

Intellectual Output 3

MAKE IN CLASS

Developing Maker-based Learning
paths in class to prevent early
school leaving

Training Programme



Co-funded by the
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Make In Class - Developing Maker-based Learning paths in class to prevent early school leaving

MAKE IN CLASS TRAINING PROGRAMME

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DRAFT VERSION

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INTRODUCTION

Welcome to our Make in Class training program on why and how to set up a makerspace at schools to reduce early school leaving phenomenon!

This Training program is a product of Make In Class, an Erasmus+ KA2 development of innovation project, co-financed by the European Commission. Seven partners coming from 4 different countries (Italy, Germany, Spain and Malta) contributed to creating the following training modules.

It is important to consider that all the modules are stand-alone and can be skipped or combined based on your objectives, target group or context.

We have produced two different types of modules: the first one presents the most common technologies and tools used by the making movement and how to implement them with students while the second one highlights different didactical aspects and skills linked to making. You can use the modules separately or mix them together, combining, for example the most technical modules activities with some reflection sessions dedicated to the didactical aspects.

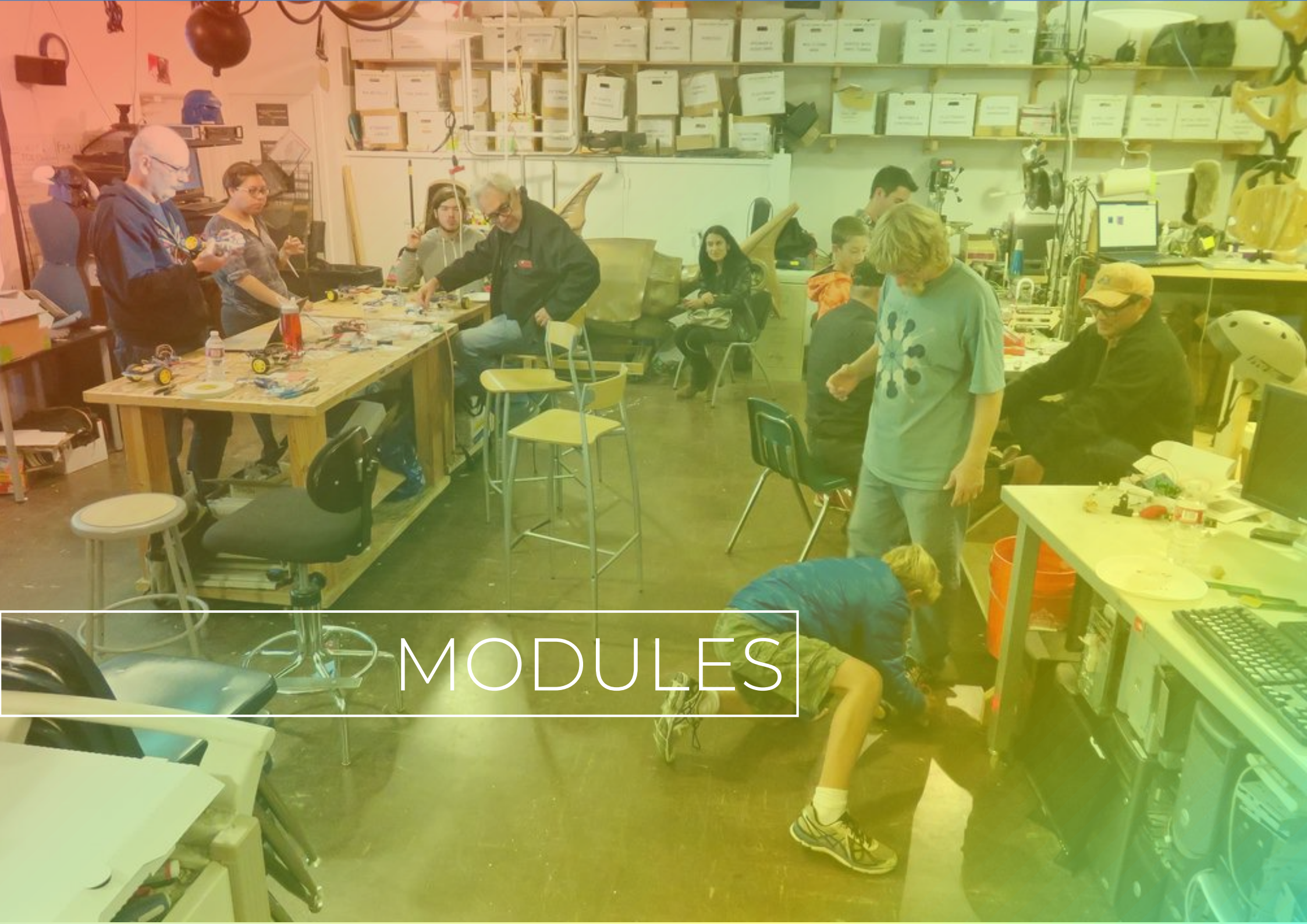
You will not find a specific module on how to prevent the early school-leaving phenomenon, but all the modules will help you to implement the following equation:

