; ideally every group has a somewhat individual space to work in (e.g., a corner in the classroom, a double-desk – the exact amount of space needed also depends on the mode of presentation, as acting out a sketch will require more space than e.g., staging a 'freeze-frame' with action figures or cut outs on a desk). The educator supports the individual groups where necessary.

LEARNING OUTCOMES:

Learners can:

- Can structure content in transferable packages
- Practice presentation skills
- Manage project-focused teamwork
- Negotiate meaning and representation

The activity allows to reference and "digest" inputs from experts, topics that were discussed in class, or experiences which were made outside of schools, and to engage with them in an interactive, emotional and socially collaborative way to better aid the retention of the acquired knowledge by translating the content into a creative medium. The activity can serve as a bridge between the world outside and what happens inside of schools, as well as between the different subjects at school, be they science-, humanities – or arts-related.

RECOMMENDED EXPERTISE:

The educator is not required to have any specific expertise.

If available, connections can be made with professionals/experts in the relevant areas to help with content or the presentation.

SDG LINKS:

- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- **Goal 14:** Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- **Goal 15:** Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

TIME IT TAKES TO COMPLETE:

- Minimum: one lesson of 50 minutes
- If the presentation is a focus point in and of its own, additional time will be needed to practise telling the story and to produce any necessary props; this will depend greatly on the age group, available resources, and how elaborate the production can be.
- Time for the presentations depends on the number of groups and how elaborate the presentations should be. Drastically limiting speaking time to one or two minutes can be a fun exercise and forces students to focus on the essentials without getting side-tracked.

MATERIALS / RESOURCES NEEDED:

- Printed handouts, one set per group of 3-5 students.
- Smartphones or cameras.
- Can be adjusted depending on what is available, the subject, and the exact goal of the activity. E.g., pictures of relevant content, numbers, for a science class cards with relevant terms or formulas, eventually Rory's Story Cubes or something similar, action figures, pictures of characters, …

USEFUL LITERATURE:

- Phillips, Louise. 2000. "Storytelling: The Seeds of Children's Creativity". Australasian Journal of Early Childhood, 25(3), 1–5. Doi: 10.1177/183693910002500302.
- Savage, Alice. 2019. The Drama Book: Lesson Plans, Activities, and Scripts for English – Language Learners. Branford: Alphabet Publishing.
- Wright, Andrew. 2015. Creating Stories With Children. Oxford: Oxford University Press.
- Wright, Andrew. 2008. Storytelling with Children. Oxford: Oxford University Press.

CONTENT FOR LEARNERS:

- *Handout 1, 'Mind-Map'*
- *Handout 2, 'Story Design'*
- *Handout 3, 'Storyboard'*

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

Ideally, per teacher there should not be more than four to five groups of three to four, at most five students. Suitability for a class will also depend on the number of students, on a class' motivation, and on how confident students are with working independently. The bigger the class, the more space will be needed, especially once groups proceed to practise presenting their stories.

The complexity of the story itself can be adjusted depending on the age group; the complexity of the task as a whole should be adjusted depending on the age group, group size, available time, and the desired outco-

me (process-oriented revision, goal-oriented presentation).
Scaling the activity up or down for different audiences also lends itself to individualization and diversification as motivated/gifted/faster students can easily be given more complex tasks or be encouraged to add more content/characters/background information of their choosing, or to work on a more elaborate presentation.

Activity

Introduction

Much in the same way as many other memory techniques, packaging content into pre-existing structures makes it easier to remember individual pieces of information as well as to establish links between the individual building blocks. Retention of content is further promoted by engaging with it(inter-)actively, by connecting it to emotions, and by comprehending connections between content items. As such, the activity can be used with all subjects and can be adapted to compile, work with, and revise content as well as to suit teachers' and learners' needs and preferences.

Once the stories have been created, students will enact these stories in several ways of varying degrees of complexity which draw on techniques also used in improv theatre and theatre pedagogy. In addition to class content and when it comes to storytelling, story elements from popular TV-series, films, books, comics (such as protagonists, narrative tropes, specific plot points or plot structure, specific characters, etc.) can be used to engage students further (e.g. *The Lord of the Rings* can be read in terms of environmental criticism (industrialisation and destruction of nature), *Spiderman* can be discussed in terms of genetic manipulation and what that means for the world and the individual).

Note: *The following instructions are to conduct the activity as a revision exercise, in this example to revise the thematic complex of biodiversity.*

Part 1: The Mind Map (10 – 15 mins)

Time is dependent on how fast groups can be formed and the specifics of the class.

- Form groups of three to four people. Each group should have a desk/their own space.
- Distribute the first handout, "Mind-Map".
- Ask students to write the main thematic complex that you will be revising in the central field. In our proposed example, this is 'biodiversity.'
- Give students five minutes to complete the mind-map, first adding topics you have talked about in class and facts that they have learnt, and then adding any further associations, ideas, and knowledge they might have, working steadily outwards until complete. They will need to hurry, but they are working together in a group, and they will also be able to return to the mind-map later.

Example:

Central field: biodiversity

Surrounding fields: fauna, flora, decline – why, effects of decline, why needed, …

Further associations: buildings – cities – streets – highways – animals isolated – inbreeding or lack of breeding partners – not enough food, not the right food – animals killed when crossing streets – species extinction – solutions? – – > e.g., 'green' animal bridges over streets and highways that connect otherwise isolated habitats

Part 2: The Story

2.1 Designing the story (15 mins)

Experience has shown that this phase tends to take up most of the time. Some groups will require gently nudging/leading questions to identify the 'plot' etc., however, other groups will be very enthusiastic and overflow with ideas. Help them to pick a focus point, an idea they want to communicate, and to add more details once their basic storyline is complete.

- Distribute the second handout, "Story Design".
- Talk about and explain the story elements mentioned on the handout. What elements does a story need?
- Ask students to pick one aspect of their mind-map and think about how they could use that aspect in a story.
- Guide students to pick a protagonist, a problem, and a solution to or consequence of the problem. Naturally, a story also needs a title!

Example:

Aspect chosen: isolated animals, green bridges as a solution

Story elements:

- **Protagonist:** e.g., a lonely boy fox looking for a girl fox/ a lost baby-deer, looking for its mother
- **The problem:** There are no girl foxes anywhere in his tiny forest, and he can't leave/ the baby-deer got separated from its mother when they had to cross the street and it got scared and ran back: everybody fears the fast, roaring monsters with huge, glowing eyes.
- **Solution:** He wanders around for a while and in the end finds a green bridge that connects his forest to another forest where he meets a girl fox, and they live happily ever after. / The baby-deer finds the green bridge and reunites with its mother.

2.2 Staging in the Story (15 mins)

Depending on the students, they may choose/need to stage a single 'frozen frame' or put together a single 'sculpture', or they might work very fast and manage to create a sequence of frames or sculptures to tell their story.

'Freeze Frame'/ 'Sculpture': Students (re-)create a moment of the story themselves, with each student taking on the role of an element in the picture, e.g., a roaring monster, two students building a bridge, a tree, … In

improv theatre each image element can talk about who they are, what they feel like, etc. if encouraged to do so by the director.

- Distribute the third handout, "Storyboard".
- Ask students to decide on one to five key moments of the story: How could they communicate the entire story in a single image? What moments would they pick if they could pick three or five images?
- Students sketch their ideas in the fields in the story boards and write down notes. What do the characters/elements feel in that position? What would they say? They may also already start trying out poses.
- Students may pick any available materials as props.
- One student takes a photo of each of the 'frames'/ 'sculptures'.

Part 3: The Presentation

Students present their stories to the class, either by moving through the frames/sculptures or by showing the photos they have taken.

If moving through the frames/sculptures, the teacher or another student can signal, e.g. by touch, each element in the frame/sculpture individually (monologue) or all together (to create a soundscape) to talk about who they are and what they are feeling, what their purpose is, etc. Sentences should start with "I" in order to focus on the specific character/element.

Other students and the teacher/trainer give feedback. What was the story? What content did the story focus on? Was there anything that was especially cool?

Example:

The teacher moves around the sculpture of a baby-deer cowering under trees and lightly touches the shoulder of the student acting the part of the baby-deer. They talk until the teacher stops touching them:

"I am a baby-deer and I have lost my mother. I am lonely and afraid of the loud monsters with the glowing eyes. ..."

Documentation/Outreach:

Given more time and more resources, the frames/sculptures can be made more detailed/elaborate. The best photos for each frame/sculpture may be printed and put together on a poster. In addition to the title and the artists' names, image descriptions can be added (e.g., a description of what is happening or parts of the monologue of the picture elements). The poster can be put up at school etc. so that others may enjoy them and even learn something about an important topic.

Credit: This activity was developed by Michaela Schober on behalf of Ars Electronica, OSHub Austria.

5.5 Educator Training

SESSION TITLE

Integrating Open Schooling in the daily-life of schools: a teacher training program

ACTIVITY IN A SENTENCE:

Training program for teachers on how to develop and implement an Open Schooling project co-creatively with students.

DISCIPLINES INVOLVED IN ACTIVITIES:

This training program promotes a project based methodology settled on equity, inclusion and democracy.

The main characteristics of this methodology are focused on: tackling local challenges/opportunities, collaborating with stakeholders, sharing with the local community and evaluating the impact of the project. As such, it can be adapted to different disciplines and, above all, allows transdisciplinarity.

RECOMMENDED AGES:

18+

LEARNING ENVIRONMENT (CONTEXT SETTING):

This training program can be adapted/integrated into any learning environment, but it is important that both educators and students feel safe and comfortable to share their thoughts and opinions, thus promoting collaboration and co-creation. Even if the training program happens in a face-to-face setting, we recommend the use of digital collaboration tools (e.g. Google documents) in complementary to post-its and other paper-based tools, since it promotes digital literacy and collaboration beyond the training site.

LEARNING OUTCOMES:

At the end of this training program, it is expected that learners will:

- Become aware of the importance of fostering active citizenship in their classroom and in their daily-life school practices, namely in regard to inclusion, gender equality, interculturality, human rights, and plural participation, contributing to community development and well-being. In addition, by being based in

democratic practices, this training program will position learners as main agents in the decision-making process.

- Be able to develop and plan projects based on tackling real life challenges that are locally relevant. Specifically, they will identify global and local challenges, define the objective of a project, design actions and assess the respective impact, and finally communicate and disseminate its process and outcomes.
- Understand the value of collaborating and co-creating with families and members of their local community, as well as other relevant stakeholders, in order to guarantee a more integrative, meaningful and sustainable development and implementation of the project.

RECOMMENDED EXPERTISE:

It's recommended that the facilitators of the training program have

- The ability of enabling a safe and comfortable environment, so that all participants share their thoughts and opinions freely.
- Experience in design thinking, co-creation and collaborative work.

In the online setting, depending on the amount of participants, it's recommended more than one facilitator, especially when there is co-creation work in breakout rooms. In this case, we recommend at least one facilitator per breakout room.

SDG LINKS:

- **Goal 3:** Ensure healthy lives and promote well-being for all at all ages
- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- **Goal 5:** Achieve gender equality and empower all women and girls
- **Goal 12:** Ensure sustainable consumption and production patterns
- **Goal 17:** Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

TIME IT TAKES TO COMPLETE:

Overall, the training program has a duration of around 16 hours, and each activity takes from 1 – 2 hours.

MATERIALS / RESOURCES NEEDED:

- **In-person setting:** whiteboard, A1 paper sheets, post-its, pens and the respectives canvas for each activity (in "Content for learners").
- **Online setting:** computer, webcam, internet, Google Workspace (GDocs, GSlides, GSheets, GDrawings[7]), Mentimeter, Padlet (or similar software).

7. Google Drawings was our platform of choice because we could create several documents for free and it was easily accessible to participants as it was part of Google Workspace. However, there are several user-friendly collaborative work platforms, such as *Miro* or *Mural*, for example.

CONTENT FOR LEARNERS:

- *Integrating Open Schooling in the daily-life of schools: a teacher training program – activities 1 to 10* – a pack with editable and non-editable files for each activity of the training program.
- *Open Schooling manual for the Citizenship and Development Discipline* – pack with editable and non editable files containing the manual and activities from the manual (integrated in the item below "Related Content From Open Schooling Manual for the Citizenship and Development Discipline").

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

The activities described in this training program can be adapted both to formal and non-formal educational contexts, depending on the educator's objectives and needs. Also, although the activities of this training program were carried out sequentially, they can be used independently, and with a different order than the one proposed here. Note that some resources are in Portuguese, so translation may be required.

Activity

Introduction:

The training program for teachers that we present in this handbook results from an empirical experience of a certified teacher training program that took place in Portugal between November 2020 and May 2021, with twenty teachers from four different school clusters (SC) and one science centre (SC Figueira de Castelo Rodrigo, SC Almeida, SC Sé – Guarda, SC Pioneiros de Aviação Portuguesa, SC Pêro da Covilhã, Museu do Côa – Centro de Ciência Viva). This program was co-developed with one teacher from the SC of Figueira de Castelo Rodrigo (FCR) – Ana Cristina Perpétuo – and it was aimed at increasing student's active citizenship and promoting teacher's autonomy in Open Schooling practices. The content of this teacher training program was based on a practical manual co-created by the OSHub-PT team together with the teachers of the Citizenship and Development discipline, from the SC of FCR – Open Schooling Manual for Citizenship and Development (see Content for learners) – and systematises the Open Schooling practices that have been developed and implemented in this school cluster since the school year of 2018/2019.

Although this program was originally designed for the discipline of Citizenship and Development (C&D), in order to scale it for different audiences, we adapted it in a way that is transversal to any discipline.

As we describe below, this teacher training program provides guidance from the identification of local relevant challenges/opportunities to the design, implementation, evaluation and communication of projects in collaboration with local partners and the surrounding community.

It is organised in three parts and comprises 10 activities. The first part starts with the creation of the working groups, by bringing together learners with diverse and complementary competences. The second part is dedicated to the identification, with the help of families and the local community, of locally relevant challenges/opportunities while reflecting about their reality from a local to a global context. It finalises with the voting of one challenge that will be tackled in the next part. The third part follows a project-based methodology and guides the planning, development, evaluation and communication of the actions aimed at addressing the challenge identified earlier and contributing to community well-being.

Overview:

- Activity 1: Creating working groups by promoting diversity
- Activity 2: From global to local: identifying challenges, opportunities and solutions

- Activity 3: My school, my community, my country, the world: analysing challenges and opportunities
- Activity 4: Involving families, friends, colleagues, citizens understanding the challenges from our community
- Activity 5: Voting the challenge of the project
- Activity 6: Developing and planning the project: section "Why?"
- Activity 7: Developing and planning the project: section "What for?" and inviting local stakeholders to the school
- Activity 8: Developing and planning the project: debating with stakeholders
- Activity 9: Developing and planning the project: sections "How?" and "Did it work?"
- Activity 10: Developing and planning the project: section "What and how to communicate?"

Part 1

Activity 1: Creating working groups by promoting diversity

HOW?

The first activity of this training program is dedicated to creating working groups that bring together diverse and complementary competences. For that, learners start by answering several questions that make them reflect on their abilities in various skills – creativity, collaboration, communication, critical thinking and problem solving. The working groups are then formed based on these individual abilities by trying to maximise the diversity of skills in each group. At the end, learners reflect about the intrinsic diversity of each group and about the importance of this diversity for collaborative work.

WHY?

- Fostering inclusion, diversity, plural participation and democratic school practices;
- Promoting the reflection about the importance of gender equality, interculturality and the respect for human rights for working collaboratively and living in society.

HOW LONG?

1 hour

MATERIALS:

- *Pack with editable and non editable files – "Creating working groups by promoting diversity"* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"Plural participation and diversity: creation of working groups"* [Portuguese]

STEP-BY-STEP:

1. Start by showing the participants the horizontal axis depicted in Figure 5.27 and by explaining that they will be doing a game about creativity, collaboration, communication, critical thinking and problem solving. Let the learners briefly discuss each skill.

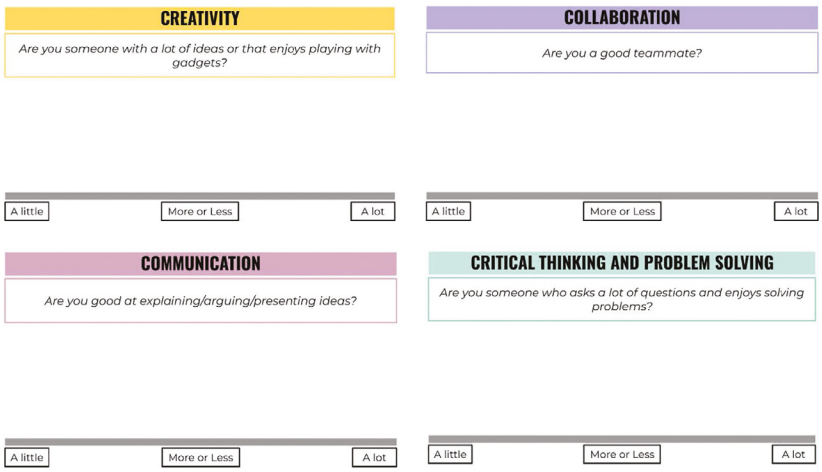


Figure 5.27: Self-assessment axis regarding the skills creativity, collaboration, communication, critical thinking and problem solving. For each skill (creativity, collaboration, communication, critical thinking and problem solving), learners are asked to position themselves along this axis by using as a reference the labels "A little", "More or less" or "A lot". Credit: MFCR.

2. Then, start playing the game.

   To assess learners' creativity, ask them the following question: "Do you consider yourself as someone with a lot of ideas or that enjoys playing with gadgets?". After this, ask the learners to position themselves along the horizontal axis in Figure 33, by using as a reference the labels: "A little", "More or Less", "A lot". Ask one of the learners on the "A little" side and another on the "A lot" side to share their choices.

   Repeat the same procedure but now for the other skills, by asking the following questions:

3. Collaboration: "Do you consider yourself as a good teammate?".

4. Communication: "Do you consider yourself good at explaining/arguing/presenting ideas?".

5. Critical thinking and problem solving: "Do you consider yourself as someone who asks a lot of questions and enjoys solving problems?".

6. After having completed this self-assessment exercise, ask each participant to identify the skill they are best at and to position themselves in the diagram depicted in Figure 34a. Ask learners if they would like to share their answer.

7. Based on the final positioning of the participants, the facilitator makes the workgroups as shown in Figure 5.28b.

   Note: *Feel free to slightly change the composition of the groups in case there's any obvious unbalance (e.g. in terms of gender representation). Please keep in mind that the objective is to create groups that are heterogeneous as possible regarding their competences.*

Figure 5.28 (a)

Figure 5.28 (b)

Figure 5.28: Diagram showing how to form the work groups based on the diversity of competences. (a) Learners are asked to position themselves in the column corresponding to the skill they consider they are best at. (b) Example of how working groups are created by trying to maximise the diversity of skills in each group.

8. Finally, ask the learners in each group to reflect about diversity in their own group, by considering different variables, like the ones depicted in Figure 5.29.

How to ensure that students reflect and are aware of the diversity in their group?

Questions for group members	How many different answers do we have in the group?
Where do we live (city, village, farm, ...)?	
How is gender represented in our group?	
Do we follow a religion? If yes, which one?	
What is our nationality or that of our parents?	
What is our favorite hobby?	
Do we have any food restrictions?	
How many brothers/sisters do we have?	

Figure 5.29: Examples of questions to ensure that the class reflects on the diversity of the group created.

Part 2

Activity 2: From global to local: Identifying challenges, opportunities and solutions

HOW?

Learners start by individually identifying and reflecting about global and local challenges/opportunities. Then, together with their groups, focus on specific local challenges/opportunities and discuss how the school community (students, teachers, school staff) can contribute to solutions that tackle them.

WHY?

- Promoting the reflection about concrete challenges and opportunities that exist around us from a local to a global perspective;
- Promoting civic attitude by seeking tangible solutions to challenges/opportunities that surround us.

HOW LONG?

1 hour

MATERIALS:

- *Pack with editable and non editable files – "From global to local: identifying challenges, opportunities and solutions"* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"The world around us and the discipline of Citizenship and Development"*
- *"The challenges and opportunities of our community and the Domains of Education for the citizenship"* [Portuguese]

STEP-BY-STEP:

1. Start by explaining to the participants that during this activity they will be looking at challenges and opportunities from a global to a local perspective. Take this moment also to clarify how challenge and opportunity are defined in the context of this training program:
   - A challenge is an obstacle that can be overcome, i.e., something that is not working so well and that can be improved.
     — Examples of challenges: food waste; bad eating habits; lack of physical exercise; few spaces with shades; few green spaces; trash on the floor; no recycling.
   - An opportunity is something that, by itself, is already good, but that can become even better if we explore it and develop it further. An opportunity can also help us solve challenges, like the ones mentioned above.
     — Examples of opportunities: green spaces; outdoor spaces to play; existence of extracurricular activities; natural/historical/archaeological/cultural heritage; proximity between people and entities; spaces for picnics; proximity to lakes, rivers, beaches.
2. Show the participants the example in Image 4 and explain that each of them will receive two images. For each image, they will need to identify (individually) a global and a local challenge/opportunity related to that image. By global challenge/opportunity we mean something that takes place worldwide. By local challenge/opportunity we mean something that is happening in our community.

