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

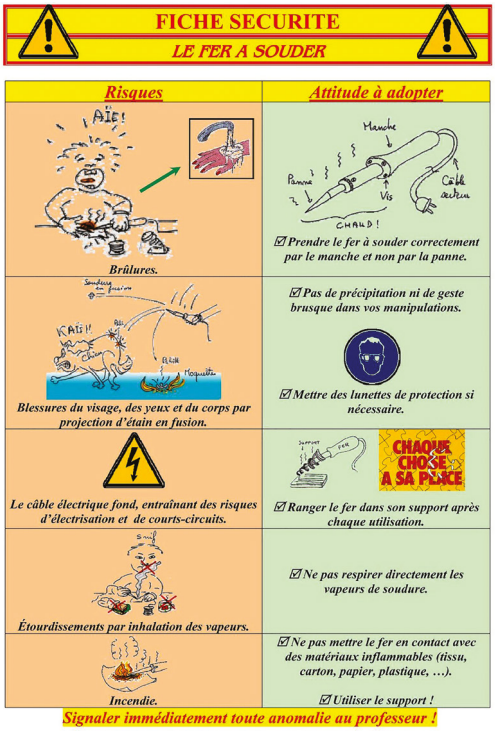
Using ergonomic workstations is important, as well as making sure that students adopt a healthy posture when working on the computers. Before using the Internet, students need to be aware that they should not disclose personal information, such as their city, school, address, phone number, email address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

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.