Making at school = more motivation and school performance = reduction of the early school leaving phenomenon.

All learning modules have the same structure: a short introduction to the topic, the total duration of the module, the Learning Outcomes, an overview of the activity suggested, the material and tools needed and the steps to implement it. As a supporting tool, you can find printable Handouts, which are linked to the steps suggested, and some Extra-resources.

We suggest you to read all the other [Make In Class Intellectual Outputs](#) (IO1 Make In Class Competence Map; IO2 Make In Class Open Educational Resources; IO4 Make IN Class Handbook) in order to have more resources and tools to plan an effective training program.

Have fun with our training program!



MODULES



Module 1

HOW TO SET-UP A MAKERSPACE

MODULE 1 – HOW TO SET-UP A MAKERSPACE

Introducing to makerspaces

In a makerspace, there are many ways to create things and ideas using new manufacturing techniques with computer aided machinery. The “Maker Movement Manifesto” describes makers’ activities and mind-sets organized around nine key ideas: make, share, give, learn, tool up (i.e., secure access to necessary tools), play, participate, support, and change. Embedded in the making culture, there is the possibility to evolve and make changes to this definition giving the possibility to include the creation of tangible and intangible outputs that are all oriented to produce effects in a real offline context. The standard equipment of a Fablab or makerspace worldwide includes cutting plotters, laser cutters, 3D printers, soldering stations, CNC milling machines. Since not every school has a corresponding room or sufficient budget for the standard equipment, we will show how to take a first step towards a makerspace even without own space and little money.

In case you have some square meters, you could set up your space somehow like this: social zone, 3D printing place, vinyl cutting area, laser cutter area, woodwork and tools on the wall, robots and Ipads / laptops, some storage space and tables to work on.

Total Duration: 8 hours

Learning Outcomes:

The course will help the participants to:

- Gain a deeper understanding of what makerspaces are and the goals/disciplines involved in them;
- Dig into the technologies and resources surrounding makerspaces and how to source materials and resources;
- Integrate maker spaces into the curriculum and lesson plans;
- Prevent early school leaving by integrating maker space into the curriculum;
- Immerse your classroom and school into the makerspace community and staying connected;
- Explore design thinking, genius hour and project based learning frameworks that enhance makerspaces;
- Use makerspaces to enhance student projects, portfolios, and assessing makerspace projects.

Activity Overview:

MODULE 1 – HOW TO SET-UP A MAKERSPACE

This module is intended for a group of a maximum of 12 teachers (all kind of schools).

First, the trainer presents general information about makerspaces to the group.

The learners will be divided into groups, which elaborate the possibilities of getting a makerspace started depending on their requirements. Each group presents the results, gives feedback and shares the results.

The trainer will give further information about tools and other equipment and finally how to run a makerspace at school.

Material/Tools needed: papers and pens, personal computers/tablets/laptops with internet connection.

Steps:

Step 1: Get permission and organize a [maker](#) event (2 h)

- Introduction into the [subject](#) (30 min). Use the document "[How to get permission and how to organise a maker event](#)" and "[Setting up a MakerSpace](#)". You may also show the following videos: "[Maker Ed: Maker](#)

[Education as a Learning Approach](#)" and "[Makerspaces - The Future of Education: Marc Teusch at TEDxLuxembourgCity](#)"

- Group of 3 learners: Elaborating the next steps to be done at their schools concerning permission and [maker](#) event (1 h)
- Short presentations and feedback (30 min)

Step 2: Buy machines, materials, equipment (3 h)