Figure 5.30: Example of the exercise where learners identify a global and a local challenge/opportunity related to the image on the left.

3. Distribute two images from the file "Images" in the *pack* with files from the activity (see Materials) to each participant and give them some minutes to identify the global and local challenges or opportunities.

4. After this, bring each group together and ask them to share and discuss the identified challenges and opportunities.

5. Distribute the canvas "Challenge – Opportunity – Solution" depicted in Figure 5.31a to the groups and ask them to write down the identified local challenges and opportunities.

   Note: *If there are similar challenges and opportunities, ask the groups to cluster them and find a common denomination.*

6. Now, ask the groups to look at the identified local challenges and opportunities and to analyse how the opportunities that were found can help tackle those challenges. The groups are free to include new information to the table in addition to the one identified earlier.

7. For each of the identified local challenges, ask each group to discuss how the school community (students, teachers, school staff) can contribute to tackle them and write down those ideas under the box "Solution", which is defined in the context of this training program as follows:

   - A solution is something that we can do to overcome the challenge or to improve the opportunity.
     — Examples of solutions: use green spaces for physical exercise; organise garbage collection activities and recycling campaigns, in collaboration with different entities, in lakes/rivers/beaches; organise food exchange markets to avoid food waste, in spaces for picnics; to make a peddy-paper of territory exploration, which promotes the practice of physical exercise and the valorization of the heritage.

In Figure 5.31b, you can find some examples that resulted from the training program with Portuguese teachers.

(a)

CANVAS | Challenge - Opportunity - Solution		
CHALLENGE	**OPPORTUNITY**	**SOLUTION**
A CHALLENGE is an obstacle that can be overcome, i.e., something that is not working so well and that can be improved Examples of challenges: food waste; bad eating habits; lack of physical exercise; few spaces with shades; few green spaces; trash on the floor; no recycling.	An OPPORTUNITY is something that, by itself, is already good, but that can become even better if we explore it and develop it further. An opportunity can also help us solve challenges, like the ones mentioned (see "CHALLENGES" column). Examples of opportunities: green spaces; outdoor spaces to play; existence of extracurricular activities; natural/historical/archaeological/cultural heritage; proximity between people and entities; spaces for picnics; proximity to lakes, rivers, beaches.	A solution is something that we can do to overcome the challenge (see "CHALLENGES" column) or to improve the opportunity (see "OPPORTUNITIES" column). Examples of solutions: use green spaces for physical exercise; organize garbage collection activities and recycling campaigns, in collaboration with different entities, in lakes/rivers/beaches; organize food exchange markets to avoid food waste, in spaces for picnics; to make a peddy-paper of territory exploration, which promotes the practice of physical exercise and the valorization of the heritage.

(b)

CANVAS | Challenge - Opportunity - Solution		
CHALLENGE	**OPPORTUNITY**	**SOLUTION**
A CHALLENGE is an obstacle that can be overcome, i.e., something that is not working so well and that can be improved. Examples of challenges: food waste; bad eating habits; lack of physical exercise; few spaces with shades; few green spaces; trash on the floor; no recycling.	An OPPORTUNITY is something that, by itself, is already good, but that can become even better if we explore it and develop it further. An opportunity can also help us solve challenges, like the ones mentioned (see "CHALLENGES" column). Examples of opportunities: green spaces; outdoor spaces to play; existence of extracurricular activities; natural/historical/archaeological/cultural heritage; proximity between people and entities; spaces for picnics; proximity to lakes, rivers, beaches.	A solution is something that we can do to overcome the challenge (see "CHALLENGES" column) or to improve the opportunity (see "OPPORTUNITIES" column). Examples of solutions: use green spaces for physical exercise; organize garbage collection activities and recycling campaigns, in collaboration with different entities, in lakes/rivers/beaches; organize food exchange markets to avoid food waste, in spaces for picnics; to make a peddy-paper of territory exploration, which promotes the practice of physical exercise and the valorization of the heritage.
Many stray animals	Existence of entities that promote animal adoption campaigns (e.g. municipalities - Porto, Setúbal; ONG - 'Adopta-me')	Developing an animal adoption campaign
Lack of trash bins outside the school	- It's easy to make appealing garbage containers from waste materials (e.g. old card boxes, unused plastic) - Institutions that work with recycling and that may help us (e.g. Resistrela - local organization on waste management, Lipor - Porto's organization on waste management)	- Making undifferentiated garbage bins and recycling bins - Carrying out awareness-raising actions for students about disposing of garbage in the appropriate places - Carrying out training actions with school employees responsible for garbage separation
Several cases of domestic violence against women	There are programs/campaigns to prevent domestic violence against women (e.g. Project Not, Red card to gender violence!, Do you like me well or do you like me badly?, ...)	- Establishing partnerships to help us: 1) understand more the challenge and 2) design and/or facilitate activities that can contribute to tackle the domestic violence against women - Developing gender equality awareness-raising actions

Figure 5.31: Canvas "Challenge – Opportunity – Solution". (a) First, learners write down the identified local challenges and opportunities and then they discuss how the school community (students, teachers, school staff) can contribute to tackle them and write down those ideas under the box "Solution". (b) Example of a canvas "Challenge – Opportunity – Solution" filled by Portuguese teachers and where similar challenges and opportunities were grouped under a common denomination.

8. Afterwards, ask each group to present to the whole class the identified local challenges/opportunities and respective solutions.

9. Finally, give each group some minutes to add to the canvas any missing challenges/opportunities that they identify as relevant in their communities, as well as some potential solutions that can be driven by the school community.

10. Before concluding this activity, allow some minutes for a final reflection together with the whole class.

Activity 3: My school, my community, my country, the world: Analysing challenges

HOW?

Learners revisit the challenges, opportunities and solutions identified in the previous activity and, together with their groups, select which ones are more important based on community relevance, personal and professional motivations, and other factors considered as meaningful by them. Afterwards, they analyse how present these challenges are in four different spatial dimensions: their school, their community, their country and the world.

WHY?

- Promoting the analysis and debate of locally relevant challenges in different contexts, from our school and community to national and worldwide dimensions.

HOW LONG?

1 hour 30 minutes

MATERIALS:

- *Pack with editable and non editable files – "My school, my community, my country, the world: analysing challenges"* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"Debate the Domains of Citizenship and Development from local to global"* [Portuguese]

STEP-BY-STEP:

1. Start by asking each participant to revisit their group canvas "Challenge – Opportunity – Solution" and to select three potential challenges they would like to pursue in their school projects based on the following parameters: community relevance, personal and professional motivations, and other factors that they consider relevant.

2. Bring the workgroups together and ask each participant to share with the rest of their group their individual choices and the respective reasons.

3. Give each group some minutes to make a joint decision regarding the three challenges considered more relevant given the previous discussion.

4. After this, explain that in the next exercise, each group will work on the selected challenges by analysing them "In your School…", "In your Community", "In your Country", "In the World", as depicted in Figure 5.32a.

5. Give three canvases "School – Community – Country – World" to each group, and ask them to write down at the centre of the images a question that is related to the challenges identified previously (one per canvas), such as "How is the reality of [replace with the challenge] in…". These questions should lead the group to reflect how present these challenges are "In your School", "In your Community", "In your Country", "In the World". Examples of questions:

   — "How is the reality of stray animals in…?"

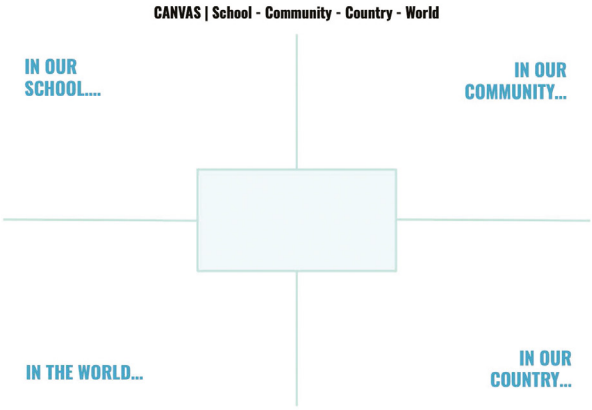
   — "How is the reality of waste management in…?"

   — "How is the reality of domestic violence in…?"

   Importantly, ask each group to provide concrete examples, real stories, news, etc. In Figure 5.32b you can find one example from the training program in Portugal.

6. At the end, ask each group to share their analysis and promote a discussion based on these reflections.

(a)



(b)

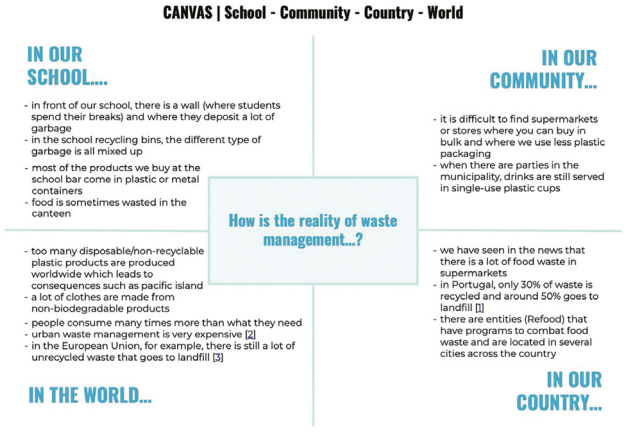


Figure 5.32: Canvas "School – Community – Country – World". (a) At the centre, the group should write a question based on the challenge identified previously, which will then trigger a discussion about the reality of this challenge "In your School", "In your Community", "In your Country", "In the World". (b) Example of a canvas "School – Community – Country – World" filled out during the training program in Portugal.

Activity 4: Involving families, friends, colleagues, citizens understanding the challenges from our community

HOW?

Learners prepare and make questions to their families and community members regarding the identified challenges, so that they can deepen their understanding about the local reality of these challenges and ways to address them with the help of others.

WHY?

- Promoting the diversity of opinions and information for a given challenge;
- Enhancing the collaboration with families, friends, colleagues and citizens from the local community.

HOW LONG?

1 hour 30 minutes

MATERIALS:

- *Pack with editable and non editable files – "Involving families, friends, colleagues, citizens understanding the challenges from our community"* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"Identify challenges/opportunities locally relevant in collaboration with the families and the community"* [Portuguese]

STEP-BY-STEP:

1. Start by explaining to the participants that in this activity we will ask for the help of our family, friends, colleagues, citizens from our communities, to know more about the previously identified challenges, find potential solutions and identify people and organisations that could help us.

2. Give three canvases "Involving our families and local community" to each group (one per challenge identified in the previous activities; see Figure 5.33), and ask them to: decide which questions they would like to pose to their families and community members; and to identify the people they would like to contact for each challenge.

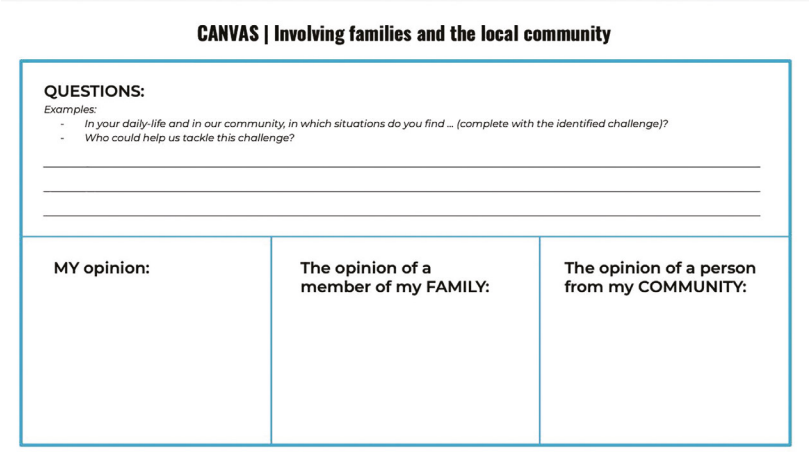
   Suggestion: *try to identify people that you can easily reach out to by making a phone call, since you'll contact them during this activity.*

3. Ask the groups to write these questions down in the corresponding canvases together with their opinions (in the box "My opinion").

4. Now it's time to make some phone calls! Ask each group to make the respective contacts and to take note of the respective opinions in the corresponding canvases. !

5. Give each group some time to analyse the obtained answers, to group common opinions and to create different clusters. After this, hopefully each group will be better informed about their challenges and how to tackle them.

6. To conclude this activity, ask the groups to share and discuss their findings with the rest of the class.


CANVAS | Involving families and the local community

QUESTIONS:

Examples:

- In your daily-life and in our community, in which situations do you find ... (complete with the identified challenge)?
- Who could help us tackle this challenge?

MY opinion:	The opinion of a member of my FAMILY:	The opinion of a person from my COMMUNITY:

Figure 5.33: Canvas "Involving families and the local community". Learners are asked to write questions they would like to pose to their families and community members, to know more about the previously identified challenges, find potential solutions and identify people and organisations that could help them. They also answer these questions with their opinion.

Activity 5: Voting the challenge of the project

HOW?

The challenge that will guide the project that each group is going to develop during the training program will be decided through a voting process, happening in this activity. For that, each group prepares a pitch per each of the challenges identified in the previous activities and presents them to the whole class. After this, each participant votes on the challenge that they consider more locally relevant given the arguments presented.

WHY?

- Fostering communication and argumentation skills and the capacity to listen and respect different viewpoints and to build one's opinion based on the integration of different arguments;
- Promoting democratic school practices, in which learners are the main agents in the decision-making process.

HOW LONG?

1 hour 30 minutes

MATERIALS:

- *Pack with editable and non editable files – "Voting the challenge of the project"* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"Vote the core Domains of the project of Citizenship and Development"* [Portuguese]

STEP-BY-STEP:

1. Start by explaining that, in this activity, each group will ask for the help of the class in deciding which challenge will be the one guiding their project. For that, each group will prepare a short pitch about each of the challenges they have been researching and, after this, the class will vote on the one they consider the most relevant considering the arguments presented.
2. Ask each group to prepare a 2 min-pitch per challenge (in total, each group has to prepare three pitches), by using as a basis the canvas "Preparing the pitch about the challenge" (Figure 5.34), where the pros and cons of each challenge are analysed. Distribute one canvas per group.
3. Ask the first group to present the pitches regarding their three challenges.
4. Open a discussion moment for the other groups to pose questions and provide comments.
5. Ask each learner to vote in one of the three challenges presented.

   NOTE: *Voting can be done in many different ways. We suggest using Mentimeter (or a similar platform), which is fast, promotes the use of digital tools and avoids wasting paper.*
6. Repeat the last three items (3-5) with the other groups.
7. To conclude the activity, ask the group to share and discuss their opinions about how each group felt about the outcome of the vote and how they saw this joint decision-making process.

CANVAS | Preparing the pitch about the challenge

Challenge 1:	Challenge 2:	Challenge 3:
Arguments in favor:	Arguments in favor:	Arguments in favor:
Arguments against:	Arguments against:	Arguments against:

Figure 5.34: Canvas "Preparing the pitch about the challenge".

Part 3

Activity 6: Developing and planning the project: Section "Why?"

HOW?

This activity and the following ones are dedicated to the development and planning of the project. In this ac-

tivity, each group focuses on the voted challenge of the previous activity and they reflect and collect evidence on why addressing that challenge is relevant. In order to do so, learners also search for projects and local stakeholders that may collaborate and/or help them with additional information and expertise.

WHY?

- Promoting the development and planning of the project that addresses a challenge locally relevant, based on searching and gathering of evidence.

HOW LONG?

2 hours

MATERIALS:

- *Pack with editable and non editable files – "Developing and planning the project: section "Why?""* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"Develop and plan the project of Citizenship and Development"* [Portuguese]
- *"Research on the challenges/opportunities selected for the Citizenship and Development project"* [Portuguese]

STEP-BY-STEP:

1. Bring the workgroups together and start by giving one canvas "Develop and plan the project" (Figure 5.35) to each group and explain that during this activity we will focus on the section "Why?" (Figure 5.36). The sections "What for?", "How?", "Did it work?", "What and how to communicate?" will be filled out later.

2. Ask each group to write down the challenge voted in the previous activity in the box "What is the local challenge we want to tackle?".

3. Then, ask each section of the group to think and complete the sentences "We know…" and "We don't know…", identifying the sources (observation, research, news, etc.) of the respective information. Ask each participant to share their reflections with the rest of their group. Give each group some minutes to analyse the information, to group common opinions and write them down in the canvas.

4. Afterwards, ask each group to fill out the sections: "Which projects do we know that address this challenge?" and "Which stakeholders can help us learn more and address the challenge?". Tell the participants that in order to answer these questions they can search on the internet, call friends or colleagues, etc.

5. To conclude this activity, ask the groups to share and discuss their findings with the rest of the class.

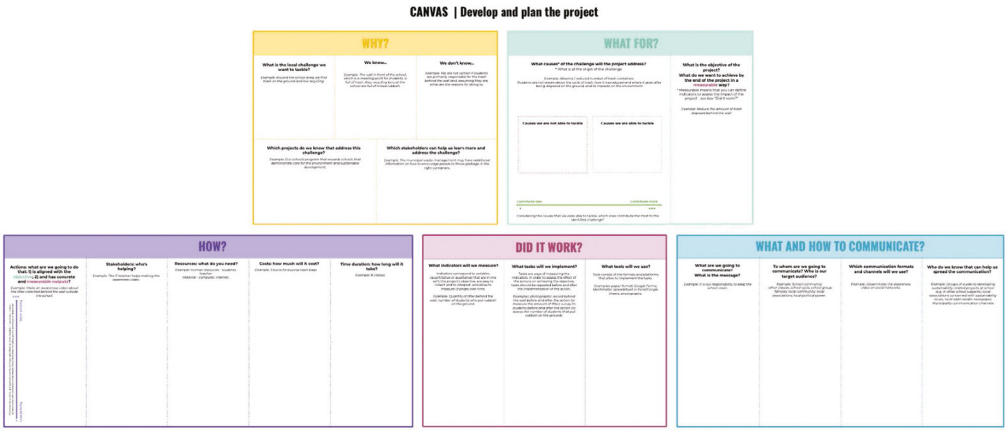


Image 5.35: Canvas "Develop and plan the project".

Figure 5.36: Section "Why?" from the canvas "Develop and plan the project".

Activity 7: Developing and planning the project: Section "What for?" and inviting local stakeholders to the school

HOW?

Each group identifies causes of the challenge and analyses which ones are able to be tackled or not by them. Then, learners define the objective of the project, by thinking what they would like to achieve at the end of the project. Afterwards, learners revisit the local stakeholders and will contact the more relevant ones in the next activity, so that they can help them tackle the identified challenge and achieve their objective.

WHY?

- Promoting the development and planning of the project with an objective that reflects the addressing of the challenge and that allows the measurement of the project impact.
- Involving local partners in the project, leveraging project work based on local knowledge and experience.

HOW LONG?

2 hours

MATERIALS:

- *Pack with editable and non editable files – "Developing and planning the project: section "What for?" and inviting local stakeholders"* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"Learning from local partners about selected challenges/opportunities: dialogue and debate session"* [Portuguese]
- *"Analyse the causes of the challenge/opportunity and define the objective of the Citizenship and Development project"* [Portuguese]

STEP-BY-STEP:

1. First, start by explaining to the class that this activity will be focused on the section "What for?". Then, ask each group to identify and write down the underlying causes to the challenge identified in section "Why?", i.e. what originates the challenge.

2. After this, ask the learners to analyse the identified causes and to separate them into the boxes "Causes we are not able to tackle" or "Causes we are able to tackle" (Figure 5.37).

3. Then, by focusing only on the box "Causes we are able to tackle", ask each group to rank the causes according to the question "Which causes contribute the most to the identified challenge" and to position them along the horizontal axis at the bottom. On the left side of the axis should be the causes that contribute less to the challenge and on the right side the ones that contribute more.

4. Now it's time to build the objective of the project, i.e. what each group would like to achieve at the end of their project. Importantly, explain to each group that their objective needs to be measurable and that in the section "Did it work?" they will identify the indicators, tasks and tools that will be used to evaluate if their objective was accomplished or not (Image 13). Give each group some minutes to formulate their objective and to write it down on the canvas.

5. Then, ask each group to revisit the section "Why?", in particular the boxes "Which projects do we know that address this challenge?" and "Which stakeholders can help us learn more and address the challenge?", and to analyse which projects and stakeholders they identify as the most inspiring and relevant ones to tackle the identified challenge and achieve their objective.

6. Let the class know that, for the next activity, each group will have the opportunity of inviting one stakeholder to discuss their projects with. As such, ask each group to choose three stakeholders by order of preference (in case the first choice is not available, then the group already has more options). Remind the class that the objective of the next activity will be to plan the next steps of the project in collaboration with the invited stakeholder – the expert on the topic, therefore it will be important to select people/entities that, given their knowledge and experience, will help them in that regard.

7. Finally, ask each group to write an email to the first of the three selected stakeholders, inviting them to the next session, with the objective of helping the group to develop and plan their project given their expertise.

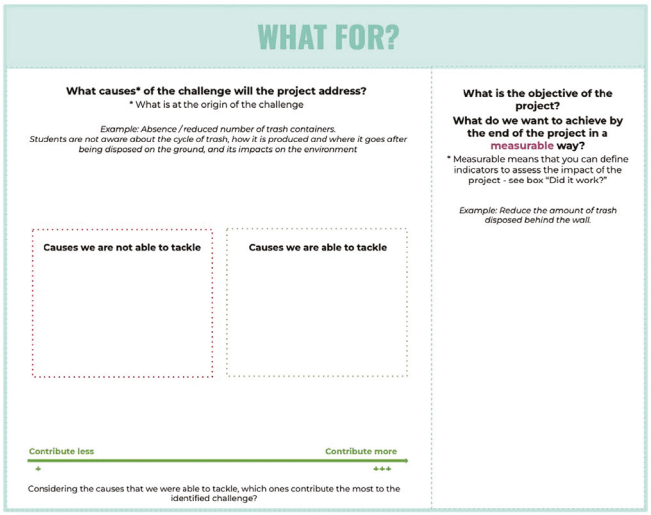


Figure 5.37: Section "What for?" from the canvas "Develop and plan the project".

Activity 8: Developing and planning the project: Debating with stakeholders

HOW?

This activity requires the participation of one stakeholder per group, since local partners are specialists in the themes they work on and can be a great ally in addressing challenges. First, each group plans a script with questions they want to ask their partners, to incorporate their expertise knowledge in the development and planning of their project. Then, each group will have a discussion and debate with the respective stakeholder.

WHY?

- Strengthening the relationship between stakeholders and the school, in order to guarantee a more integrated and sustainable action of the projects.
- Enhancing the collaboration and co-creation with stakeholders.

HOW LONG?

2 hours

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"To involve local partners in the development and implementation of the Citizenship and Development project"*

- *"Learning from local partners about selected challenges/opportunities: dialogue and debate session"*

STEP-BY-STEP:

1. Start by explaining to the group that this activity will be divided in two different parts. In the first hour, each group will prepare a script with questions for the invited stakeholder, that will help them plan the development of the project by taking into account the knowledge, experience and expertise of the invitee. After preparing the script, each group should start thinking about potential actions that could be performed to achieve the defined objective. In the second hour, each group will meet with their invited stakeholder and will start by presenting the elements of the canvas that have been filled out already, namely the challenge and objective, and then will go through the question script and discuss the actions.
2. After this introduction, start the first part and ask each group to prepare the question script. You can give learners some example questions:
   - Do you consider the identified challenge to be locally relevant?
   - Do you have suggestions of other projects and/or partners that could be relevant to help tackling this challenge?
   - Do you think that the causes have been correctly identified and that the defined objective is adequate, meaningful and measurable?
   - Do you consider that the project objective will contribute to address the identified challenge?
   - What do you think of the proposed actions? Are they aligned with the proposed objective? Do you have suggestions for other actions?
   - How could we measure the impact of these actions?
3. In the second hour, welcome and introduce the invited partners. Each group will then discuss their canvas with the respective stakeholder, with the support of the question script prepared during the first hour. Each group should have, at least, one person appointed to take notes of the conversation with the stakeholder.
4. To conclude the activity, give each group and stakeholder some minutes to share their thoughts about the respective projects with the rest of the class.

Activity 9: Developing and planning the project: Sections "How?" and "Did it work?"

HOW?

Learners focus on "How" to develop and plan their project, by designing actions that allow them to achieve the objective. For each action, learners define a set of measures that will enable them to assess the impact of the project when it's finished, allowing them to answer the question "Did the project work?". In the end, learners prioritise activities, according to parameters of feasibility and impact.

WHY?

- Promoting the development and planning of the project based on actions that contribute to tackle the selected challenge.
- Fostering the assessment of the project's impact, as a way to analyse what should not be repeated, what can be improved and what is successful.

HOW LONG?

2 hours

MATERIALS:

- *Pack with editable and non editable files – "Developing and planning the project: sections "How?" and "Did it work?""* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"Analyse and prioritise the actions to be implemented during the project of Citizenship and Development"* [Portuguese]
- *Assess the impact of the Citizenship and Development project"* [Portuguese]

STEP-BY-STEP:

1. Start this activity by telling the class that in this activity we will focus on the sections "How?" and "Did it work?", which will be filled out based on the suggestions given by the invited stakeholders.

2. Before jumping into these sections, ask each group to revisit the "Why" and "What for?" sections and to analyse if they would like to change anything considering the previous conversation with the invited stakeholder.

3. Ask learners to take a look at the sections "How?" (Figure 5.38) and "Did it work?" (Figure 5.39). Let's start by focusing on the "How?" section, in particular, in the action box. Remind the group that actions need to be aligned with the objective, i.e. actions are aimed at achieving the defined objective. This implies that actions need to have concrete and measurable outputs, which allows one to test if the objective has been achieved or not. Ask each group to define and write down their actions.

4. After this, for each action, ask the groups to fill out the other boxes from the section "How?", regarding stakeholders, resources, costs and duration.

5. Then, it's time to complete the section "Did it work?". Explain that for each action, each group should define indicators that will allow to measure the impact of the action, as well as the corresponding tasks and tools. Take this moment also to clarify how indicators, tasks and tools are defined in the context of this training program:

    — **Indicators** correspond to variables (quantitative or qualitative) that are in line with the project's objective; are easy to collect and to interpret, and allow to measure changes over time. Examples of indicators: Quantity of litter in the schoolyard, number of students who put rubbish on the ground.

    — **Tasks** are ways of measuring the indicators. In order to assess the effect of the actions on achieving the objective, tasks should be repeated before and after the implementation of the action. Examples of tasks: photographic record of the schoolyard before and after the action (to measure the amount of litter), survey to students before and after the action (to assess the number of students that put rubbish on the ground).

    — **Tools** consist of the formats and platforms that allow to implement the tasks. Examples of tools: paper format; Google Forms; Mentimeter; spreadsheet in Excel/Google Sheets; photographs.

6. Considering the feasibility – in terms of amount of resources, costs, duration – and the potential impact – how likely they will allow you to achieve your objective – , prioritise your activities, giving more priority to those identified as more feasible and with more impact. After this, rearrange the actions and related information in descending order or priority (more priority on top) along the vertical axis in

the box "Actions: what are we going to do that: 1) is aligned with the objective; 2) and has concrete and measurable outputs?".

7. To close the activity, ask the groups to share and present their work with the rest of the class.

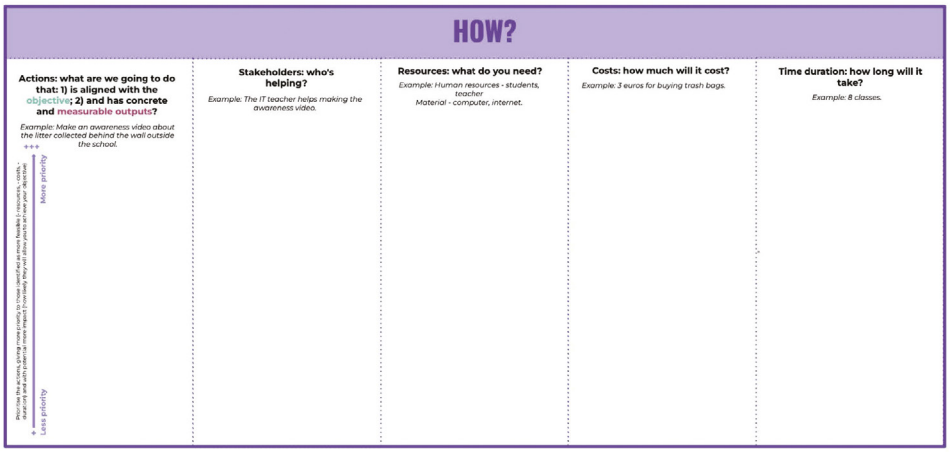


Figure 5.38: Section "How?" from the canvas "Develop and plan the project".

Figure 5.39: Section "Did it work?" from the canvas "Develop and plan the project".

Activity 10: Developing and planning the project: Section "What and how to communicate?"

HOW?

Firstly, each group will define a communication action for each of the actions defined in the section „How?", by using different formats and channels for project sharing. Secondly, the groups will have a practical exercise which consists of writing a social media post about this training program on Open Schooling. In the end, each group presents their post and discusses good practices on communication, particularly in the school context.

WHY?

- Promoting the dissemination of the project among the school/local communities, transmitting knowledge about it and facilitating the involvement of these communities in the project.

HOW LONG?

1 hour 30 minutes

MATERIALS:

- *Pack with editable and non editable files – "Developing and planning the project: section "What and how to communicate?""* (all images depicted below are included in the files)

RELATED CONTENT FROM OPEN SCHOOLING MANUAL FOR THE CITIZENSHIP AND DEVELOPMENT DISCIPLINE:

- *"Dissemination and involvement of the school/local community in the Citizenship and Development project"* [Portuguese]

STEP-BY-STEP:

1. Start by explaining that this last activity will be dedicated to the section "What and how to communicate?" and will consist of two parts: in the first part, each group will define a communication action for each of the actions defined in the section "How?"; and in the second part, the groups will have a practical exercise which consists of writing a social media post about this training program on Open Schooling.

2. For each project action, ask each group to define and write down in the respective boxes: 1) the message they want to communicate (box "What are we going to communicate"); 2) the target public, for example, teachers, students, local community (box "To whom are we going to communicate"); 3) the formats (text, poem, song, video) and channels (newspaper, social media, radio) on how they want to communicate their message, which will be very dependent on the target public as well (box "Which communication formats and channels will we use"); and 4) who could help them disseminate their message (box "Who do we know that can help us spread the communication").

3. After completing the canvas, ask each group to share one communication action with the rest of the class.

4. Then, it's time to create a social media post about the experience that learners had during this training program on Open Schooling. For that, ask each group to do the same exercise as in 2., but now knowing that the channel used will be a social media channel. However, groups still need to define which channel will be used (Facebook, Instagram, TikTok, Youtube, etc).

5. Finally, let each group present their post and promote a discussion about good practices on communication, particularly in the school context.

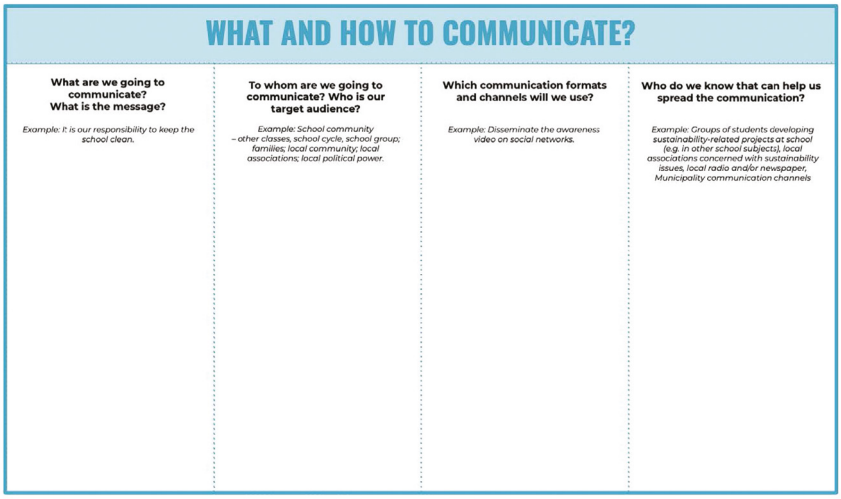


Figure 5.40: Section "What and how to communicate?" from the canvas "Develop and plan the project".

Credits: This activity was developed by OSHub Portugal, in collaboration with teachers of the discipline of Citizenship and Development, from the school group of Figueira de Castelo Rodrigo.

SESSION TITLE

Open Science Hub Board

ACTIVITY IN A SENTENCE:

A co-creation tool to get familiar with the Open Schooling methodology and to identify themes, resources and stakeholders involved in implementing a programme in the local community. The tool has been adapted from the Full Stack Tool Board, developed by IAAC, Barcelona.

DISCIPLINES INVOLVED IN ACTIVITIES:

Management, Pedagogy

RECOMMENDED AGES:

18+

LEARNING ENVIRONMENT (CONTEXT SETTING):

Class, meeting room, virtual room

LEARNING OUTCOMES:

- Will understand the key elements of open schooling
- Can relate specific stakeholders and resources from their community or their experience of the categories in this framework
- Can think of examples in different contexts when they read the description of cards in each category
- Will be able to use the open science hub board to assess their activities

RECOMMENDED EXPERTISE:

- Facilitation
- Open Schooling
- Education

SDG LINKS:

- **Goal 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- **Goal 11:** Make cities and human settlements inclusive, safe, resilient and sustainable
- **Goal 17:** Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

TIME IT TAKES TO COMPLETE:

90 – 120 minutes

MATERIALS / RESOURCES NEEDED:

- White Board or Miro (virtual) board
- Cards (Found on Miro)
- Tables and chairs
- Screen and internet connection

CONTENT FOR LEARNERS:

- The *Miro board can be shared or printed as a PDF*

TIPS FOR SCALING FOR DIFFERENT AUDIENCES:

The activities described in this training program can be adapted both to formal and non-formal educational contexts, depending on the educator's objectives and needs. Also, although the activities of this training program were carried out sequentially, they can be used independently, and with a different order than the one proposed here. Note that some resources are in Portuguese, so translation may be required.

Activity

Introduction:

The Open Science Board is a board game to introduce educators, students and Open Science Hub practitioners to the Open School methodology. Participants work in groups of at least three members for a maximum of 6 groups.

They mimic the process of setting up an Open School programme and participants go through the different steps of the implementation, identifying the required resources and relevant stakeholders.

To start with, participants decide a topic related to SDGs and have access to inspirational cards of already developed Open School programmes (via the *Miro board*). The more "open" the activity is, the more tokens and chips can be achieved. Time permitting, we advise to carry out one "demo" round all together and then split the group into teams for the second and third rounds.

Part 1: Getting familiar

- Check the OSHUB cards (orange – see Figure 5.42) and choose one topic that you are working on or interested in. Place it on your board.
- Check the Inspiration cards (green – see Figure 5.42) and choose one that you like and that corresponds to the chosen topic. If you don't know the project, google it to find out more. Place it on your board.

Part 2: Shape your activity

- Write your activity on a white card and place it on the board. The activity must relate to the chosen topic, and should be an Open Schooling activity. More information can be found on the Miro board. Example of activity: *'Our Coffee Culture'*
- Which stakeholders do you have? Choose one or more stakeholder cards and place them in the box next to the white card.
- Which resources do you have? Choose one or more resource cards and place them in the box next to the white card.
- Is your activity contributing to scientific research? Is it creative and financially sustainable ? If so, pick a OSHUB token from the pile and place it next to the white card.
- Add a new white card and repeat steps 2.2, 2.3 and 2.4.

You can find images of the Miro-Board layout and cards at the end of this section.

Part 3: Count your points

Is your activity complete, have you added a token, or were you the first to complete a line? Then let the others know by placing a book chip on the OSHUB board!

Part 4: Again!

Choose another topic and repeat Parts 1, 2 and 3.

Part 5: Share what you learned

- Allocate 5-10 minutes per group (depending on the number of groups) to share what they learned or discussed during the exercise. The format is a simple roundtable with one speaker per group.
- Give 10 minutes if there are less than four groups, but only 5 minutes if there are more than four.

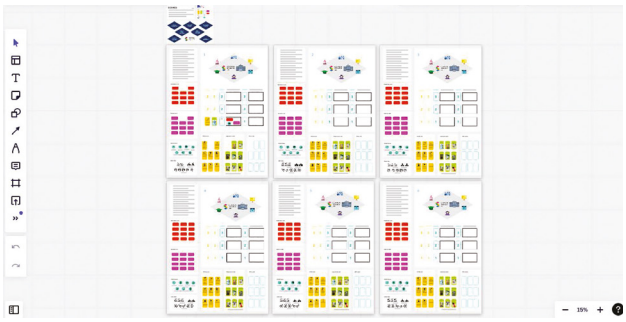


Figure 5.41: Overview of Miro Board. Credit: IAAC Barcelona.

Figure 5.42: Close up on OSHub Cards and Inspirational Cards. Credit: IAAC Barcelona.

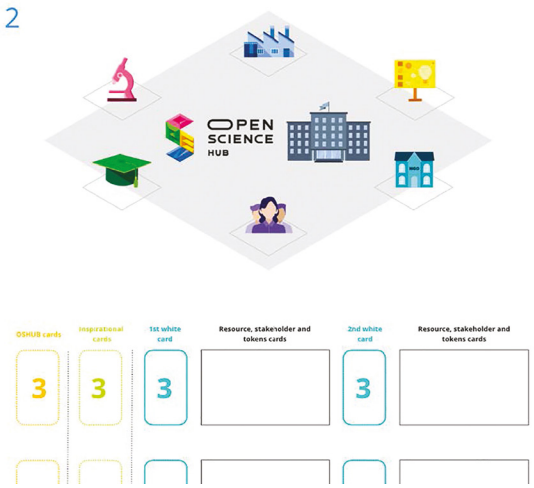
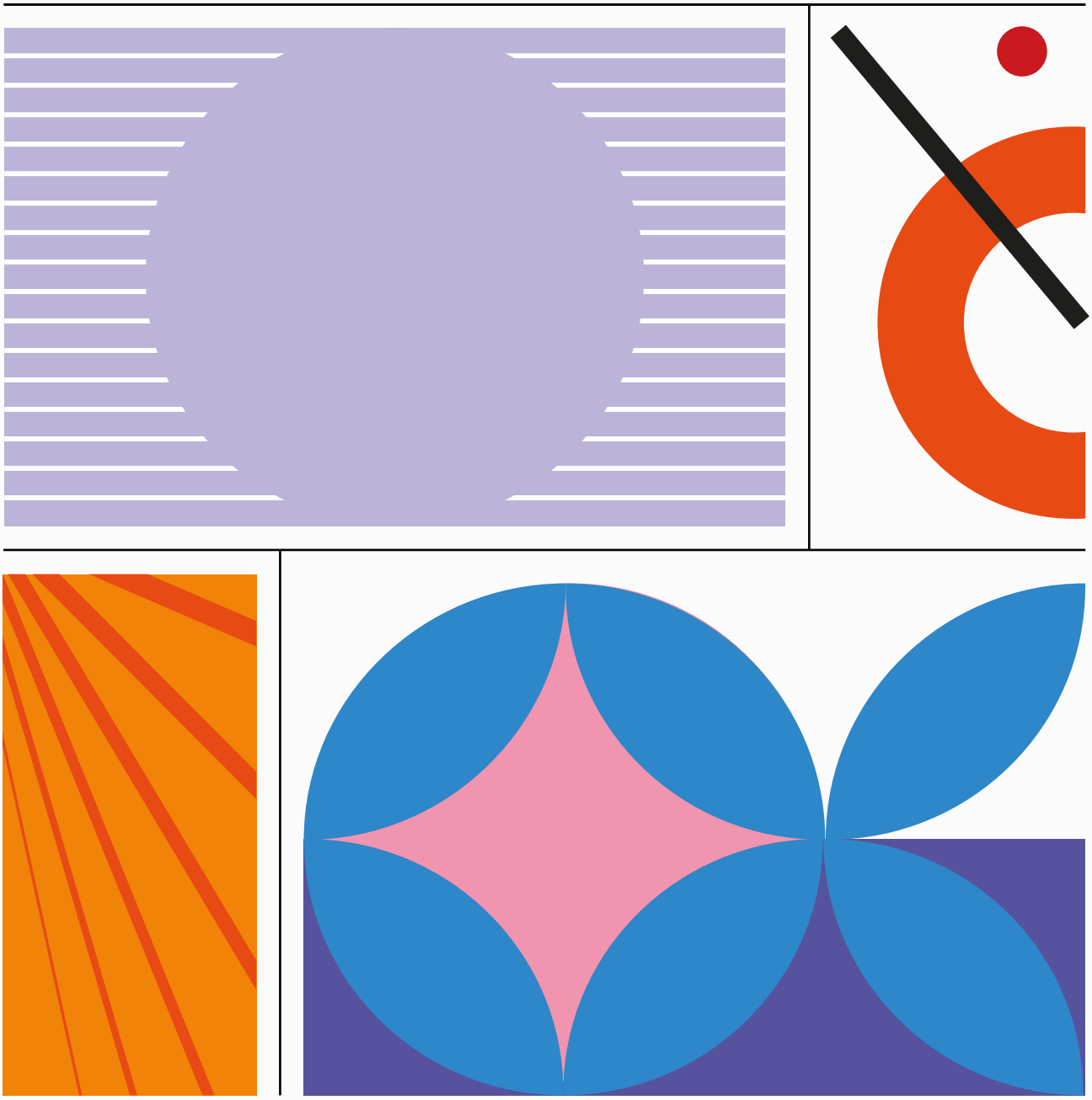


Figure 5.43: Close up of game board. Credit: IAAC Barcelona.

Credit: This activity was adapted from the Full Stack Board Tool, developed by IAAC, Barcelona. Adaptation was carried out by Onl'fait Makerspace, OSHub Switzerland.

Impact Evaluation Toolkit

06



This section is aimed at educators and educational coordinators wishing to evaluate activities associated with Open Schooling practices. It is a guide to creating an evaluation approach for such projects and programmes, and includes descriptions of different evaluation forms so that educators can accurately choose the form which suits their needs.