- Presentations on what machinery / tools / materials / equipment is possible and necessary for what purpose (use the document "[Buy machines, materials, equipment](#)"). According to its own applications, you can show the different variants (use the documents "[Variant A](#), [Variant B](#), [Variant C](#), [Variant D](#)") (1,5 h)
- Elaborate in groups of 3 teachers which variant of [makerspace](#) would fit to their needs in school. (1h)
- Short presentations and feedback (30 min)

Step 3: Get the [MakerSpace](#) running (3 h)

- Presentations on the possibilities to get your makerspace running in the end (use the document "[Get the MakerSpace running](#)") (1h)

MODULE 1 – HOW TO SET-UP A MAKERSPACE

- Talk about general safety rules and give a handout to the participants (use the document “[Planning for safety](#)”) (1 h)
- Open Discussion for the participants on what will be the challenges back to school starting a space (1 h)

Resources:

Handouts

Step1

- [How to get permission and how to organise a maker event](#)
- [Setting up a MakerSpace](#)
- [Maker Ed: Maker Education as a Learning Approach](#)
- [Makerspaces - The Future of Education: Marc Teusch at TEDxLuxembourgCity](#)

Step 2

- [Buy machines, materials, equipment](#)
- [Variant A - Starter Package](#)
- [Variant B - Starter Package plus additional equipment](#)
- [Variant C - Separate room and small budget](#)
- [Variant D: Own room and large budget](#)

Step 3

- [Get the MakerSpace running](#)
- [Planning for safety](#)

Extra-resources

- [The Making of a Makerspace: Pedagogical and Physical Transformations of Teaching and Learning](#)
- [Maker Program Starter Kit](#)
- Set up a makerspace
 - <https://www.instructables.com/id/How-to-Start-a-Makerspace>
 - <https://education.cu-portland.edu/blog/classroom-resources/create-steam-makerspace>
 - [Create a MakerSpace for your school in Five Steps](#)
 - [Starting a school Makerspace from Scratch](#)
- [MakerED Resources for school Makerspaces](#)
- [Makerspace Tools](#)
- [Makerspace for education](#)
- [A Handbook for the 21st Century Teacher](#)
- [People, Means, and Activities: A Conceptual Framework for Realizing the Education Potential of Makerspaces](#)



Module 2

LASER CUTTING

MODULE 2 – LASER CUTTING

Introducing to laser cutting

The laser cutter is the tool in digital production. In addition to the variety of materials that are processed in FabLabs, universities or schools, even the finest geometries can be produced with the highest precision. Laser cutting gives users complete freedom for developing and implementing ideas. Using engravings and cuts, inspiring designs can be produced with a laser cutter in just a few process steps.

The laser cutter (central unit) contains a movable mechanism controlled by high-speed stepper motors. The mechanism moves the laser beam over the material to be cut. The CO2 laser tube, which generates the laser beam, is permanently mounted in the central unit. The laser beam is deflected several times by mirrors until it finally hits the material. The filter system is required to extract fine dust, smoke and vapours generated during the cutting process. The exhaust air is filtered and led outside on the roof. The Air Assist device in the laser cutter blows from above onto the workpiece to be cut and ensures that smoke and dust are kept away from the optics and quickly removed from the cutting area. It also reduces the risk of a workpiece catching fire.

Lasers are incredibly versatile, and can be incorporated into a variety of courses. We also find that lasers are exceptionally popular in schools outside the classroom setting, as they can also be used for creating student or teacher awards, cutting classroom signage in-house, creating promotional products for school fundraisers, etc.) Depending on the class subject and curriculum, we have seen lasers used in all kinds of courses including:

- wood working / woodshop
- industrial arts
- fashion courses and labs (for cutting patterns and fabric and other substrates such as pendants and earrings)
- technology classes
- art, design or photography courses
- STEM-focused courses

[Here](#) you can find some ideas what projects could be done at school.

Total Duration: 10 hours

Learning Outcomes:

- The participants learn how to use a vector-drawing program.

MODULE 2 – LASER CUTTING

- The learners identify and explain processes that can be completed on a laser-engraving machine and be able to setup and perform basic operation of a laser-engraving machine.
- The learners work with a laser-engraving machine to produce a product.
- The learners demonstrate and describe parametric 2D modelling processes.
- The learners develop, evaluate and construct the final project.
- The participants will be able to understand the link between laser cutting and the standard curriculum.
- The participants will be able to apply methodologies for the assessment of laser cutting in his class.
- The participants will be able to Assessing student's performance on laser cutting using formative assessment.