This section contains a set of five methodologies. Each method is explored in practical detail and accompanied by an OSHub case study, so that the reader may see how it was implemented, thus acting as inspiration for adaptation.

6.1 What is Evaluation?

Evaluation is a process that determines, using a systematic evidence-based approach, whether a project has met its aims and objectives. In doing this, it also provides a deeper understanding of what worked well across a project and what could be improved. Evaluation involves continuously collecting and documenting information throughout a project, as well as reporting findings, sharing final outputs and disseminating outcomes of the project.

Evaluation is not about highlighting successes; instead it is a structured and replicable way of identifying both the positives and negatives that may arise over the lifetime of a project . These results inform the project development and underscore aspects of the project that could be improved. Evaluation also creates an invaluable opportunity for stakeholder reflection both internal and external to the project.

Evaluation is an iterative process. When utilised consistently, it will shift and shape the parameters of a project as it develops, allowing a project to remain dynamic and responsive to multiple stakeholders. Evaluators will encounter new questions, alter methodologies and seek new participants. It is an integral process that should continuously inform the project.

6.1.1 Evaluation of Open Schooling

In Open Science Hub we aim to understand the value and impact the project has had for and on its audiences, including students, teachers, stakeholders, local and wider communities. Developing a robust evaluation strategy enables us to successfully identify and focus on specific priorities that are important to the project, the partners, and the stakeholders. Some of these priorities include; community development, relationships between stakeholders, the level and types of innovation, the interest that learners have in science, citizenship education, and the challenges faced in the implementation of Open Schooling projects.

Evaluation can assist and inform project design by determining and ensuring that the methodologies and initiatives developed are accessible, inclusive, and robust over time. Evaluation also encourages project leaders to critically reflect on the real value, relevance and meaning of the work carried out, and to identify potential points for further development and scaling of the project.

6.2 Preparing an Evaluation

The evaluation process is essential to the success of projects, programmes and businesses alike. In this section, various forms of evaluation are outlined and the crucial elements of an evaluative framework are highlighted.

6.2.1 Forms of Evaluation

Evaluation can take many forms, depending on project context, aims, and limitations. Various methods are often combined within a project's evaluation framework to broaden its scope and ensure the validity of results. OSHub's evaluation framework applies a mixture of reflective, outcome, and process evaluation methods.

- **Auditing Evaluation**

  Implemented at various stages of the programme depending on the programme's needs. This approach is often highly specific and the outcomes and outputs are measured against a strict rubric. Quantitative indicators are most commonly relied upon for auditing evaluation.

- **Summative Evaluation**

  Conducted after the completion of a programme, or at the end of a programme cycle. It generates data on the efficacy and/or efficiency of the programme's outputs and outcomes in relation to its target audience. It is useful in quantifying the project's effects on participants.

- **Formative Evaluation**

  Implemented before the programme begins. It generates data informed by the needs of the programme and continuously evolves during a project through baseline monitoring. This approach identifies areas for improvement and provides insights on programme priorities . This helps managers to determine areas of focus.

- **Reflective Evaluation**

  Typically conducted at the end of a programme, but can also be implemented throughout. This approach collects personal and emotional responses to a programme. It is useful in identifying how those involved connected with the programme, its topics, and implementation.

- **Outcome Evaluation**

  Typically conducted during the programme. It aims to generate data on the programme's outcomes and the influences the programme has had on those outcomes. It is useful in measuring the programme's areas of effectiveness.

- **Impact Evaluation**

  Evaluates the entirety of the programme, with a focus on the long term effects. It is usually implemented after the programme has ended or at specific time intervals.

- **Process Evaluation**

  Implemented at the beginning of the programme. It measures how effective and efficient the programme's procedures are. The data it generates is useful in identifying inefficiencies and streamlining processes. This helps to avoid potential issues and ensure project effectiveness.

6.2.2 Evaluation Framework

An evaluation framework sets out an approach to measuring particular outcomes, including choosing the aims of the evaluation, identifying indicators, planning data collection, analysis, and sharing results. Evaluations require stakeholder input and resources, therefore detailed planning is important from the outset. Each OSHub case study and corresponding evaluation method is outlined in this handbook according to this framework.

Step 1 – Understanding the objectives

The first step in developing an evaluation framework is understanding the objectives of the project. Critical questions to consider include:

- What do you want to achieve?
- How are you going to achieve it?
- Who needs to be involved?
- Where/When is this going to happen?

Understanding these early on will provide a clearer understanding of the framework.

Step 2 – Establish indicators of success

An indicator is something that can be measured over the course of the project, or compared from the beginning to the end. Establishing indicators early on is a critical exercise to conduct, though it is important to keep in mind that these indicators may change and evolve with the project. Indicators should be SMART[8]:

- **Specific:**

  The indicators should be well defined and not leave room for interpretation. e.g. "Students will improve their skills over the course of the programme" is not sufficiently specific. "Students will improve their digital skills over the course of the programme" is more concise.

8. Identify SMART indicators. (n.d.). Colorado State University. Retrieved 7 October 2022, from https://extension.colostate.edu/docs/staffres/program/Identify-SMART-Indicators.pdf

To move from a goal to an indicator, a pathway to providing evidence should be mentioned e.g. "Students will improve their digital skills over the course of the programme, and demonstrate these by writing a piece of code using Python."

- **Measurable:**

  The indicators should be quantitative, but qualitative data may also be collected. Qualitative data can be converted to quantitative using a method called 'Coding' – a method of organising data to identify repeating themes or ideas. A code is assigned to a response depending on its content, and after the data has been analysed, the frequency of each code can be measured. See Step 7 for a more detailed explanation.

  Eg. The goal of the evaluation is to see if all students improved their digital skills. Qualitative data collected is interviews with students discussing the skills they felt they developed. A quantitative indicator is the number of students who mentioned digital skills in their answer.

- **Attainable:**

  Goals should be realistic and measurable within a given timeframe. Every participant or stakeholder may not get involved in the project, but sufficient data may be derived from a subset of these.

  Eg. Data must be analysed within one month of the end of the project, and 80% of students that participated in the project must be interviewed.

- **Relevant:**

  The goals and indicators of the evaluation should align with the long-term aims of the project while upholding the beliefs and integrity of the project.

  Eg. The overall objective of the workshop is to provide students with skills required for scientific research. One of these skill subsets is "explaining scientific phenomena", which the goal and indicator are related to.

- **Timely:**

  Indicators be reflective of current affairs and challenges surrounding the project at the time of collection.

  Eg. Digital literacy is low in students attending the workshop, however with current advances in technology within society, improvement in this is vital.

Step 3 – Question development

Once the indicators have been established, the next step is deciding on the questions that will be used to measure the indicators. These questions can be either quantitative or qualitative in nature.

- **Quantitative Questions**

  Quantitative questions generate results that can easily be described through numerical data. They can be useful in measuring amounts (e.g. how many participants grew up in a rural or urban community), frequency (e.g. how often a participant has visited a particular museum), or to get a general overview of agreement or satisfaction through use of a scale (eg. 'On a scale from 1-5, with one being the lowest and five being the highest, how informative was the workshop for you?'). This type of scale is sometimes called a Likert scale.

  Quantitative questions should be carefully worded in order to prevent or mitigate misinterpretation. The answers available to the participant must be exact, such as a yes/no, a number for frequency, one answer from a discrete set of possibilities (multiple choice), or a number that indicates positioning on a scale related to the statement provided.

- **Qualitative Questions**

  Qualitative questions are used to gain a more detailed understanding of a phenomena, with answers that are not as straightforward as a yes/no or a numerical value ; these allow for participants to give more detailed descriptions of their experiences. Open ended survey and interview questions, as well as questions that probe specific domains of a participant's experience (e.g. 'Can you describe how your confidence in the subject changed during the programme?') generate qualitative data.

Step 4 – Choosing the right evaluation method

The evaluation method should be determined by the information desired, the general ability of participants, the resources available, and most importantly, the time allowed.

In this section, a number of different evaluation methods that were used during the OSHub project, and which can be adapted for open-schooling practices, are presented:

- **Surveys / Questionnaires**

  Pre – and post-, providing quantitative data from before (pre) and after (post) the programme.

- **Semi-structured Interviews**

  Periodic interviews that happen once or twice throughout the programme, which provide qualitative data through the use of open questions. Semi-structured refers to an approach that the researcher has created or structured a predetermined set of questions. It can be somewhat scripted but the interviewer is able to be responsive to their interviewee, and has the freedom to follow up on threads of conversation which are particularly pertinent to the project.

- **Skill Archive**

  A two-question structured survey provided to learners at various time points throughout their project. It provides quantitative and qualitative data.

- **Zines**

  Creative reflective diaries that yield highly detailed qualitative data based on learners' perspectives and experiences. These small diaries can contain both text and image-based data.

Section 6.3 below provides an overview of each of these methods, including a case study detailing how each method was implemented as part of the OSHub project.

Step 5 – Implementation of method – gathering data

Once the methods have been chosen, questions formulated, and resources gathered, the next step is implementation. Good facilitation is an important component of evaluation. In some cases, the designers of the evaluation (e.g. researchers or programme directors/coordinators) might not be able to be on location, and so responsibility for collecting evaluation data might fall to teachers, workshop facilitators, or others involved in the programme. These facilitators should be informed of the evaluation timeline, methods, and points of contact, and be prepared to answer participant questions on the subject, or to direct participant questions appropriately.

Step 6 – Privacy and consent

When carrying out an evaluation, it is integral to consider consent, data protection and privacy regulation, and how these will affect the collection, storage and presentation of data. It is fundamentally necessary in the EU to follow General Data Protection Regulations (GDPR) and to adhere strictly to these guidelines.

When carrying out an evaluation, informed consent must be obtained from the participants (or their legal guardians if they are under a certain age) to store and use their data for a specific purpose. Consent can be given either verbally or in writing, but it must be recorded. Before collecting consent from participants it is essential that they are informed, either verbally or in writing (though ideally both) what data will be collected or how this data will be used. If the data is to be used for means other than those described to the participants, consent must then be renewed before the data is used.

When collecting and storing data, it is important to go through the process of anonymisation so that the participants cannot be identified. Names are not the only way a person might be identified, so multiple elements may need to be anonymised. For example, if every teacher in a school has been interviewed, but only one teacher is female, and only one is under 30, then either the gender and ages of the teachers must be anonymised, or the school itself.

As a rule of thumb, only seek essential information. This serves to lessen the workload and ensures you are not saving unnecessary and possibly sensitive data. Furthermore, data must be stored and processed in line with institutional, national and international regulations. Most organisations have Data Management Plans, and personnel responsible for secure management and storage of data – evaluators should work with those responsible within their organisation to ensure all data is properly managed.

These are general guidelines, but it is essential to check and align with local, national and international regulations around data, privacy and consent.

Step 7 – Analysing the data

After collecting the data, the final steps of the process are organising, analysing and sharing the data. In this regard, quantitative surveys are typically simplest, as graphs can be generated directly from the collected data. Qualitative data can be a little more complex as the data has to be coded and analysed. Creative evaluation methods, which ask for participants to describe their experience in alternative ways to answering questions (e.g. zines, art-based mapping, photograpahy), can be even more complex, as a rubric for particular indicators must be developed. An example of this can be found in ection 6.3.2 (table 6.5).

When analysing the data, it is helpful to commit to a methodology that is simple, easy to follow and succinct. While there are many approaches to analysing qualitative data, thematic analysis is an adaptable and reliable approach. Braun and Clarke (2006[9]) describe the process of thematic analysis as searching across a dataset to identify patterns of meaning. They outline six key phases:

- A. Familiarisation with the data
- B. Generating initial codes
- C. Collating codes to search for themes
- D. Checking themes against coded data
- E. Defining and naming themes
- F. Reporting

9. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

In Step B, generating codes involves labelling and organising your results into different categories and subsequently identifying themes and patterns within them. To do this, a codebook is required, which describes a specific idea or indicator of interest to the project, and the corresponding codes that will be assigned to segments of the data which demonstrate or enact those indicators. – For example, a quote from a learner who says *"I loved working with the others on my team to build the robot"* may be assigned to the code "collaboration" as well as "engineering skills".

A codebook should be written in a way that all evaluators going through the data should be able to apply codes and end up with similar categorisation. Biases can still occur, and therefore it is important that there are at least two coders involved to reduce the influence of one person's perspective. To reduce bias even further, coders should check their intercoder reliability on a subset of the data. They can do this by each coding the subset and comparing the results. This simple test will reveal whether th codebook needs to be refined for clarity . Intercoder reliability can be measured using a number of statistical methods. For more information on how to ensure intercoder reliability, see *this website*.

Coders should go through the data more than once, as codes may change or new ones arise as the data is organised. For further reading on coding, see *The Coding Manual for Qualitative Researchers* (Saldaña, 2013[10]).

Following the coding stage, the codes can be gathered together to form overall themes – for example, codes "collaboration", "communication" and "confidence" may be grouped together as one theme related to "interpersonal skills", while "engineering skills", "scientific content knowledge", "digital skills" and "mathematical reasoning" may be grouped together to demonstrate a theme around "STEM disciplinary knowledge and skills".

As cautioned by Braun and Clarke (2020)[11] it is important to remember that generating codes and themes is not enough to analyse qualitative data. he key step in thematic analysis is the one in which the researcher infer meaning from the themes that they have generated from the dataset. It is also important to remember that themes do not "emerge" from the dataset – they are generated by the researcher, and influenced by the researchers' own knowledge, and experiences – two different researchers may generate different themes from the same data. Again, inputs and perspectives from multiple evaluators/researchers can be useful in mitigating biases and reaching a reliable and actionable agreement on the meaning and relevance of the results.

6.2.3 Open Science Hub Evaluation – Case Study

The OSHub project provided the means to develop, test and implement evaluation techniques for open schooling practices. As a project with nine consortium partners across Europe, OSHub represented a unique opportunity to create methods that may be easily adapted in different contexts without losing meaning or impact. Below, the local contexts of each OSHub are outlined and the evaluation approach used to measure a number of project outcomes, both locally and at the consortium level, are described.

10. Saldaña, J. (2013). The coding manual for qualitative researchers (2nd ed.). London: Sage.
11. Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis?. Qualitative research in psychology, 18(3), 328-352.

6.2.3.1 Local OSHub Contexts

The objectives of each OSHub, while in keeping with the principles of open schooling, were specific to the needs of their local community and partners. The evaluation methods outlined in this handbook were implemented for a number of these hubs, and therefore when considering their findings, it is important to consider the disparate contexts in which each OSHub is situated. Table 6.1 provides an outline of the goals of each participating OSHub and their context.

Table 6.1: Local contexts and goals of each OSHub.

OS-HUB	LOCAL GOALS AND CONTEXT
Austria	• To tackle community need for digital literacy in regional schools and schools where students come from low socio-economic backgrounds. • To give agency to young people in determining the roles that humans and machines will play in the future. • Aligns with the Digital Humanism mission of OSHub partner Ars Electronica.
Czech Republic	• To establish a school-led form of education, which engages students, teachers, parents and various local actors for knowledge-based community development • To tackle environmental, historical, cultural, and socio-economic issues faced by local communities. • To build relationships and networks between different levels of stakeholders concerned with sustainable development of local communities.
Ireland	• Student retention in Delivering Equality of Opportunity In Schools (DEIS) schools in socioeconomically disadvantaged areas. • Increasing youth leadership skills. • Student co-creation: challenges defined during the process by the students. • Showcasing future life opportunities for students. • Building / strengthening school relationships in a pandemic. • Tackling *SDGs* with the local community and emphasising the role of science in society.

France	• A neighbourhood with social and economic difficulties that increased due to the pandemic. • Surge of violence • Helping students to develop their knowledge, their feeling of being an active part of their community ("well being together"). • Capacitate teachers and stakeholders with fabrication skills. • Promote connections and collaborations between local partners and schools.
Greece	• Lemnos island: geographically isolated and with less access to STEM opportunities. • To create tangible projects that address real issues in Lemnos. • To create a live network between school and local stakeholders. • To drive student and teacher engagement in STEM education. • To increase student awareness of SDGs and environmental issues in Lemnos.
Netherlands	• Educational inequality; pupils falling behind in their academic, creative and emotional development. • Increased teacher workload due to teacher shortage. • Social/economic disadvantaged neighbourhoods in the Hague, with increased challenges due to COVID-19 pandemic.
Portugal	• Low population density territory in the border between Portugal and Spain • Reduced citizen participation and low collaboration between partners and school • Low connectedness between students and research & innovation • Low digital literacy of students and teachers • Low motivation, autonomy and confidence of teachers for more open and collaborative approaches
Switzerland	• Making: strengths and technical competences of OSHub partner Onl'fait • Interregional: located at the border with France • Sustainability: key issue identified by Department of Public Education; recently introduced in school programmes • Collaboration: schools looking for collaborative / applied projects; engaging with science and technology; inspiration about careers

6.2.3.2 OSHub Evaluation Approach

So, how do you evaluate an open schooling project with various partners, stakeholders and objectives involved? The solution initially adopted by the OS Hub project was to evaluate at three different levels: 1) The consortium, 2) the school network, 3) the learners. Each level had different outcomes to be measured and involved different actors. Therefore it was necessary to evaluate these separately to ensure meaningful findings could be formulated. By centering the evaluation approach on these three levels we developed further evaluation tools in order to obtain an in-depth and holistic view of each level and the ways in which they functioned together to support open schooling practices.

Level 1: The Consortium

The first of these levels examined the European network-wide consortium of nine partner institutions: University Leiden (NL), Science Gallery at Trinity College Dublin (IE), Impact Hub Siracusa (IT), Onl'fait (CH), Ars Electronica (AT), CCSTI de Grenoble – La Casemate (FR), ESA-ESERO Česká Republika (CZ), Plataforma de Ciência Aberta-MFCR (PT), and SCICO (GR). These partners represent a range of institutions across Europe, and as such, interacted with different audiences with a variety of cultural backgrounds. Each partner tackled projects with their local stakeholders, including learners, that related to specific socio-economic, cultural and environmental challenges in their communities. This cohort provides insight into the progress of the overall project, the development at each stage, project sustainability and insights into resource management, and training requirements. We also evaluated the processes of communication and collaboration between the partners of the OSHub.Network.

Level 2: The School Network

The second level focused on the bridge between local OSHubs and the learners: the schools and teachers. It was essential to gain a deep understanding of the effects an OSHub can have on participating teachers, without whom the local networks would not exist. The teachers' experiences with OSHub resources were evaluated. We also sought to understand the ways in which these resources, teachers' professional development, and best practices worked together, with a particular focus on the teachers' views on open schooling and the aspects which they felt were most important to improving the experience of learners

Level 3: The Learners

The third level evaluated the individual OSHubs and their projects and programmes. Focus was placed on investigating participant experiences (specifically the experience of learners) within each OSHub project.

The OSHub evaluation approach aimed to investigate students' skills and competencies as they developed over time, the relationship students are developing with science in society, and their engagement with their OSHub and community. Students were assessed on their experiences in workshops and throughout the project development. This was explored through pre – and post – questionnaires, alongside continuous reflection throughout the programme using the skill archive and learner-led zine creation.

6.2.3.3 Research Instruments

To complete the evaluation of the OSHub.Network project at the three levels described above, a set of evaluation instruments were developed and used. It is important to note that many of these techniques were deployed via different formats from partner to partner, and those detailed in this handbook are meant to serve as examples for guidance. The evaluation methods described are flexible and modular; they can be implemented at various times, and in various ways. The protocols are not overly restrictive , as we worked with a very diverse group of learners and coordinators.

These instruments provided OSHubs with an adaptable means of evaluation to capture the experiences, feedback, thoughts and needs of partners, stakeholders, and students throughout the OSHub Network. They also informed the overall project management as well as necessary future actions to ensure the project's future sustainability. They were created as a form of approachable evaluation, intended to ease the pressure on learners and coordinators to spend excessive time working on the evaluation, allowing the evaluation methods to be easily applied in different settings.

The variety and accessibility of these evaluation instruments allowed for a homogeneous evaluation approach across multiple aspects of the OSHub.Network. These instruments also allowed the consortium to adapt their processes by identifying the needs of partners or participants and providing further resources as needed.

Table 6.2 provides an overview of the various instruments outlined in the next section along with their corresponding level, the actors involved and the type of data generated by the instrument.

Table 6.2: Evaluation tools and their corresponding levels.

LEVEL	EVALUATION TOOLS	WHO IS INVOLVED	TYPE OF DATA
1.Consortium	Coordinator Interviews	OSHub Coordinators	Transcripts – Qualitative
2. School Network	Teacher Evaluation	Teachers of students taking part in OSHub project	Transcripts & written reflections – Qualitative
3. Learners	Skill Archive	Students	Counts of skills – Quantitative / Short reflections – Qualitative
3. Learners	Pre/Post STEAM Relationship Surveys	Students (can also be used for teachers)	Quantitative
3. Learners	Zines	Students	Creative reflections – Qualitative

6.3 Evaluation Methods

As described in Table 6.2, this section contains five evaluation methods utilised to measure outcomes for the three levels identified for OSHub evaluation. For each evaluation method, we will include the following:

- **Introduction:**

  A general introduction to the method and an overview of possible outcomes it can be used to measure.