Activity Overview:

A group of 4 to 6 teachers will learn how to laser cut materials and create vector files. The teacher's experience the process of laser cutting (operating the laser cutter and being able to prepare designs for laser cutting) and make them improve pedagogical practices concerning the of laser cutting based on the standard curricula.

Material/Tools needed:

- 4-6 personal computers/laptops with internet connection, laser cutter(s), Beamer, USB stick, SD card, cutting foils
- Recommended software: TinkerCAD / Inkscape / Corel Draw / Adobe Illustrator.

Steps:

Step 1: How to use the laser cutter (4 - 5 h)

First, you have to inform your participants to the safety instructions properly (use the document "[Safety instructions for Laser cutting](#)").

Introducing the two things a laser cutter can do: [Cutting and engraving](#) (30 min): as trainer, you introduce your participants to the module: the laser cutter distinguishes the 2 working methods laser cutting and laser engraving. A combination of the two modes is also possible (adjustable in the driver), where all objects except the hairlines are engraved first, then the hairlines are cut (use the document "[Laser-cutting and laser-engraving](#)").

MODULE 2 – LASER CUTTING

Following this, you explain materials to the participants. You can use the document "[Lasercut Materials](#)"

Using the document "[5 Steps to do a lasercut](#)" (3 - 4 h), the participants will explore autonomously how to use a laser cutter. As trainer, you should support their learning process.

Step 2: Concentrating on how to get a vector file (2 h to several days)

Create a CAD model with any vector-drawing program: You can use Adobe Illustrator, Corel Draw, Inkscape and even Tinkercad. PDF from intermediate format has proven to be the best way to import drawings from other programs. You can use the open source software Inkscape available for Windows, Linux and Mac OS X ([link](#)).

Step 3: Why and how integrate laser cutting into school (1 h)

Lasers are incredibly versatile, and can be incorporated into a variety of courses. We also find that lasers are exceptionally popular in schools outside the classroom setting, as they can also be used for creating student or teacher awards, cutting classroom signage in-house, creating promotional products for school fundraisers,

etc.). Depending on the class subject and curriculum, we have seen lasers used in all kinds of courses including:

- wood working/woodshop
- industrial arts
- fashion courses and labs (for cutting patterns and fabric and other substrates such as pendants and earrings)
- technology classes
- art, design or photography courses
- STEM-focused courses

Using the document "[Guide for lasers in education](#)", you can find some ideas what projects could be done at school.

Resources:

Handouts

Step1

- [Safety instructions for Laser cutting](#)
- [Laser-cutting and Laser-engraving](#)
- [Lasercut Materials](#)

- [5 Steps to do a lasercut](#)

Step 2

- [vector file](#)

Step3

- [Guide for lasercutters in education](#)

Extra-resources

- [How a laser cutter works](#)
- [How to get vector files](#)
- [how to prepare files for laser cutting](#)
- [hot to make a photo ready for laser cutting](#)
- [how to make laser cut box](#)
- [40 laser cut projects and the skills they will teach](#)
- [how to get the laser cutter running](#)
- [how to do your first project](#)
- [card board lamp](#)
- [best laser cutters 2020](#)
- [Learning Inkscape](#)

- [10 Essential Tips & Tools All Adobe Illustrator Beginners should learn](#)
- [Graphics Tutorials](#)



Module 3

3D PRINTING



Introducing to 3D Printing

3D printing technology is one of the most important manufacturing techniques in digital production, both in the industrial and since some years even in the private sector. This technology has been used since the 1980s, when it was developed for the simple and inexpensive creation of prototypes.

3D printing makes it possible to produce three-dimensional objects. Before printing, the objects have to be designed using any 3D modelling software. The printing is done by layering the object and is therefore an additive manufacturing technique. The layered structure is realized by physical or chemical hardening or melting processes. Either a liquid (e.g. synthetic resin) is hardened in layers, a powdered material is melted in layers or a material is melted and then quickly applied in layers again and hardened. Standard materials for 3D printing are plastics, synthetic resins, ceramics [3] and metals. There are now also carbon and graphite materials that allow the printing of carbon parts. FDM or resin printers are usually found in makerspaces. The high-performance laser sintering systems are very expensive due to their technical complexity and can only be found in large MakerSpaces or in industry. For schools a FDM printer is recommended. These printers work according to a very simple principle called Fused Deposition Modelling (FDM). In this case, a plastic, usually in the form of a plastic cable (filament), is transported through a

feed-producing transport module (extruder) to a printhead with a two-axis bearing, which is used to heat the filament to the melting point and then push it through a nozzle (Nozzle), which causes the filament to taper from a diameter of approx. 3 or 1.75 mm to 0.4 mm (standard nozzle diameter). The principle is applicable to all meltable or liquid materials that harden quickly, so there are now 3D printers for various materials such as concrete, ceramics, metals, chocolate and sugar, the possible uses are becoming more and more diverse. Nowadays the 3D printer is no longer used for prototyping only, but is also used in construction, in the food industry, in medicine, aerospace and other industries.