- **Implementation:**

  An explanation of how to implement each method, with a focus on evaluating open schooling practices.

- **Evaluation:**

  A description of how to analyse the data gathered (eg. use of codebooks, indicators).

- **Open Science Hub Case Study:**

  An overview of how the technique was used in the context of the OSHub project including specific findings and discussions on the use of the method.

The results described in the case studies below are from some of the OSHubs outlined in Table 6.1. As mentioned before, the evaluation methods outlined here can be adapted to suit the needs of any open-schooling project. Resources developed during OSHub have been added as an example, but how you collect and organise your data can be decided upon by you and your team.

6.3.1 Coordinator Interviews (Level 1: The Consortium)

In Open Science Hub we aim to understand the value and impact the project has had for and on its audiences, including students, teachers, stakeholders, local and wider communities. Developing a robust evaluation strategy enables us to successfully identify and focus on specific priorities that are important to the project, the partners, and the stakeholders. Some of these priorities include; community development, relationships between stakeholders, the level and types of innovation, the interest that learners have in science, citizenship education, and the challenges faced in the implementation of Open Schooling projects.

6.3.1.1 Introduction

Interviews give voice to participants, offering an alternative way to express their knowledge, experiences, concerns and needs as opposed to the closed-ended format of questionnaires. Interviews come in three basic forms; structured, semi-structured and unstructured. Structured and semi-structured interviews follow a set of predetermined questions, where the former follows the questions more rigidly, while the latter allows new directions and questions to be introduced depending on the responses of the interviewee. Unstructured interviews do not follow a set of predetermined questions.

In the case of our open schooling interviews, we focus on semi-structured interviews, which were designed to capture different aspects of the partners' experiences, potential future goals, and their unique opinions on open schooling.

The questions are open-ended to allow the interviewee to express the information they felt was most important with little restriction. However, it is important that the questions were developed in line with the goals and indicators of the overall evaluation.

6.3.1.2 Implementation

Some key indicators that would be useful to consider within an open schooling project in might include references to;

- School engagement (positive and negative)
- Stakeholders which may include local authorities/ local organisations/ ministries of education) (positive and negative
- Local community sentiment
- Strength of OSHub community or consortium relationship
- OSHub value propositions (links to open schooling, open learning, open science hub, SDGs)
- OSHub specific activities (workshops, events, trips etc.,)
- Feasibility, technical and financial considerations
- Skills adopted or developed by students
- Skills adopted or developed by teachers
- Inclusivity, equality, and accessibility of the project

Coordinator interviews can be conducted in two ways. The questions can either be sent to coordinators as a digital questionnaire to answer, or the questions can act as a guiding script for an interview with coordinators. It is essential that the interview is recorded and transcribed, or that there is someone available to take detailed notes.

The interviews can be conducted in person or using a video communications software. If the interview is being recorded, the interviewee must be made aware of and subsequently consent to the recording. Interviews should not last too long, although with the open-ended format, interviewees are encouraged to speak openly, for as long as they wish, so time duration will vary per participant.

It is useful to carry out interviews at multiple times throughout the project (e.g. at the end of each year) to track the evolution of the coordinators' views throughout the project. Yearly reviewing also allows for adaptations to be made to improve the project, while supporting the identification and resolution of issues that may arise along the way.

6.3.1.3 Evaluation of results

Once you have identified the main points made within the coordinator interviews, it is important to then organise the data so that you can come to reliable and actionable conclusions. For instance, noting when and how often a specific indicator or idea appears (using the codebook) will give you a better indication of the coordinator's attitude towards different elements of the project.

The data should be analysed two or three times as the codebook may also need to be updated as the data is analysed. As mentioned previously. there should be a second coder who goes through the same data with the same codebook in order to reduce bias in the results. In the case study below, an example of a codebook is shown.

6.3.1.4 OSHub Case Study

Goals and Indicators

Table 6.3 shows an outline of the objectives of the coordinator interviews, and the indicators used to measure these.

Table 6.3: Goals of the OSHub coordinator interview evaluation and corresponding indicators.

OSHUB GOALS	INDICATORS
Develop a international network between OSHubs.	Comments regarding formation, development and strengthening of international collaborations and relationships between an OSHub and another entity.
Develop a network between local OSHubs and their local stakeholders.	Comments regarding formation, development and strengthening of local collaborations and relationships between an OSHub and a local stakeholder.
Develop a sustainable network that share OS resources.	Comments regarding resources, activity, process that allow for long term engagement & sustainability.
Develop a process of working that allows for successful implementation of open schooling.	Comments regarding activities, actions resources that facilitate open schooling.
Assist technically and financially to implement open schooling.	Comments regarding providing technologies, resources and financial aid to participants.
Evaluate the impact OS has on it participants.	Comments regarding notes of the impact open schooling has had on its participants.
Address issues of local community relevance related to the global SDG.	Comments regarding the effect open schooling projects has had on needs of the stakeholders local communities.

Questions for Participants

1. **What were the 3 most important additions to your local open science hub network?**
    a) How did you manage to grow your network?

2. **Did you feel like you had adequate support or training from the Open Science Hub project consortium?**
    a) Did you use any of the tools from the consortium?
3. **Thinking about the original aims and objectives of your OSHub, were you satisfied with the final outcomes?**
4. **What do you feel have been the most impactful outcomes of the Open Science Hub project both locally and internationally?**
5. **Will the Open Science Hub Project continue next year?**
    a) If so, will it be different to this year, and how?
    b) If not, why not?
6. **Do you think there is a future for open schooling in education?**

Gathering data

Interviews were carried out with coordinators from the different OSHubs at the end of each year of the project. Each interview was semi-structured, lasted approximately 20 minutes, and was carried out online over video conferencing software.

The interviews we focus on for this case study were carried out at the end of Year 3 (2021/2022) of the OSHub Project, and involved four OSHubs.

Privacy and consent

All interviewees were asked for consent before the interview began. They consented to take part in the interview, to have the interview recorded, and for the results to be utilised in research outputs including conferences, papers and reports.. The results were anonymised and stored following GDPR. As there are only a small number of coordinators, it was important that any identifiable data was removed when presenting the results, to ensure that no data could be connected with a specific coordinator.

Data Analysis

In order to analyse the data collected, a codebook was created to identify indicators as outlined in the section 6.3.1.3 Evaluation. The breakdown of a subset of codes can be found in Table 6.4. Each code corresponds to a specific goal of the evaluation, which is associated with an indicator to measure. For the full table, see Appendix, Section 7.1.

Table 6.4: A snapshot of the codes used for coordinator interviews.

GOALS	CODE	EXPLANATION
Develop a network between international OSHubs and local stakeholders.	Networking / collaborating	Positive comments about increasing network or strengthening collaborations in already existing networks at an international level.
Develop a network between international OSHubs and local stakeholders.	Relationship building / building trust	Positive comments about developing relationships / trust in existing local networks e.g. between coordinators and teachers.
Develop a sustainable network that share OS resources.	Support	Positive comments regarding support offered by the OSHub consortium and management.
Develop a process of working that allows for successful implementation of open schooling.	Limiting the bureaucracy	Comments regarding the needs for action that allow for less bureaucracy to access community and stakeholders.
Assist technically and financially to implement open schooling.	Lack of resources	Comments regarding the lack of resources felt by schools and learners attending OSHub.

The above table represents how information provided in interviews can be transformed into information that can be readily analysed for evaluation. Once the data was organised, the evaluators began to turn the comments into coded items based on identified themes. The themes were related to identifiable goals/outcomes of the project. Below is a summary of five themes and corresponding outcomes identified using this method.

- **Sharing of resources:**

  The consortium provided tools to the local schools and associations they were working with, such as hardware (e.g. sensors), but also provided them access to new types of collaboration tools like Mural /Miro and co-creation methodologies for working on their projects. Partners mentioned that they received tools from the consortium too, such as co-creation and stakeholder management and evaluation methodology provided by TCD, and the self assessment and business canvas provided by Impact Hub.

- **Collaboration Locally / Local Needs / Issues:**

  Collaboration on a local level means schools becoming more connected to local universities, research institutes, and teachers. Making sure that teachers feel connected to the network is of utmost importance. Many partners commented that they aimed to strategically identify local stakeholders, such as associations that have similar goals and values , as they often lead to more productive opportunities.

- **Future of OSHub project in local area:**

  All partners plan to continue with their OSHib project next year. They have developed infrastructures that allow them to run similar projects in the future. Participation in the local network may vary depending on opportunities for projects and the type of local relevant challenges, however the initiative, desire, and preliminary plans for implementation are there. There is a particular drive to continue to design and implement more co-creation sessions inspired by activities from the OSHub project. A number of respondents also shared a vision for more international collaborations.

- **Value of Project:**

  The primary values that have been identified by the partners are focused on the utility of having the support and extra resources to develop projects in the local context in new ways and the impacts these projects have on the community. There are still questions around the long term impact of these individual projects. However, partners have developed a customised format where they can re-run projects with schools, which is also beneficial to the host hubs. They also provide a kind of scaffolding with which to imagine and design future projects. The coordinators also emphasised the value of these formats in addressing very specific community needs.

- **Open Schooling / Learning:**

  It is believed that open schooling has a very real future in education, as it allows students to both practically and creatively connect to local issues, organisations and opportunities. It also supports their exploration of new perspectives and approaches. In order to maximise positive impact, it is recommended that these projects be grounded in the value they i contribute to society. These contributions should be clear to the students as well, in order to make the most out of the learning potential for each project. . There must be contributions from both bottom-up (creators and educators in schools such as us) and top-down (government, policy makers, universities and public bodies) approaches to society in order to make open schooling become relevant and sustainable. The issues of relevance must be identified through bottom up approaches, and then supported by those with resources at the top.

Discussion

Positive takeaways

Semi-structured interviews provided participants the opportunity to freely express their knowledge and experiences, it allowed evaluators to push for more in-depth answers that would not be generated and available using quantitative questions or a structured interview format. The consortium provided a wealth of valuable information, such as how impactful each OSHub was in its community, whether they were able to meet their objectives, and what the future for both OSHub and open schooling in general could be. . There was overwhelming positive feedback regarding the experiences of the learners, teachers and consortium members throughout the project. The future outlook on open schooling and OSHub are positive overall. Partners stated that they planned to continue their OSHub initiatives but that strategies were still being defined with local stakeholders

Limitations

Interviews take time and resources to carry out. Even after the interview has taken place, it must be transcribed, coded and analysed (multiple times with at least two coders). Therefore, the planning and allocating of resources must be well defined before embarking on this type of evaluation. interviews also take the time of an interviewee, so you must be cautious to ensure interviews are no longer than the previously agreed time. Staff constraints and time commitments may change over the course of the project, so you may not be able to interview the same individual multiple times over the duration of a project. This was the case for OSHub.

During the first two years, all coordinators were interviewed, but in the final year, a number of staff changes meant that only four interviews could be carried out. Despite these limitations however, the data generated over time, that is to say through multiple interviews conducted with the same individual, is of particular value. These longitudinal approaches, even with a small number of interviewees, can provide a researcher with invaluable insights into the ways a projects' impacts may grow, diminish or change over time, along with the attitudes, and perspectives of the interviewees.

Recommendations

Semi structured interviews allow the interviewer and interviewee the freedom to explore unanticipated results.. Begin these interviews early on as you may uncover surprising or unexpected results, which is crucial for understanding novel projects. New indicators may arise during the interviews that have not yet been considered, but are highly useful for such evaluations.

6.3.2 Teacher Evaluation (Level 2: School Network)

6.3.2.1 Introduction

Semi-structured interviews are interviews with predetermined questions. They are more free flowing than surveys or structured interviews as they allow for diversion to new topics that may not be predetermined, and encourage the participant to provide detailed anecdotal evidence.

This method will focus on semi-structured interviews used to evaluate the experience of a teacher/facilitator within an open-schooling project. Teachers are in direct contact with learners and receive first hand experience of how they respond to the activities. They also must implement the activities, and therefore can provide important insight into what works, and what doesn't in practice. The questions should first seek to get an understanding of the learners' experience throughout the project and whether there were any positive or negative impacts on the learners, the teachers and the local school network. This includes knowledge acquisition, behavioural changes, skill and competency development, but can also be an assessment of their feelings towards open schooling methodology.

6.3.2.2 Implementation

Goals and indicators should be set out based on what you want to learn from the teachers, and therefore will likely be split into two sets; those focused on the learner's experience, and those focused on the teachers'. With this in mind, two sets of questions are also recommended covering the same topics. Participants should be asked to answer each section in as much detail as possible, providing reasons and evidence for their answers. Questions may have sub-questions/ secondary-questions below labelled as letters (a-c), these allow us to dive deeper. These can be used as a prompt when participants do not fully answer the question.

Some key indicators that would be useful to look out for with an open schooling project in mind would be any reference to;

- School engagement (positive and negative)

- Stakeholders (positive and negative)
- Local community (positive and negative)
- Any specific challenges/suggestions
- Open schooling value propositions (open learning, SDGs etc.,)
- Open schooling specific activities (workshops, events, trips etc.,)
- Feasibility, technical and financial considerations
- Skills adopted/developed by students
- Skills adopted/developed by teachers
- Inclusivity, equality, accessibility of the project

Teacher interviews can be conducted in two ways. The questions can either be sent to teachers as a form / questionnaire to answer, or the questions can act like a script for an interview for coordinators. It is important to make sure the interview is recorded and transcribed, or that there is someone available to take notes.

The interviews can be conducted in person or using a video communications software. If the interview is being recorded, the interviewee must be aware and consent to the recording. Interviews should not last too long, however with the open-ended format, interviewees are encouraged to speak as openly, long or short as they wish, so time duration will vary per interview.

6.3.2.3 Evaluation of results

When evaluating teacher responses, it is advisable to have an evaluation rubric/tool on hand to assist with identifying indicators within the data.

Once you have identified the main points made within the teacher responses, it is important to then organise the data so that you can come to reasonable conclusions. For instance, noting when and how often a specific indicator or idea appears will give you a better idea in terms of the teacher's attitude towards the different elements of the project. Use of a codebook is a beneficial way to organise and analyse data. See Step 7, Section 6.2.2

6.3.2.4 OSHub Case Study

Goals and Indicators

Below is an outline of the objectives of the teacher interviews, and the indicators used to measure these.

Table 6.5: Goals of the OSHub teacher interview evaluation and corresponding indicators.

OSHUB GOALS	INDICATORS
Evaluate the effectiveness of OSHub programme on the learners.	Comments regarding notes of the impact open schooling has had on its participants.

Evaluate the effectiveness of OSHub programme on the teachers.	Comments regarding notes of the impact open schooling has had on its participants.
Developing a sustainable network that shares OS resources.	Comments regarding resources, activity, process that allow for long term engagement & sustainability.
Develop a process of working that allows for successful implementation of open schooling.	Comments regarding activities, actions resources that facilitate open schooling.
Assist technically and financially to implement open schooling.	Comments regarding providing technologies, resources and financial aid to participants.
Address issues of local community relevance related to the global SDG.	Comments regarding the effect open schooling projects has had on needs of the stakeholders local communities.

Questions for Participants

Primary Questions have been numbered per each section (1-5). Participants should be asked to answer each section in as much detail as possible, providing reasons and evidence for their answers. Questions may have sub-questions/ secondary-questions below labelled as letters (a-c).

Learner-focused Questions:

1. **How did you feel the experience was for students / learners of the programme?**
    a) What benefits did you feel the learners had from taking part?
    b) Were there any negative aspects of the experience you think the students had?
2. **How did you feel the programme interacted with the school curriculum?**
    a) Did you feel it complemented or impeded on the curriculum?
3. **Did you feel the programme was accessible, diverse, inclusive and equitable for learners?**
    a) Were there any sections of the programme that you feel had accessibility issues for the learners?
    b) If you think there were accessibility issues for the learners, how do you feel these could be overcome?
4. **What do you feel was the most significant change for the learners over the course of OSHub?**
5. **Do you have anything else to add regarding the students' experience of OSHub?**

Teacher-focused Questions:

1. **What was your experience from taking part in the programme?**
    a) Do you feel like the programme benefited you in any way? (e.g. Did you learn anything ? / Get resources? / Improve your practices? / Increase network?)
    b) Did the programme impact you negatively in any way? i.e. Were there any drawbacks or complications to taking part?
2. **What skills do you feel you used most during your time on OSHub?**
    a) What do you feel like you improved on the most?
    b) What do you feel are the most important skills / competencies for a teacher/facilitator carrying out a programme like OSHub?
3. **Has OSHub changed your teaching practice in any way?**
4. **What benefit, if any, do you think OSHub brought to your school or could bring to your school?**
5. **Do you think Open Schooling, or a similar model to Open Science Hub, is important for the future of education?**
    a) Do you think it is possible to enact this type of education, if so how?
    b) If not, why?
6. **Did you feel supported throughout the Open Science Hub programmes / Did you feel you had enough support throughout your activities by Open Science Hub? (e.g. Did you receive adequate training / Resources provided / Anything else)**

Gathering data

Throughout the course of the project, information was gathered from two teachers per hub. Teachers were interviewed at the end of every year, with more casual exchanges happening throughout.

Privacy and consent

All interviewees were asked for consent for the interview to be recorded and their results used. The results were anonymised and stored following GDPR guidelines. As there are only a small number of teachers, it was important that any identifiable data was removed when presenting the results, to ensure that no result could be connected to a specific teacher.

Data Analysis

The interviews were analysed using the codes seen in Table 6.6 to identify indicators connected to themes of interest (see Section 6.3.2.2). Note that Table 6 does not contain all codes, but a full overview is available in the Appendix Section 7.2. Using this method of result organisation, evaluators were able to analyse the results and produce helpful findings.

Table 6: Codes used to identity indicators within the OSHub teacher interviews.

GOALS	CODE	EXPLANATION
Evaluate the effectiveness of OSHub programme on the teachers	Novel Content / Experience / Idea	The teachers and students are introduced to new ideas and contents.
	Skills	Comments regarding skills that teachers and students acquired by taking part in OSHub that they did not happen in school.
	Positive change	Comments on the general positive effect OSHub had on teachers and students.
	Critiques	Comments by teachers about issues students had.
Evaluate the effectiveness of OSHub programme on the learners	Sense of Accomplishment / Achievement	Positive comments regarding the accomplishments felt by the students.
	Group work / teamwork	Comments regarding the effectiveness that group work had on the students.
	Research	Positive comments regarding the research methods and strategies the students had to follow.
	School trips	Positive comments regarding school trips the students went on.

- **Novel Content:**

  Teachers commented that the material and content the students were learning was new and "refreshing", "broke away from other school life" where the students could be their own investigators and "learning was more intentional" for the students.

- **Skills:**

  Many teachers commented on the types of skills that were introduced to students such as organisational and collaborative skills. Teachers commented that they themselves were also able to learn new

skills e.g. technical skills such as building a Raspberry Pi computer, or creating a Wordpress website; as well as developing facilitation skills that can be used in the classroom.

- **Adaptability:**

  Teachers commented on the flexible approach open schooling allows. In one case the programme could be "broken down into more accessible bite sized pieces", while another commented that it allowed them to "asses the individual needs and experiences of the students"

- **Critiques:**

  Teachers provided constructive critiques on many aspects of the programmes. In one case they thought the "zines were overused" and they were unable to cover all aspects of the programme. Some teachers found that timing for workshops was an issue, and in some cases students felt disconnected for the long term projects.

Discussion

Positive takeaways

The teacher interviews provided beneficial insight into the implementation of OSHub activities and programmes within different local contexts.It's clear that teachers found open schooling practices as positive and worthwhile. This gives OSHub confirmation that such a project can be implemented and received well within school networks, no matter the location. These interviews also allow teachers to be open about their own experience, resulting in constructive criticism that can be used to improve such activities and projects in the future.

Limitations

Not all teachers were able to provide feedback. The teacher evaluation commenced after the school projects finished in June, therefore teachers had already begun their break and could not contribute over their holiday period. Teachers also answered the questions in a written format. These answers were less detailed than those who participated in interviews

Recommendations

Teachers have very limited capacity, it's recommended to use their time as wisely as possible, for us in person/online 20 minute interviews allowed teachers to express themselves more openly than written surveys. The better relationship interviewees have with the interviewer the more open, honest and constructive the answers will be, therefore its recommended to have 5-10 minutes before questions to explain the importance of the interview and what the answers will be used for.

6.3.3 Skill Archive (Level 3: The Learners)

6.3.3.1 Introduction

The skill archive was inspired by a self assessment tool developed by the Horizon 2020 project *SySTEM 2020: Science Learning Outside of the Classroom (2018-2021)*[12], led by Trinity College Dublin (IE). The tool was expanded upon here and consisted of a two-question survey that asks learners to identify a skill they feel they have improved on (scientific, creativity, communication etc.) and to provide justification and an example for their choice. This allows us to quickly sample how learners are progressing within a particular programme.

The two questions both have a quantitative & qualitative element to them. The first question asks the learners to identify skills they feel they have improved on. These skills were chosen from the OSHub pilot evaluation, in which students were asked to complete the sentence "The Open Science Hub programme helped me to…..". This question allows us to keep track of what skills learners believe they are using on their course. For open schooling, these skills can be divided into eight categories:

- Scientific
- Digital
- Critical Thinking
- Creativity
- Collaboration
- Communication
- Citizenship
- Personal Development

The second question requires the learner to provide a justification and an example for their choice, providing us with qualitative reflective information. E.g. "Please give an explanation and an example as to why you think you improved your ……. skills".

6.3.3.2 Implementation

The goals of the skill archive are focused around understanding how the skills of learners' developed throughout a project, through their own perception of these skills. This can be broken down into more specific goals and their corresponding indicators. An example of such can be found in the case study in Section 3.3.4.

The skill archive is designed to be used as a 2 – 5 minute reflection that has two questions. This can be completed on any electronic device with internet connection. We recommend getting learners to scan a QR code to gain access to the link. It is recommended that the skill archive questionnaire is completed multiple times over the course of the programme or engagement (2 – 5 times) to see how the learners skills are progressing. Participants can be tracked over time if they have some identifiable nickname or username. Learners should write this nickname down so that they may refer to it each time they must complete the survey, otherwise they may forget it.

12. SySTEM 2020 received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 788317

When first introducing the skill archive, ensure that you explain to the learners the overall goals of the survey, and how it should be completed.

6.3.3.3 Evaluation the results

It is useful to create and utilise a Skills & Competencies Indicator Key when analysing responses from the skill archive. Such a key separates skills into a number of categories, and explains how to identify skills from the data. An example of a key used in the OSHub evaluation can be seen in Table 6.7.

Table 6.7: Skills and Competencies Indicator Key Example (OSHub).

SKILLS	INDICATORS OF SKILLS	IMPLEMENTATIONS OF SKILLS
Scientific Literacy	Explain phenomena scientifically	Learners are referencing / explaining scientific phenomena.
	Designing scientific enquiry	Learners are referencing experimenting/evaluating.
	Interpret data and evidence scientifically	Learners are reflecting on data and making conclusions.
Digital Literacy	Learning operations	Learners are referencing doing operations oncomputers.
	Uses of Technology	Learners are referencing using technology to produce project outcomes.
Problem Solving & Critical Thinking	Developing an understanding of information (issue/ problem/challenge)	Learners reference problem solving / completing the task.
	Acting as a team / Completing the task	Learners are referencing / explaining scientific phenomena.
	Reflecting and learning	Learners reference completing the task through doing.

Creativity	Learning by doing / Expression	Learners learn or perform creative skills through doing / acting.
	Knowledge Creation	Learners develop new pieces of information about the creation process.
	Cognitive Skills	Learners reference cognitive skills – such as imagination, divergent / convergent thinking, motivation etc.
Collaboration	Establishing and maintaining shared understanding	Learners are engaged in dialogue, share understanding, perspectives, visions and sharing roles.
	Working together	Learners reference the positive experiences of working together such as being inspired by peers, solving challenges and sharing responsibilities.
	Display Diversity, equity, inclusion and justice	Learners references sensitivity to the diversity of their group and audience, demonstrating flexibility, inclusion and trust.
Communication	Understanding others views	Learners reference interpreting and distilling information from diverse sources considering their perspective, emotions and experiences.
	Expressing views	Learners references expressing their own ideas and views using appropriate methods, language and protocols.
	Formats of communication	Learners reference the mixed methods they may use to communicate their views and ideas.
Citizenship and Community	Participation in community activities	Learners references gaining knowledge of their community, participating in community projects and show motivation to improve their community.

Personal development and Knowledge acquisition	Exposure to new knowledge	Learners references exploring novel topics and perspectives and expanding their own ideas, concepts and vocabulary.
	Personal Changes	Learners references improving personal skills such as social / motivation, changing how they view the world and increasing their awareness.

Using the key

When analysing the responses, we first look at the skill the learner has identified (e.g., scientific skills, communication skills etc. (Column 1, Table 6.7). This general section can be considered to be level one of the analysis (A) . The justification is then read, which leads to level 2 the "indicators of skills" (Column 2, Table 6.7). The response to an indicator (AA). Further explanations and emerging themes can also be found in the key (Column 3, Table 6.5).

Using the two levels of analysis (A and AA) outlined above, code the learner's responses and examine data across different audiences (e.g. different ages, gender, location) to identify what skills are being used by each audience, and to get a better understanding of the skills that learners feel they are utilising and developing the most throughout the duration of the project.

6.3.3.4 OSHub Case Study

Goals and Indicators

The goals and indicators set out for the Skill Archive when used to evaluate the OSHub project was as follow:

Table 6.8: Goals and corresponding indicators for the OSHub Skil Archive evaluation.

OSHUB GOALS	INDICATORS
Track the skills being used by the learners during the OSHub project.	Count of responses per skill and per OSHub.
Track the specific skills learners feel they are developing.	Change of skill count over time.

Gain an understanding of how learners are developing these skills during the OSHub project.	Qualitative responses from question two.
Identify if this skill development is in line with the original objectives and values of OSHub.	Comparison of high scoring skills and reflective answers with local goals of each OSHub.

Questions for Participants

Q1: "Which of the following skills do you feel like you have improved the most?"

Choose from: Scientific; Digital; Critical Thinking ; Creativity; Collaboration; Communication; Citizenship; Personal Development.

Q2: "Please explain why you think you improved on this chosen skill?"

This answer was qualitative, and learners could write as much or as little as they preferred for this explanation.

To assist with identifying skills, learners were also provided with an example as to what that skill is. These examples can be seen below.

- Scientific Skills might involve explaining scientific information, carrying out scientific experiments or interpreting information.
- Digital skills might involve working with computers to carry out tasks, finding new ways to solve problems and designing new pieces of information.
- Critical thinking skills involve understanding and exploring problems in different ways, representing the problems, designing plans and evaluating progress.
- Collaboration skills involve engaging with multiple people, organising the team based on knowledge abilities and perspectives, and maintaining a healthy working relationship.
- Communication skills involve understanding others views, expressing your own views effectively and using appropriate formats for communicating.
- Citizenship skills involve participating in community activities, gaining knowledge about your community and other types of communities and cultures.
- Creative skills involve expressing yourself in different ways, in creating new types of knowledge, and using different types of thinking skills and behaviours.
- Personal Development skills depend on you. They might involve gaining new knowledge or skills that were not listed above, it might be exposure to new ideas or it might be some personal changes.

Gathering Data

The Skill Archive was implemented 2-5 times across 5 different contexts (depending on the type of hub). The interface used was a Google Form. Students could access the form by scanning a QR code, allowing them to complete the form with their phones.

Learners logged their progress into the Skill Archive up to 5 times over the course of their programme. As each OSHub delivered a specific programme, learners would log the skill archive at different points. For

example, Ars Electronica hosted five workshops that spanned 3 months. After each workshop, learners would log their skill archive. Trinity College Dublin hosted a year-long programme as part of the school curriculum. Learners here logged the skill archive at the end of each of 4 sections of the curriculum.

Privacy and Consent

All learners were asked for their and their parents consent before participating in the skill archive. They were asked on google form to input their OSHub nickname which consisted of an animal-colour-birth date (e.g. redpenguin23), this allowed us to track participants over time.

Data Analysis

The data was then organised and analysed using microsoft spreadsheets.

The skill archive rubric used to evaluate the data can be found in Table 6.7. The skill archive consists of a list of skills that were identified over the course of the OSHub project. Each skill has a set of identifying indicators that were created based on a review of the literature. The set was then narrowed down for relevance, based on what was reported by the students in their responses to the Skill Archive survey. The following is a summary of the findings.

Total Skills Identified Across Each of the Hubs

Table 6.9: This is the individual count of skills logged per OSHub.

SKILLS	AE L (n=101)	TCD (n=94)	SCICO (n=18)	MCFR (n=50)	FAB (n=52)	TOTAL (n=315)
Scientific Skills	38	12		3	9	62
Digital Skills	8	6	3	9	2	28
Critical thinking	12	11	5	7	1	36
Creativity	30	25	3	12	12	82
Communication	11	9	6	2	14	42
Collaboration		25	1	6	6	38
Citizenship		1		6	1	8
Personal Development	2	5		5	7	19

Table 6.10: Percentage breakdown of the skills logged per each OSHub.

SKILLS	AE L (n=101)	TCD (n=94)	SCICO (n=18)	MCFR (n=50)	FAB (n=52)	TOTAL (n=315)
Scientific Skills	42.2%	12.8%	0.0%	6.0%	17.3%	19.7%
Digital Skills	8.9%	6.4%	16.7%	18.0%	3.8%	8.9%
Critical thinking	13.3%	11.7%	27.8%	14.0%	1.9%	11.4%
Creativity	33.3%	26.6%	16.7%	24.0%	23.1%	26.0%
Communication	12.2%	9.6%	33.3%	4.0%	26.9%	13.3%
Collaboration	0.0%	26.6%	5.6%	12.0%	11.5%	12.1%
Citizenship	0.0%	1.1%	0.0%	12.0%	1.9%	2.5%
Personal Development	2.2%	5.3%	0.0%	10.0%	13.5%	6.0%

Table 6.9 and 6.10 displays the total skills logged per each OSHub taken from the Skill Archive survey. Table 6.9 displays this information as skill count, while table 9 describes it in the form of percentages. We will focus on table 6.10, as some hubs had a much greater number of responses than others, therefore percentages allow us to more clearly compare each OSHub. When comparing, it is important to remember that the activities for each hub were quite different, and therefore the same skills could have been gained in various ways and over different timeframes.

It can be seen that the skills vary greatly depending on each OSHub. For example, improvement in collaboration skills was not noted in the survey for AE, but they were one out of two most improved skills for learners involved in the TCD survey. This is likely due to the difference in emphasis put on specific skills per OSHub.

Each OSHub has different aims and objectives depending on the partners involved, the local community, the learners, and sometimes even the facilities available. For example, TCD focused heavily on co-creation activities, where students would work together alongside teachers and other stakeholders to define challenges and develop solutions. This can be linked to 'collaboration' being one of the most improved skills. MFCR focused on open schooling within the discipline of Citizenship and Development. It is also interesting for OSHubs to acknowledge other skills that they may not have expected, and to consider how these skills may have come into play. For example, those who participated in the FAB programme most improved their communication skills, however this was not identified by FAB as the most important aspect of the programme.

The qualitative results of Q2 of the Skill Archive survey were coded and analysed, and from this a number of key points were identified.

- Students struggle to provide an adequate explanation as to why they are improving their skills. Some did not provide any, (e.g. One hub had n=18 participants, while only n=7 provided qualitative results). It is also important to note that learners have been observed mistaking which skills they have learned. For example, learners may state that they improved on a particular skill, such as communication, stating *"My group and I began to work better over the course of the project"*, therefore conflating the skill of collaboration with that of communication. This could also be caused by the explanation given by the OSHub facilitator.

- Students reflected that they developed their skills through completing the assigned work. This was either due to the students' self initiative or the design of the tasks and projects. This shows that students have an awareness of the skills they are using during a given task.
- Several students made a very clear note that they improved on some skills due to the fact there was a physical object that they created or developed using those skills. This point was extremely important to them.
- The project assisted with student confidence and reflection.

Discussion

Positive takeaways

The Skill Archive survey is a quick and simple means to evaluate the skills learners feel they have improved on over the course of a programme and yield both quantitative and qualitative data.The quantitative questions were easy for learners to fill out, and so many responses were recorded and analysis could be carried out. It asks the learner to carry out self-reflection throughout their learning journey, and provides both facilitators and evaluators a wealth of data surrounding their own activities and the learners' responses to these. It allows OSHubs to consider if their objectives with regards to skill development were achieved, or if areas need improvement.

Limitations

Some hubs found it difficult to implement multiple times which lead to reflections shorter and less in depth reflections as reflections improve. It was clear from the qualitative data that some students confused the different skills, leading to possible confusing results for Q1. Fewer learners also answered Q2, possibly indicating that they did not have a good grasp on reflection of skill development.

Recommendations

The effectiveness of the Skill Archive comes from its multiple implementations. The less it is used the less effective it is for understanding the overall programme. It's recommended to identify milestones in the timeline of the project to use the skill archive. Learners can find reflections challenging, it's recommended to give examples of what good reflections are and show how they can provide more in depth answers. This will provide the evaluator with better results.

6.3.4 Pre & Post STEAM Relationship Survey (Level 3: The Learner)

6.3.4.1 Introduction

Surveys or questionnaires are efficient ways to collect information from a large number of people. They can be completed in person, online, by mail or over the phone. Questions can consist of open ended or closed questions, multiple choice, Likert scales, ranking etc. Surveys can be used for any type of audience; special consideration will need to be taken for younger or vulnerable participants and surveys will need to be made accessible. Surveys can be given before and after (Pre/Post) a project to see a perceived change in participants. They can also be given at particular points throughout a programme/project.

The STEAM relationship survey captures learner demographic information, learner's perspectives around 'STEAM and active citizenship' and the relationship they each play within their own lives. Finally it asks learners to rate themselves on a scale from 1-5 on the eight key skills and competencies mentioned in the OSHub Skills & Competencies Indicator Key, table 5 (but also table 10 for convenience). Note that this can be adapted for different indicators depending on the project. The post STEAM survey asks the learner's the same questions, minus the section that concerns the learner's demographic information.

6.3.4.2 Implementation

Surveys or questionnaires are generally created with the indicators pre-determined. The STEAM relationship survey is focused around how learners interact with STEAM-based topics, therefore goals and indicators for this evaluation technique should be in keeping with this theme. For open schooling, the OSHub indicator key is a good example of the type indicators of which to evaluate (see Table 6.7). An example of such goals and indicators can also be found in the case study of this technique, in Section 6.3.4.4.

The survey can be made as a digital form using any questionnaire/survey software. The survey should take approximately 15 minutes to complete. The survey will need to be altered depending on the students' ages and abilities. Learners should be provided with multiple ways to complete the survey such as computers, mobile devices, on paper etc.

The STEAM Relationship survey needs to be completed once at the beginning of the project, before any engagement starts, and once at the end. You can implement a survey multiple times throughout an engagement, however students and teachers can become frustrated if given many forms to complete.

6.3.4.3 Evaluation of results

Organising the data into simple, clear tables on a spreadsheet will allow you to get a better idea of what responses the students had to each question. Once you have organised the data from both the pre and post surveys, you can then create a table that acts as a comparative whereby you subtract the post survey value responses for any given question from the pre survey value responses from that same question. See Section 6.3.4.3 for details.

The purpose of the survey is to provide demographic and quantitative information. Having both a pre and post STEAM survey should allow us to recognise any perceived changes in the learners. It is important to note that there can be multiple factors that influence a learners relationship with STEAM and not all can be accounted for in this survey.

6.3.4.3 OSHub Case Study

Goals

The questionnaire used in the OSHub project were designed to look at four main aspects:

Table 6.11: Goals and corresponding indicators for the OSHub STEAM survey evaluation.

OSHUB GOALS	INDICATORS
Collect demographic information of OSHub participants.	Quantity of students who identify their age, ethnicity, gender, place of residence, family quantity.
Learners' perspectives around 'STEAM and active citizenship'.	A count of students who agree / disagree that science, art and activism are interesting , easy and important.
The relationship they each play within the learners' lives.	Quantity of students who take part in scientific, artistic or activist based activities.
Developing a baseline understanding of students skills.	A count of students that rate themselves on a scale of 1-5 on how they perform at a number of skills.

Gathering Data

The pre and post survey was implemented across a number of OSHubs, at the beginning and end of each of their programmes. The pre-survey was completed by 122 participants across five OSHubs, while the post survey was completed by 100 participants across four OSHubs. Each hub had a different number of participants for the pre-survey as compared to the post-surveys, and three hubs only completed either the pre or post, but not both.

Questions for Participants

The pre and post surveys were identical with the exception of the first 7 questions on the pre-survey, which were demographic questions. These were not asked in the post survey. Because of this, we will only provide the questions from the pre-survey. The pre-survey can be found in the Appendix, Section 7.3.

Privacy and Consent

All learners were asked for their and their parents consent before participating in the skill archive. They were asked on google form to input their OSHub nickname which consisted of an animal-colour-birth date (e.g. redpenguin23), this allowed us to track participants over time.

Data Analysis

The pre and post surveys were collected, and comparison sheets for OSHub were created. Only a subset of the surveys were used for analysis. From this, it was possible to analyse the data for a number of elements including:

- Change in science perception
- Change in perception of other topics e.g. art and activism
- Change in skill evaluation
- Comparison of opinions and changes of opinions among different demographic categories

This survey can also be compared to results of other evaluation methods, such as the Skill Archive, to further evaluate development of skills and perceptions.

For this handbook, we will focus on two results to demonstrate how such data can be used:

Science Perception

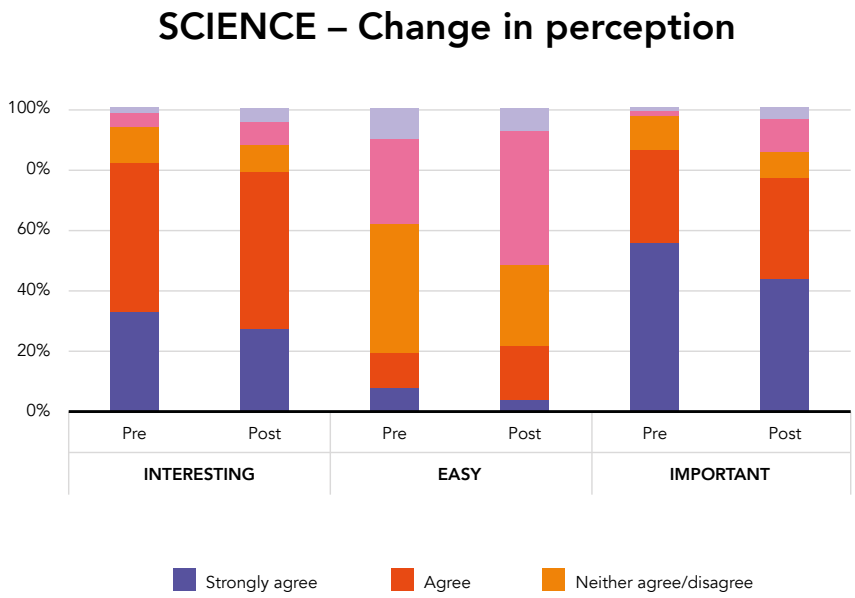


Figure 6.1: Change of perception in science (Q8). Credit: Cathal Fallon (TCD).

Figure 6.1 describes the results from the pre and post survey in percentages, demonstrating how the learner's perception of science changed over the course of the programme. Note that these are the total results of all learners from all OSHubs that took part in the survey.

It appears that the learners' opinions became stronger throughout the OSHub project, as less felt neutral about the aspects questioned in the post survey. While interest in science did not vary much, the perception of how 'easy' science is did. This could be due to learners' experience level with science, and therefore after working more closely with it, they get a better understanding of what is involved in certain science topics, which alters their perception.

Due to the demographic questions, we can also focus on how results differ between specific categories, such as gender or age. Here we present an example of how skill evaluation changed overall (Figure 6.2), and then focusing on males (Figure 6.3). The change in skills evaluation was found by comparing the given score (1-5) before and after for Q15 and rating an increase as positive, no change as neutral and decrease as negative. For this analysis, results could only be used from learners who completed both the pre and post surveys.

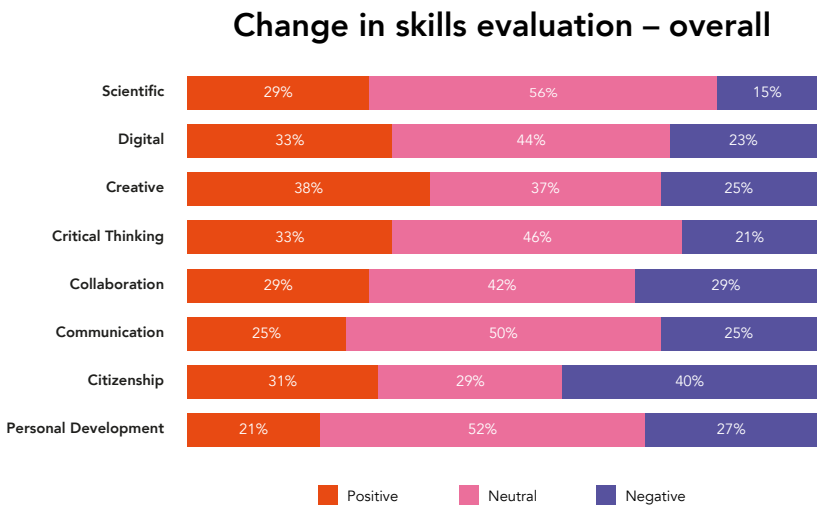


Figure 6.2: Overall change in skills evaluation. Credit: Cathal Fallon (TCD).