Total Duration: 4 hours

Learning Outcomes:

- The teacher will be able to work with a 3d modelling software, a slicer to convert .stl files into GCode and he will be able to teach 3D modelling.
- The teacher will be able to start a 3D printer and change filament.
- The participant will be able to understand the link between 3D modelling and printing and the standard curriculum.
- The participant will be able to apply methodologies for the assessment of 3D modelling and printing in his class.
- The participant will be able to Assessing student's performance on 3D modelling and printing using Formative assessment.

MODULE 3 – 3D PRINTING

Activity Overview:

The module is intended for a group of 4 to 10 teachers (all kind of schools).

First, the trainer presents general information about 3D printing to the group.

The learners have to train 3d modelling and printing and how to improve the pedagogical practice concerning the assessment of '3D modelling and 3D printing' based on the standard curricula.

The trainer will give further information about tools and other equipment and finally how to run 3D printing at school.

Material/Tools needed:

Personal computers with internet connection, 3D printer(s) and filaments, Beamer, USB Stick, SD Card Filament

Steps:

Step 1: 3D-Modelling (1 - 2 h)

Demonstrate briefly the registration process with tinkerCAD and basic functions of this simple CAD program. Then let the participants model and try them out themselves (use the document "[3D modelling with tinkerCAD](#)"). The participants then briefly present their models. At this point, you can demonstrate even more special functions.

Step 2: Preparing for 3D-Printing (Slicing) (30 min)

Demonstrate the basic functions of the slicer with which the 3D models are prepared for 3D printing. Then let the participants to slice their model and try out different settings (see the tutorial "[Cura 3D Slicer For Beginners](#)"). The participants then exchange ideas about their approach.

Step 3: 3D printing (1 h)

You start printing a small object (use the document "[3D Printing](#)"). Then you demonstrate the change of filament. Finally, participants should change the filament themselves. During this time, the other participants can continue to work on their models in TinkerCAD.

A close-up photograph of a person's hand reaching towards a 3D printed hand model. The hand is positioned on the left side of the frame, with the index finger pointing towards the right. The 3D printed hand is on the right side, resting on a white platform. The background is a blurred 3D printer with a blue and white color scheme. The lighting is soft and even.

Resources:

Handouts

Step1

- [3D modelling with tinkerCAD](#)

Step2

- [Cura 3D Slicer For Beginners](#) (tutorial)

Step3

- [3D Printing](#)

Extra resources

- [Practical Examples](#)
- [Curricula of 3DP course](#)



Module 4

VINYL CUTTING



MODULE 4 – VINYL CUTTING

Introducing to Vinyl cutting

A vinyl cutter is a computer-controlled machine that uses a blade to precisely cut out shapes and letters from sheets of vinyl. The vinyl can then be stuck to a variety of surfaces, depending on the adhesive and type of material. A vinyl cutter is also capable of cutting a variety of other thin, flexible materials such as paper or fabric.

After creating a design in the appropriate software, the vinyl cutter cuts along the vector paths laid out in the design. The cutter is capable of moving the blade on X and Y axes over the material, cutting it into any shape imaginable.

A plotter, also called curve recorder, is an output device that displays function graphs, technical drawings and other vector graphics on different materials. Therefore, it is one of the few devices that is able to reproduce a vector graphic immediately without having to convert it into a raster graphic before. The cutter is a plotter using a knife instead of a pen.