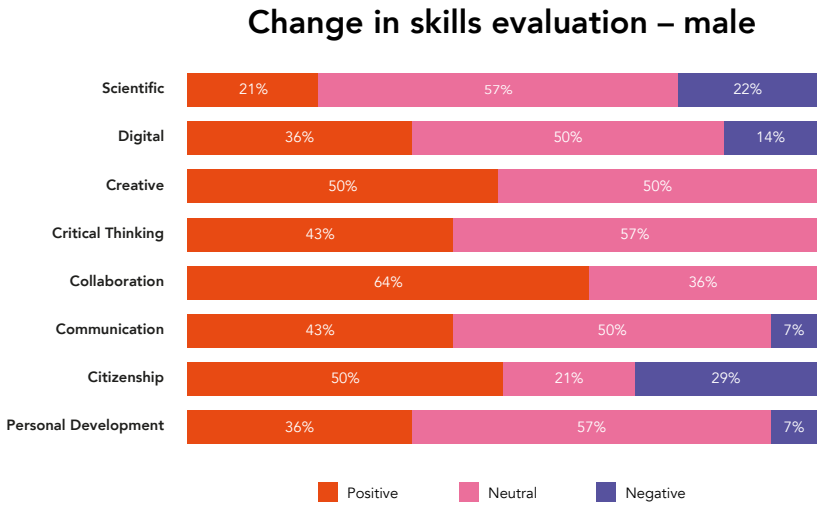


Figure 6.3: Focus on change in skill evaluations for males.

Table 6.12: Demographic comparison of change in skill evaluation.

BIGGEST INCREASE IN SKILLS EVALUATION OVERALL	
Creative	38%
Critical thinking	33%
Digital	33%

BIGGEST INCREASE IN SKILLS EVALUATION – MALE	
Collaboration	64%
Creative	50%
Citizenship	50%

BIGGEST DECREASE IN SKILLS EVALUATION OVERALL	
Citizenship	40%
Collaboration	29%
Personal Development	27%

BIGGEST INCREASE IN SKILLS DECREASE – MALE	
Collaboration	29%
Scientific	21%
Digital	14%

Figure 6.2 demonstrates that in general, the majority of learners changed their perception of their own skills. This change of perception varied between improvement or disimprovement from what was previously thought. It is important to note that a negative change does not necessarily mean that the learner's felt the programme worsened their skills. This is an indicator more so of how their perception changed. Perhaps they first did not have experience with a particular skill, so made a guess, then as they gained more experience using the skill and reflecting on it, they felt that they actually had more room to improve the skill than originally expected. For example, a learner may think that they have good collaboration skills, but they have only ever worked with a group of friends. During the programme, they are required to work with people outside of their friend group who may have strong differences of opinions, and they may find this challenging. Therefore in the post survey, they will identify that perhaps their skills could be improved, thus providing a 'negative' result.

Comparing Figure 6.2 and 6.3 and the summary in Table 6.12, interesting results can be seen. It seems that male participants felt that their skills improved in general, especially in Collaboration, Creativity and Citizenship. The former two skill areas had no negative change, meaning that only those who listed genders other than male felt a negative change. Such analysis could be carried out for all demographics and could bring beneficial insight for bringing projects to different contexts.

Discussion

Positive takeaways

The Pre-Post survey method to understand how learners' perceptions have changed throughout. Demographic questions allow for comparisons to be made between specific contexts, and therefore if targeting a specific audience in a follow up programme, changes can be made to better suit that audience. The survey acted as an interesting indicator when it comes to knowledge and skill perception and evaluation.

Limitations

While some students perhaps felt an improvement in a specific skill, others likely came to a greater understanding of the skill, allowing them to accurately reflect on this skill and their own perceptions. However, to truly identify if this is the case, it would be beneficial to ask for a qualitative response to Q15 asking learners to further explain their answers. Learners show a reduction in their perceptions of science, art and activism in some cases. The novelty of these projects may provide new understanding of these terms to learners. Therefore further study is needed.

Recommendations

Surveys can be long and tedious activities for young learners. Therefore we tried to have a small number of surveys (2) and keep them short, this puts less stress on coordinators, teachers and learners. However, there are many questions left unanswered from the survey. It is recommended that there are multiple very short surveys used over the course of a project with the same group. Conversely if using two surveys (pre and post),

have a longer time commitment and aim to get as many in depth questions answered as possible. It is recommended to alter or create alternative surveys for participants of mixed abilities, for example a second survey was created for younger audiences (10-13) however this was not implemented.

6.3.5 Zines (Level 3: The Learners)

6.3.5.1 Introduction

Zines are short booklets of text, images, and collage that may be used for personal reflection. They are often thought of as a cultural ephemera, mediums which may contain graphic, artistic or even poetic works. They can be created using low to no-cost materials that are widely available including extra pieces of paper, magazine clippings, photos, books, stickers, colours etc. The material accessibility of zines (with pen and paper anyone can create this small reflective booklet) is particularly relevant to those participants or organisations who do not have consistent or reliable access to other resources such as laptops or ipads. To learn more about zine culture, check out *this website*.

Zines are also used as a powerful instrument for reflection[13,14]. The use of zines as an evaluation tool has become increasingly popular due in part to their accessibility and adaptably within a wide variety of contexts. Learners may be encouraged to explore their own reactions, ideas, and experiences , or, particularly if there are time constraints, they can be guided and supported in their reflection with prompts and facilitation. Providing prompts may ease creative anxieties of participants. It is also important to note that while zines are often used to examine learners, emerging research utilises zines in evaluating and re-shaping institutional and organisational structures and practices. Through reflection, participants can document their process, analyse the work they have done,, and express their thoughts and perspectives in creative ways.

Reflections assist in processing and analysing experiences, thoughts, and emotions. It is a process whereby learners describe or look back on their learning journey and consider how it has changed over time and how their learning can be used to impact future conditions, experiences and goals. It allows for an emotional connection to be explored with the topic, which is beneficial when exploring social issues like climate change and inequity, which require action from the general public.

Zines are very useful in the scope of open schooling, with a focus on OSHub. Such projects involve co-creation and innovation, multidisciplinary topics and require skills that learners and participants may not be familiar with. Therefore self-reflection and introspection, which is advocated through zines, allows learners to reflect on a deeper level on these areas, identify elements where they would like to improve or that had great meaning to them, and inspire them for the future. Zines are also accessible to those who may struggle with language as they do not require the use of words.

6.3.5.2 Implementation

The first step of implementation involves setting out goals and deciding on indicators. Zines explore the

13. Learning portfolios—Zines. (n.d.). SySTEM 2020 https://system2020.education/resources/learning-portfolio-zines/
14. Brown, A., Hurley, M., Perry, S., & Roche, J. (2021). Zines as reflective evaluation within interdisciplinary learning programmes. In Frontiers in Education (p. 199). Frontiers.

topic, the learning journey involved, and the emotional responses throughout that learning journey. Zines can be examined from multiple perspectives, and these perspectives depend on your goals and indicators. Examples of such perspectives are outlined below.

Depth of Reflection: Examine how the learner is reflecting and what they're doing with their knowledge and experience. Is the learner describing their experience (reporting) or are they transforming the knowledge gained from their experience into something new (reconstructing).

Scope of Reflection: Examine who is involved in the learners reflecting. Open schooling is often used to promote global citizenship for learners. Therefore you may wish to investigate if the participants are reflecting on themselves personally, their local networks, or global society.

Skills Involved in Reflection: Investigate the type of skills the learners are either referring to, using, or displaying within their zines. It is helpful to identify the important skills your learners use and create a key from this that allows you to identify the skills learners are referencing/displaying within their zines.

Method of Reflection: Examine how the learner is reflecting. Are they using text, materials, or illustrations? Are they trying to present an argument or a message in their zines?

Thematic Reflections: Capture the theme the learner is reflecting on. Is it a campaign message against inequitable technology or is it a diary entry related to sustainable lifestyles?

Introducing zines to learners

The format for delivering zines should be identical throughout and adhere to the following steps (Brown, A., 2021).

- **Step 1 – Introduction to zines**

  The concept of zines should be first presented to the learners. This includes a brief history of zines, what they can be used for, and how to make/design a zine. For instructions on how to introduce zines and how to make a zine, see Appendix, Section 7.4 / 7.5.

- **Step 2 – Reflections**

  Facilitators should then present and explain the different types of reflection that can be done.

- **Step 3 – Prompts**

  Learners can be issued with prompts to aid their reflection journey. Learners may be issued with multiple prompts over the course of their programme.

- **Step 4 – Expectations**

  Learners should be given an allocated time and an allocated quantity of material to complete each of their reflections. For example, 1 page per reflection.

- **Step 5 – Presentation**

  Learners should have the opportunity to present their zines at the end of the programme. Note that reflective zines are often implemented at the end of a lesson or project, so that the learner may reflect on what they have learned and how they have interacted with the topic throughout the programme.

Develop a supportive environment

It is important to make the environment where learners are working as comfortable as possible. Encourage sharing of reflections, by maintaining a safe and confidential space. Learners should never feel pressured to share anything personal. A facilitator should be monitoring the content being placed in zines and checking in with learners frequently.

To create a suitable atmosphere, we recommend re-arranging the traditional style of the room (especially if carried out in a school setting). It makes learners feel as though the activity is different to standard lesson-time. We recommend having crafting materials to one side of the room from which learners can pick materials to decorate their zine with. Background music is a great way to create a fun and vibrant atmosphere. If learners are reflecting at home, it is important to provide them with any materials they may need. It is also necessary to provide some time to share reflections with one another and to recognise and appreciate their work.

6.3.5.3 Evaluation of results

Evaluation can be time consuming, especially when analysing highly qualitative information and material that is contained in zines. Having some form of assessment or criteria sheet that can help to evaluate the zines in an efficient and practical manner is recommended. Having a standardised guide in which all zine reflections can be analysed will allow us to learn more about the learner, about the type of reflection that the learner is using, the scope of their reflection, the skills employed in the reflection as well as any alternative formats being used for reflection.

By considering the context and the message of each zine, as well as the methods, it is possible to gain a more comprehensive insight into what the learner is reflecting on.

To create your rubric, you can refer to the evaluation perspectives outlined in Section 6.2.3.2. An example of such used for OSHub can be found in Table 12 the following section.

WHAT YOU MIGHT SEE (in a learner's zine)	WHAT THIS EXEMPLIFIES	WHAT THIS MEANS (depth of reflection)
"Today we dida a drama workshop about space" "I lerned how to..."	Describing an incident or experience	Reporting / Responding
"I realise now that some of the choices I have made about buying food and clothes in the past were not very sustainable"	Drawing a relationship between the event and prior experiences or knowledge	Relating
"We rely on plastic but it has so many issues, including pollution and health problems"	Considering broader ethical, social or political factors and impacts	Reasoning
"I think using science and art together can really change future technology" "Tomorrow I will..."	Developing a plan, hypothesis, model or imagining future actions or developments	Reconstructing

Figure 6.4: Reflection framework based on the 4R's evaluation method outlined in Ryan and Ryan (2015). Credit: Brown et al. 2021.

There are multiple ways zines can be evaluated, one example we used in OSHub is the 4R's method from Ryan and Ryan (2015)[15] (reporting/responding, relating, reasoning, and reconstructing), as outlined in Brown et al. (2021)[16]. For an example of this, and how it can be used to measure indicators, see Figure 6.4.

6.3.5.5 OSHub Case Study: Zine

Goals and Indicators

Table 6.13: An example of how evaluation perspectives of zines were used to identify indicators of specific goals in OSHub.

GOALS	INDICATORS	OBSERVATIONS
The learner increased their knowledge of a particular topic	— Depth topic knowledge displayed — Style of reflection used by the learner	— Depth of reflection — Thematic reflection
The learner developed a particular skill	— Referencing application of skills — Display of skills in their reflections	— Skills involved in reflection
The learner had a positive learning experience during OSHub	— Use of positive wording and imagery related to OSHub content — Discussion of future	— Thematic Reflection — Method of Reflection
The learner built positive relationships with stakeholders	— Mention of stakeholders accompanying positive phrasing	— Scope of Reflection — Thematic reflection

Questions for participants

When it came to implementing the evaluation using zines, each OSHub used the general prompts in Table 6.14 to then develop unique prompts (Table 6.15) to relate to the specific socio-scientific issues or topics being studied in that setting.

15. Ryan, M., and Ryan, M. (2015). "A Model for Reflection in the Pedagogic Field of Higher Education," in Teaching Reflective Learning in Higher Education. Editor M. E. Ryan (Cham: Springer), 15–27. doi:10.1007/978-3-319-09271-3_2

16. Brown, A., Hurley, M., Perry, S., & Roche, J. (2021). Zines as reflective evaluation within interdisciplinary learning programmes. In Frontiers in Education (p. 199). Frontiers.

Table 6.14: General zine prompts to be adapted for a specific topic.

INDIVIDUAL	COMMUNITY	TOPICAL	FUTURE / SPECULATIVE
What matters most to me is...	My area / community is important because...	What I wish people knew about [INSERT TOPIC] is...	My hopes for the future are...
How do you think we can improve...	What have I learned? Who taught me? Why is it important?	Understanding [INSERT TOPIC] is important because...	A change I would most like to see is...
What do you think of when you hear / see...	...Is important to my area / community because...	Does [INSERT TOPIC] Remind you of anything?	The impacts of [INSERT TOPIC] are...
What have you found most surprising during your time working on OSHub?	In my community of... I am important because of...	Tell a story which includes text and/or images about what you have discovered so far?	How does [INSERT TOPIC] affect...

Table 6.15: Specific zine prompts provided by OSHub. The left most column refers to the reflection number a set of prompts was used for.

	TCD (1)	TCD (2)	ULEI	MCFR	AE L	FAB
1.	What have you found most surprising during your time on Open Science Hub?	What has been the most interesting experience for you?	What questions do you have?	What have you experienced so far from working in citizenship and development?	How can I do better at self care?	How do you feel about Covid 19 / the climate crisis?
2.	Understanding microplastics is important because...	What I learned from OSHub is...	Why is water important for life?	What have I learned? Who taught me? Why is it important?	What can humans do to save our planet?	My hopes for 2022 are...

3.	My community is important to me because...		What have I learned? Why is it important?	What would I like the people to know about my project?	What would humans have to change about ourselves to be able to live on Mars?	A change that I'd like to see in my community is...
4.	A change I would most like to see in my community is...			How do you think your project will help the school community?	Tell a story about how the theme has changed your thinking of urban development?	Understanding the subject is important because...
5.						What do you remember about this activity?

Gathering Data

Throughout OSHub projects, learners were asked to complete four sets of reflections to complete their zines. All reflections were prompted, and there were four categories of prompts (individual , community, topical , future). Students would complete one prompt from each category, as chosen by the facilitator, with examples provided in Table 6.4. Learners were asked to complete 1-2 pages per reflective prompt. The zines were created after activities, workshops and programmes.

Privacy and Consent

All learners were asked for their consent before participating in zines, and parental or guardian consent as required. They were asked to anonymise their zines by writing a unique OSHub nickname on the front. Participants were asked to use this unique nickname across all evaluation materials.

Data Analysis

Below is a collection of zines (Figure 6.5) from multiple OSHubs, representing reflections on different topics.

Figure 6.5: A collection of reflective zines created by learners in multiple OSHubs. These zines were among those analysed as part of this case study.

A rubric (Zine Evaluation Sheet) was developed to support analysis of the zines. Part of this can be found in Table 16. The complete version can be found in the Appendix, Section 7.6.

Table 6.16: Snapshot of Zine Evaluation Rubric.

QUESTIONS	ANSWERS	EXPLANATION
What category best describes how the learner is reflecting?	Reporting	The learner reports on the events of the day. A summary of experience describing how they responded/took part in an event.
	Descriptive Reporting	The learner describes their experience including sensory details of the event, direct quotes or definitions, or point-to-point comparison between two incidents.
	Relating	The learner makes connections between the event with another realm of their knowledge, skill or experience etc. referencing another point in time, alternative conditions or a difference in their ability.
	Reasoning	The learner provides a detailed understanding and explanation of the event, they make reference to relevant theories or experience, and give analysis from an alternative perspectives.
	Reconstructing	The learner has reconstructed / reframed the information in a new way. Create alternative hypotheses / predictions based on the event. Their ideas are supported by information given / they ask "what if?' / the effect it can have on others.

Who does the learner appear to be reflecting on?	Themselves / Individually	The learner makes direct reference to themselves, their experience, perceptions, feeling, emotions and thoughts.
	Family & Friends	The learner makes reference to individuals close to them such as friends and family.
	Local Community	The learner makes reference to individuals from larger communities in their locality or groups of people within other communal cultures.
	Global / Wider Society	The learner makes reference to individuals from outside their communities or unfamiliar groups. Typically on a national or global scale.

Using the rubric, evaluators would assign data points if 'Answer(s)' (Column 2, Table 6.16) were identified within the reflection. If one 'Answer' was noticed, it received one point. Each 'Answer' can only receive at maximum one point per reflection. The aim is only to identify if a particular theme was reflected on, not how often it was mentioned.

The total number of points vary between reflections, as the number of students completing reflections changed. The zines analysed were a subset consisting of 43 zines from 5 partners, all who conducted more than one reflection.

Recurring themes across each OSHub

- **Trinity College Dublin**
  - Learners reflect on standout activities to them; things that were important such as workshops that resonate with them, people they enjoyed talking to, or novel experiences such as trips to the Science Gallery.
  - Learners reflect on their learning journey, such as their collaborations with others both internal and external to their class group.
  - Learners do show some existentialism in their reflections when they speculate on the future. One learner mentions humans in their zine because they have the solutions to fix the problems. For deeper reflections that are specific to microplastics, learners reflect on the current situation and issues, and discuss their hope to see these problems solved.
  - Learners that completed more reflections regularly mentioned the effect their project has on the community.
- **Onl'fait:**
  - Focus on concepts they have learned during the programme.
  - Reflection on what we need to do to transmit knowledge to improve our living conditions, i.e. what we need to do for our society.
  - Learners use irony and sarcasm when speculating on their future and the environment.
  - Learners focus on a call to action, what needs to be done to benefit the future and what society needs to invest in.

- **Ars Electronica:**
  - Learners comment on their friendship and happiness, the importance of self-care and tips to look after oneself.
  - Focus on sustainability, the environment and environmental protection. Other learners reference plastic use and local litter versus global production of plastic. Learners highlight the importance of biodiversity, and the positives and negatives of everyday uses, e.g. how having a bath can affect the environment.
  - Learners, when focusing on Mars and space exploration, comment on the important uses of technology and what they can do for humanity. This speculation leads them to ask questions about our future; "What else is possible?" and "What would it take to achieve this?"
  - Focus on local challenges, their living situation, and how specific development of these places can have positive effects (reduce CO_2, improved transport, better for young people).
- **Municipality of Figueira de Castelo Rodrigo:**
  - Learners reflect on what their project means for the community.
  - Learners reflect on why they are learning citizenship and how it helps you to become a better person, and that their projects are made with good will from everyone involved.
  - One learner reflects that to help "doesn't cost anything", and that it is good to help others. They also describe how their project brings together different communities such as their community and those in Ukraine.
  - One learner reflects that they have learned things that they would not have learned anywhere else.
  - One learner reflects on how challenging communication was for them, but that they improved on this throughout. The learner also reflects on how important it is to learn these skills as "communication skills are important because we meet lots of different people throughout our lives that are not equal to us."

Discussion

Positive Takeaways

Reflection journals proved to be enjoyable experiences for the learners. OSHubs reported that learners could reinforce their learning in their reflections, share their thoughts and feelings and physically create an object. The groups who provided the majority of reflections made journals did so as an organised activity in their OSHub programme. They provided more zines, with more reflections and the learners provided more depth in their reflections.

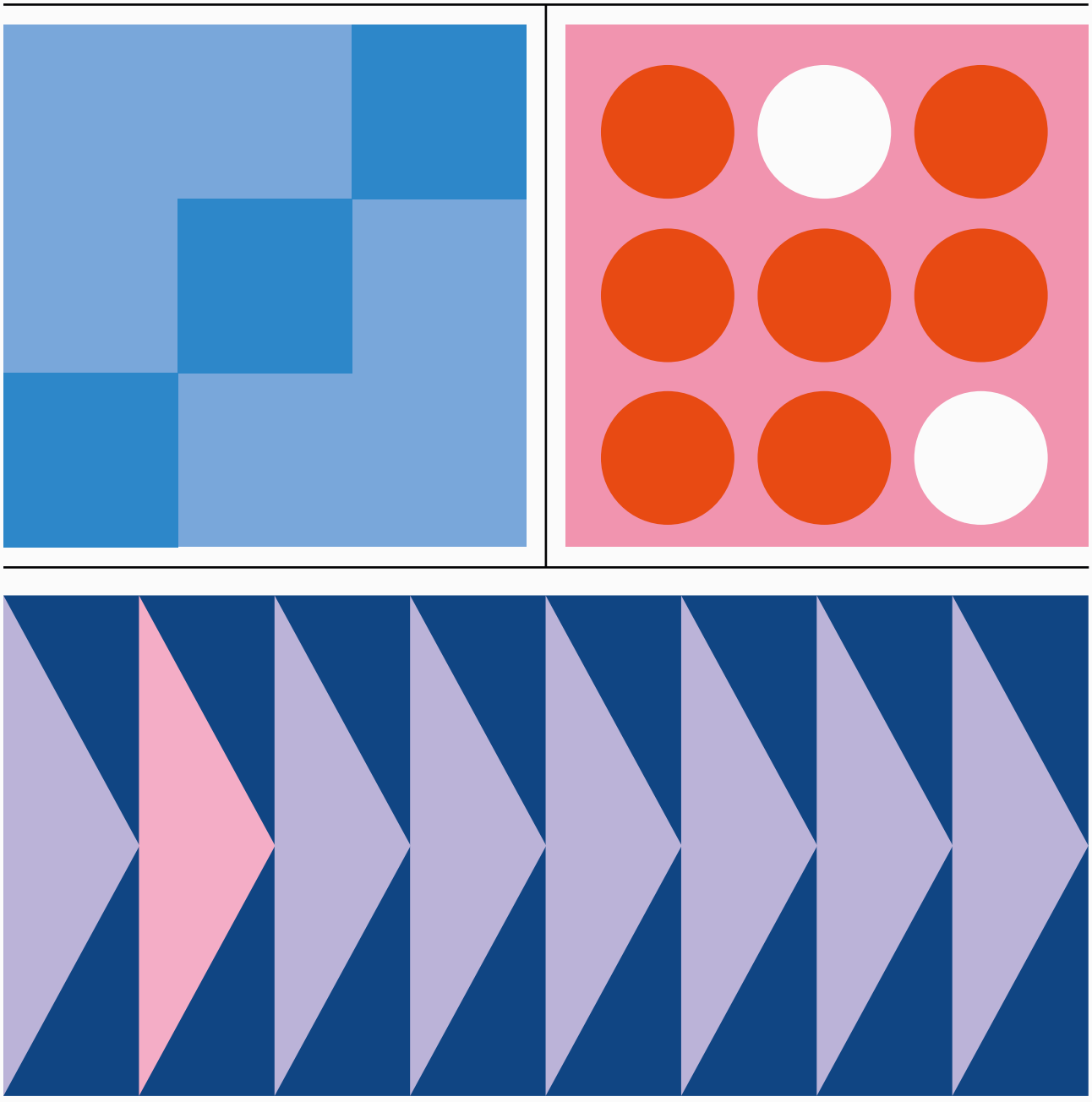
Limitations

One hub encouraged zines as a homework activity. Due to the high demand of work placed on students in school and short class times, the learners could not effectively complete their reflections. Younger participants provided much less content in their zines, and used their zines to provide answers to the questions rather than reflections. Many students lost their zines, or forgot to write their OSHub nickname on the front and so the zines could not be effectively gathered and analysed.

Recommendations

For zines to be effective they need to be built into the programme, given a specific time slot, and have a facilitator present with the correct materials provided. Questions and prompts to aid in reflection must be carefully discussed beforehand, and may need to be altered to best facilitate the reflections of the participants, for example it may not be suitable for younger learners. Storage of zines needs to be appointed to a particular person so they do not get lost.

Appendix 07



7.1 Codes for coordinator interviews

Below is the complete version of Table 6.4.

Table 6.4: Codes for coordinator interviews.

GOALS	CODE	EXPLANATION
Develop a network between international OSHubs and local stakeholders.	Networking / collaborating	Positive comments about increasing network or strengthening collaborations in already existing networks at an international level.
Develop a network between international OSHubs and local stakeholders.	Relationship building / building trust	Positive comments about developing relationships / trust in existing local networks e.g. between coordinators and teachers.
Develop a sustainable network that share OS resources.	Support	Positive comments regarding support offered by the OSHub consortium and management.
Develop a process of working that allows for successful implementation of open schooling.	Limiting the bureaucracy	Comments regarding the needs for action that allow for less bureaucracy to access community and stakeholders.
Assist technically and financially to implement open schooling.	Lack of resources	Comments regarding the lack of resources felt by schools and learners attending OSHub.
Assist technically and financially to implement open schooling.	Tools / technology / equipment	Comments regarding providing schools and learners with resources that had a positive effect on their learning.
Develop a sustainable network that share OS resources.	Training / curriculum / information	Positive comments regarding the training provided to the consortium.

Develop a sustainable network that share OS resources.	Collaboration / networking at the local level	Positive comments regarding collaboration at the local level with schools and local stakeholders.
	Collaboration / networking at the European / global level	Positive comments regarding collaboration at the international level with other projects / stakeholders.
	Collaboration / networking among consortium partners	Positive comments regarding collaboration at the international level between OSHubs.
Address issues of local community relevance related to the global SDG.	Events	Comments regarding the positive impact the events organised by OSHubs locally had on their participants.
Address issues of local community relevance to the global SDG.	Novel ideas / content / exposure to new things	Comments on the impact OSHub regarding coordinators and participants to explore novel ideas and curriculum.
	Engaging students / teachers / researchers	Positive comments regarding engaging targeted participants such as students, researchers and teachers.
	Teacher's willingness to do project again	Positive comments regarding the openness of the teachers to participate once more.
Evaluate the impact OS has on it participants.	Suggestions	Comments regarding to suggestions made by to alter the OSHub in the future.
	Critiques	Comments regarding critiques of the OSHub projects locally and internationally.

Address issues of local community relevance related to the global SDG.	Local needs / issues	Comments regarding OSHub dealing with the local needs and issues of the participants.
	Objectives / goals	Comments regarding the OSHub meeting thelo-cal hub objectives.
	Local authorities / local organisations / ministries of education	Comments regarding having contact and relationships with local government authorities.
	Future of OSHub pro-ject in local area	Comments regarding the sustainability of the local OShub for the coming year.
Evaluate the impact OS has on it participants.	Future of OSHub partnership	Comments regarding the future continuation of interna-tional OSHub partnerships.
Evaluate the impact OS has on it participants.	Positive impact (local area)	Comments regarding OSHub having a positive impact in the local areas.
	Value of project	Comments regarding local OSHubs upholding and carrying out the original values of the project.
	Skills	Comments regarding OSHub facilitating a translation of skil-ls from one party to another.
	Open Schooling / Learning	Comments regarding positive relationships with Open Schooling as a future in education.
	Workshops	Comments about the positi-ve impacts the workshops had on participants.

7.2 Codes for teacher interviews

Below is the complete version of Table 6.5.

Table 6.5: Codes for coordinator interviews.

GOALS	CODE	EXPLANATION
Evaluate the effectiveness of OSHub programme on the teachers.	Novel Content / Experience / Idea	The teachers and students are introduced to new ideas and contents.
	Skills	Comments regarding skills that teachers and students acquired by taking part in OSHub that they did not happen in school.
	Positive change	Comments on the general positive effect OSHub had on teachers and students.
	Critiques	Comments by teachers about issues students had.
Evaluate the effectiveness of OSHub programme on the learners.	Sense of Accomplish-ment / Achievement	Positive comments regar-ding the accomplishments felt by the students.
	Group work / teamwork	Comments regarding the effectiveness that group work had on the students.
	Research	Positive comments regarding the research methods and strategies the students had to follow.
	School trips	Positive comments re-garding school trips the students went on.
Evaluate the effectiveness of OSHub programme on the learners.	Transdisciplinary Skills	Comments regarding the positive impact multiple disciplines had on the students development.

Develop a process of working that allows for successful implementation of open schooling.	Suggestions	Comments by teachers about changes that could be made to OSHub.
	Workshops	Positive comments regarding the workshops that students took part.
	Needs / Accommodations / Accessibility / Inclusion	Comments regarding needs and accessibilities that OSHub accommodated for the teachers and students.
Assist technically and financially to implement open schooling.	Showcase	Positive comments about the students showcasing/ sharing their projects.
	Support	Comments regarding the support that OSHub provided teachers and the schools.
	Technology	Comments regarding the positive use of technology on open schooling projects, and technology provided to the schools.
Developing a sustainable network that shares OS resources.	Facilitation	Positive comments regarding the facilitation styles the students and teachers experiences.
	Links to other educational experiences / exams / tasks	Comments regarding OSHub allowing access to other educational experiences outside of traditional curriculum.
Address issues of local community relevance related to the global SDG.	OpenSchool	Positive comments regarding open schooling and the future of open schooling.
	Links to future education / career	Comments regarding how OSHub provided students with a look into future careers.
	SDGs	Comments regarding addressing sustainable development goals.
	Future thinking	Comments regarding the positive impact future thinking has had on students.

7.3 STEAM Relationship Pre-Survey

This survey corresponds to that discussed in Section 6.3.4.

1.	**Please create an OSHub nickname in the box below. Your nickname should follow this pattern – COLOUR + ANIMAL + DAY OF BIRTH for example: "RedPenguin23". This nickname is important for later activities, make sure you take a note so you can use it again later.**
2.	**What country were you born in?**
3.	**What ethnicity do you identify as?**
4.	**What gender do you identify as?**
5.	**What age are you?** a) 6 – 8 b) 9 – 11 c) 12 – 14 d) 15 – 17 e) 18+
6.	**What location best describes where you live?** a) City centre b) Outskirts of a city c) Suburbs d) Rural town/Village e) Rural countryside f) Other
7.	**How many people live in your household?** a) 1 – 3 b) 4 – 6 c) 7 – 9 d) 10+

8.	**On the scale from strongly disagree to strongly agree how much do you agree with the following statements describing science. "I think science is..."** a) Interesting: Strongly disagree Agree Strongly agree b) Easy: Strongly disagree Agree Strongly agree c) Important: Strongly disagree Agree Strongly agree
9.	**On the scale from strongly disagree to strongly agree how much do you agree with the following statements describing art. "I think art is… "** a) Interesting: Strongly disagree Agree Strongly agree b) Easy: Strongly disagree Agree Strongly agree c) Important: Strongly disagree Agree Strongly agree
10.	**On the scale from strongly disagree to strongly agree how much do you agree with the following statements describing activism & social science. "I think activism/citizenship is..."** a) Interesting: Strongly disagree Agree Strongly agree b) Easy: Strongly disagree Agree Strongly agree c) Important: Strongly disagree Agree Strongly agree
11.	**How would you best describe yourself in the following sentence:"I think of myself as a…"** a) Scientist b) Artist c) Activist / Active citizen d) Other
12.	**How often do you do any of the following:** a) Read books / magazines / Blogs b) Listen to podcasts c) Watch youtube videos or other social media pltfomrs for science content d) Speak with you family about scientific topics e) Speak with your friends about scientific topics f) Attend community events / activities g) Take extra classes or attend after school clubs / community clubs h) Visit science museums / galleries / centres i) Visit art museums / galleries / centres

	j) Attend protest or activist activities k) Spend time outside in nature l) Look up information on the internet about science m) Use tools to build things or take things apart
13.	**Are there any other activities related to science, art or activism that you do?**
14.	**If you said yes to any of the activities above, why do you like to do these activities?**
15.	**On a scale from 1-5, with 1 being the lowest and 5 being the highest, how would you rate yourself in the following skills?** a) Scientific skills: I feel I can I can explain scientific information, investigate a problem scientifically and understand scientific data b) Digital skills: I feel I can explain the how computers function, understand the different uses for computers and the safety and ethics of computer use c) Creative skills: I feel I can express myself i multiple forms, develop new ideas and try tackle problems in different ways d) Critical Thinking skills: I feel I can understand the problem, figure out how to solve it and present results e) Collaboration skills: I feel like I am good at working, staying organised, learning from one another and making sure everyone is treated equally f) Communication skills: I feel like I am good at understanding other people views, expressing my own views and communicating with people in different ways g) Citizenship skills: I feel like I have a good knowledge of my community, and the people, facilities and business in it h) Personal Development skills: I feel like I am good at applying my knowledge to a real life problem and learning new things from new people

7.4 Introduction to Zines

Learners may be introduced to zines for reflection using the following questions and answers.

What is reflection and why is it important?

1. Reflection is an exploration and explanation of events; it allows us to process what has happened, and helps us organise and understand our thoughts and feelings.

2. Reflection is important when dealing with complicated scenarios. In research we deal with complicated topics that sometimes have multiple causes and solutions. Having time to reflect gives us time to think of things from multiple perspectives.

What way can we reflect?

1. Reflection is about taking a step back from the event, really thinking about your experience, and trying to be as honest as possible to yourself. There is no right or wrong way to reflect, sometimes it's about thinking, sometimes talking, and other times it can help to write it down.
2. It's important to not just describe what happened, but try to communicate what you thought, felt, behaved and what you did. It is often useful to also think forward to the future.

How do you reflect using a zine?

1. Reflective zines are similar to diaries, they help us document our experiences. (Show examples.)
2. Questions/prompts help to guide your reflection. It is important to think carefully about what the question is asking, and that you spend time answering the question fully, e.g. make sure you are not just giving one word answer, or recounting what you did, but explain what you think, your opinions and don't forget to say why you think that.

Learners should know they have plenty of time to complete their reflections, they should not be rushed. Learners should be aware that they will present their creations at the end of the project. These are not just pieces of paper, they play a crucial role in the project itself and within open schooling, allowing learners to capture and share their experience with one another and the wider community they are collaborating with.

7.5 Making a Zine

To make a zine, you require the following materials:

Required:

- A4 Paper
- Pen/pencil

Optional:

- Markers
- Newspapers, magazines and/or photos
- Scrap materials
- Scissors and glue

- Needle and thread
- Post-its

Each learner will fold an A4 piece of paper 4 times in half, cut halfway through the centrefold, and wrap it into a booklet (See Figure 6 for a step by step guide). For younger students or students who want large zines we recommend using an A3/A2 size piece of paper (they may also need more help with folding). The booklet should have 6 pages in total, including a front and a back page. Learners can make multiple booklets if needed.

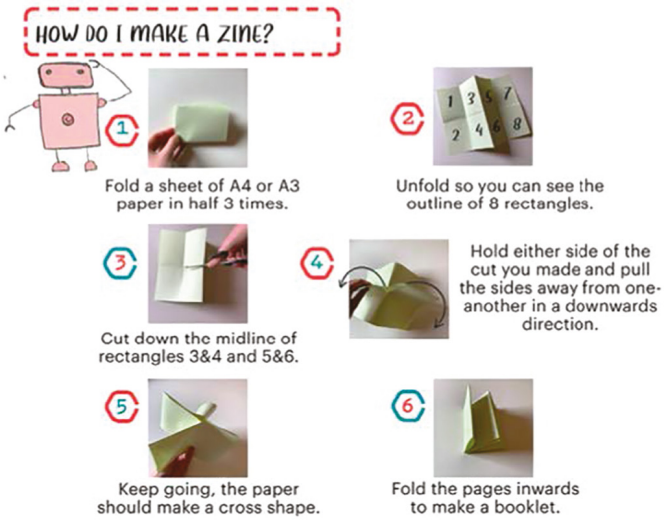


Figure 8.1: Step by step guide on 'How to make a zine'. Credit: Brown et al. (2021).

Learners may also benefit from the "How to Make a Zine" It may be helpful to also provide learners with a "How do I make a zine" guide and video from the SySTEM2020 project and Science Gallery at Trinity College Dublin. Check it out here.

Figure 8.2: Screenshot from video 'How to make a zine'. Credit: SySTEM 2020, Science Gallery Dublin

7.6 Zine rubric (completed)

To make a zine, you require the following materials:

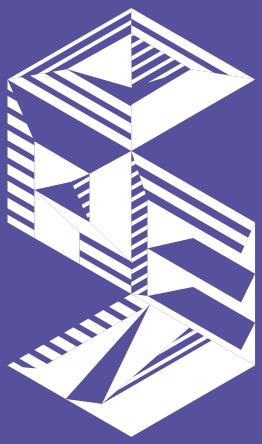
QUESTIONS	ANSWERS	EXPLANATION
What category best describes how the learner is reflecting?	Reporting	The learner reports on the events of the day. A summary of experience describing how they responded/took part in an event.
	Descriptive Reporting	The learner describes their experience including sensory details of the event, , direct quotes or definitions, or point-to-point comparison between two incidents.
	Relating	The learner makes connections between the event with another realm of their knowledge, skill or experience etc. referencing another point in time, alternative conditions or a difference in their ability.
	Reasoning	The learner provides a detailed understanding and explanation of the event, they make reference to relevant theories or experience, and give analysis from an alternative perspectives.
	Reconstructing	The learner has reconstructed / reframed the information in a new way. Create alternative hypotheses / predictions based on the event. Their ideas are supported by information given / they ask "what if?' / the effect it can have on others.
Who does the learner appear to be reflecting on?	Themselves / Individually	The learner makes direct reference to themselves, their experience, perceptions, feeling, emotions and thoughts
	Family & Friends	The learner makes reference to individuals close to them such as friends and family.
	Local Community	The learner makes reference to individuals from larger communities in their locality or groups of people within other communal cultures.
	Global / Wider Society	The learner makes reference to individuals from outside their communities or unfamiliar groups. Typically on a national or global scale.

	Scientific Literacy	Scientific Skills might involve explaining scientific information, carrying out scientific experiments or interpreting information.
	Digital Literacy	Digital skills might involve working with computers to carry out tasks, find new ways to solve problems and designing new pieces of information.
	Critical thinking	Critical thinking skills involve understanding and exploring problems in different ways, representing the problems, designing up plans and evaluating progress.
Does the learner make reference any of the following skills/ competencies in their zine? **Does the learner explicitly say they have used or made use of the skills in what they are reflecting on?**	Creativity	Creative skills involve expressing yourself in different ways in creating new types of knowledge and using different types of thinking skills and behaviours.
	Communication	Communication skills involve understanding others views, expressing your own views effectively and using appropriate formats for communicating.
	Collaboration	Collaboration skills involve engaging with multiple people, organising the team based on knowledge abilities and perspectives, and maintaining a healthy working relationship.
	Citizenship	Citizenship skills involve participating in community activities, gaining knowledge about your community and other types of communities and cultures.
	Personal Development	Personal Development skills depend on you, they might involve gaining new knowledge or skills that were not listed above, it might be exposure to new ideas or it might be some personal changes.
Does the learner display any of the following skills/ competencies in their zine? i.e. **(continue below)**	Scientific Literacy	Scientific Skills might involve explaining scientific information, carrying out scientific experiments or interpreting information.
	Digital Literacy	Digital skills might involve working with computers to carry out tasks, find new ways to solve problems and designing new pieces of information.

Does the learner create graphs, or explains their hypothesis. **Does the learner use creativity skills in communicating their ideas?**	Critical thinking	Critical thinking skills involve understanding and exploring problems in different ways, representing the problems, designing up plans and evaluating progress.
	Creativity	Creative skills involve expressing yourself in different ways in creating new types of knowledge and using different types of thinking skills and behaviours.
	Communication	Communication skills involve understanding others views, expressing your own views effectively and using appropriate formats for communicating.
	Collaboration	Collaboration skills involve engaging with multiple people, organising the team based on knowledge abilities and perspectives, and maintaining a healthy working relationship.
	Citizenship	Citizenship skills involve participating in community activities, gaining knowledge about your community and other types of communities and cultures.
	Personal Development	Personal Development skills depend on you, they might involve gaining new knowledge or skills that were not listed above, it might be exposure to new ideas or it might be some personal changes.
Does the learner make clear reference to knowledge/ information they acquired during their time in OSHub?	No reference	The learner does not say anything about new knowledge.
	Some reference to knowledge	There is references to knowledge but not specific if it is new or if where it came from.
	Reference to knowledge but unsure if it is from OSHub	There is clearly reference to the learners gaining new ideas but it is not about where they got the knowledge from.
	Clear reference to knowledge gained OSHub	The learner explicitly speaks about learning information from the OSHub intervention.

Does the learner communicate a clear message in their zine?	No message can be seen	The learner does not show any message in their work.
	There are slight references to message	The learner may be trying to show some sort of message but it is unclear.
	There are clear efforts of communicating a message	The learner is clearly trying to communicate a message, and it can be interpreted.
	There is a very clear message	The learner makes a clearly defined message throughout their zines.
What methods is the learner using to create their zine?	Text	The learner uses mostly TEXT in their zine to communicate their message.
What methods is the learner using to create their zine?	Illustration	The learner uses mostly ILLUSTRATION in their zine to communicate their message.
	Collage	The learner uses mostly COLLAGE in their zine to communicate their message.
	Textiles	The learner uses mostly TEXTILE in their zine to communicate their message.
Does the learner reference their own learner identity / background?	None at all	The learner makes no reference to their background identity, knowledge, or personal experiences.
	Possibly but uncertain	The learner might be trying to make some reference to their background identity, knowledge, or personal experiences but we can not be sure.
	Yes	The learner clearly makes reference to their background identity, knowledge, or personal experience but does not expand on how it influences them in their current situation.
	There are clear reference	The learner clearly makes reference to their background identity, knowledge, or personal experience but does not expand on how it influences them in their current situation.

On a scale from 1-5 How well do you rate the learner in the following scenarios	EXPLANATION
The learner is recalling / regurgitating facts and knowledge?	The learner is exhibiting previously learned material by recalling facts, terms, basic concepts and answers.
The learner is showing evidence of creating new information and coming to conclusions?	The learner is showing understanding in finding information and is demonstrating basic understandings of facts and ideas.
The learner is displaying or making reference to applying knowledge they have required?	The learner is using information in a new situation – solving problems by applying acquired knowledge, facts, techniques and rules in a different way.
Is the learner questioning or making inferences about evidence or information they have acquired?	The learner is examining and breaking information information into parts by identifying motives or causes; making inferences and findings evidence to support generalisations.
Is the learner creating new ideas or hypotheses?	The learner is hanging or creating something new. Compiling information together in a different way by combining elements in a nw pattern or proposing alternative solutions.
Is the learner defending or critiquing information?	The learner is justifying, presenting or defending opinions by making judgements about information, validity of ideas or quality of work based on criteria.



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