The knife can be used to cut contours of a vector graphic in thin materials such as self-adhesive foils, cardboard, paper, leather, felt and much more. Before cutting, very thin material is applied to a transport film coated with assembly adhesive and to maintain more stability during the cutting process. There are two main types of device concepts: drag knife and tangential knife. With the drag knife, the knife tip is

not attached in the centre of the cutting head. During cutting, the knife is dragged along the contour (dragged); the resulting offset must be factored into the cutting path by the plotter software. However, this technology is less complex than the tangential knife and is implemented in cheaper devices. With the tangential knife devices, the knife sits exactly in the centre of the cutting head and must therefore be turned in the cutting direction on all curves. This requires a complex cutting head, but brings a more precise cutting result and is primarily used in the commercial sector.

Total Duration: 6 hours

Learning Outcomes:

- Identify and explain processes
- Design and create final projects
- It is easy to learn - low threshold.
- It sparks the imagination into thinking of possibilities.
- It provides students with an opportunity to practice creative thinking by thinking of constraints and how to work with and around the constraints.
- It helps students gain confidence working with both manual and digital tool and processes. The students get a chance to build skills measuring, working with precision, planning carefully, and using design tools.

MODULE 4 – VINYL CUTTING

- It provides a quick win - that had them thinking of new ways to use the tool.
- It makes learning personal!
- It naturally leads to the EMPATHY stage of design thinking - How might I make _____ for _____.
- It leads to thinking about sustainability in that they could repurpose, redesign, and recycle many objects using their new skills and available tools and materials.
- It provides a first experience with design tools and the process of designing for computer-controlled machines.

Activity Overview:

A group of 4 to 6 teachers will be enabled to use the vinyl cutter on their own, make own designs and do the whole process from designing to cutting and finishing. In the end, they will get ideas on how to use the machine in regular lessons to teach pupils to use the machine for different projects useful for the curriculum.

Material / Tools needed: 2 Vinyl cutter, 6 laptops, materials to be cut.

Steps:

Step 1: Learn to make a design (2 h)

Start with giving some general information on vinyl-cutting (you can use the document "[General Information on vinyl cutting](#)") and also mention different machines and software (you can use the document "[Different machines and software](#)") (40 min).

Similar to laser-cutting you need to know how to create a vector file (visit the link "[Learning Inkscape](#)") or use the software released on your Vinyl-cutter, such as for example [Silhouette Cameo](#))

Step 2: Learn how to work with the Vinyl-cutter (4 h)

First, you can see the following video (40 min): "[Cutting Your Design on the Vinyl Cutter](#)".

Then, cut using Silhouette Cameo. You can see the following video (20 min): "[First cut using Silhouette Cameo](#)".

Each teacher should work on a little project and present what she/he did in the end (3 h).



Resources:

Handouts

Step1

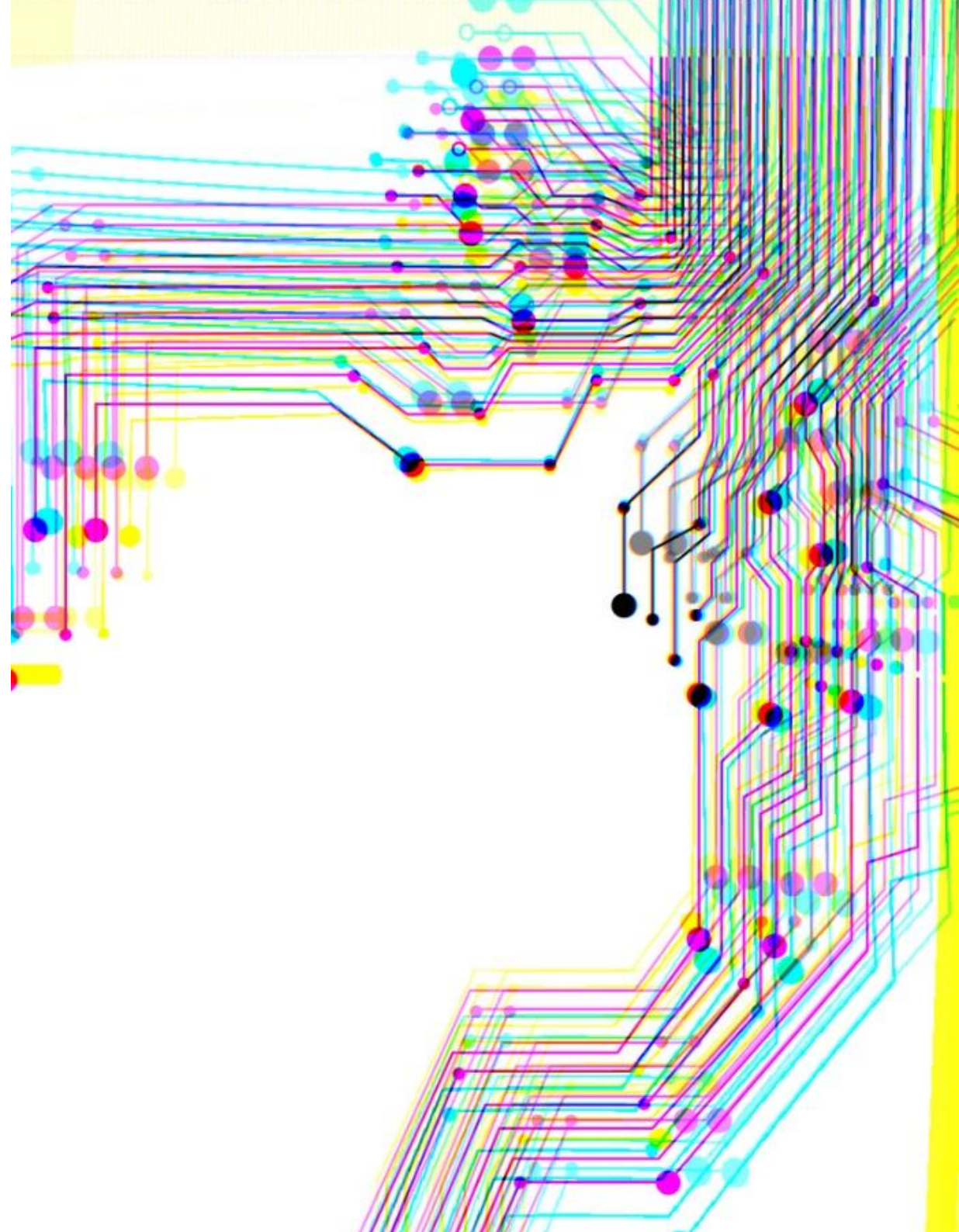
- [General Information on vinyl cutting](#)
- [Different machines and software](#)
- [Learning Inkscape](#)
- [Silhouette Cameo](#)

Step2

- [Cutting Your Design on the Vinyl Cutter](#)
- [First cut using Silhouette Cameo \(tutorial\)](#)

Extra resources

- [Vinyl Cutting in a Maker Space](#)
- [34 Cool Things You Can Do with Your New Vinyl Cutter](#)



Module 5

ELECTRONICS

MODULE 5 – ELECTRONICS

Introducing to Electronics

Electronics represent an improvement from classical electrical technologies where active devices are used to manipulate electrons and the signals they create to make more complex amplifications and logical outputs.

In electronics, blueprints called schematics are used for arranging components and constructing electronic circuits.

Typical basic electronic components some of which may be used in maker based project: Resistor, Variable resistor, Diode, Light-emitting diode, Transistor, Capacitor, Thyristor, Speaker, Buzzer, Switches, Thermistor, Filament bulb, Motor, Stepper motor, Solenoid, Relays, Light-dependent resistor.

[Basic electronic components explained](#)

Total Duration: 6 hours

Learning Outcomes:

- Apply safe working practices associated with the soldering process
- Understand the problems of electrical overstress (EOS) and electrostatic discharge (ESD)

- Identify the various types of components used
- Determine component values from case markings
- Prepare wires for soldering
- Select the correct grades of solder
- Understand the hazards and use of fluxes and cleaning solvents
- Correctly solder unsupported and supported through-hole PCB components remove and replace solder joints and components on PCBs using: solder wick, soldering irons, heated tweezers and hot air rework stations

Activity Overview:

This training module will provide a group of 6 to 8 teachers with the knowledge of what equipment you need to do electronics and soldering with the pupils and it will provide them with all the skills necessary to work with basic electronic equipment and how to solder properly. It is intended to reach students who have little or no experience of working on electronic systems or components neither soldering experience.

Tools / Material needed: soldering stations, tin, basic components like LEDs, resistors, capacitors, transistors, ICs, switches, buzzer, battery. In order to have an idea of the most common tools and materials needed, you can check the presentation [“Electronic Component, uses and symbol”](#)

MODULE 5 – ELECTRONICS

Steps:

Step 1: Introduction to the topic (1,5 h)

Start the training with a general presentation on how you can use electronics in the context of making. You can use the document "[25 Makerspace Projects For Kids](#)", as introductory examples of making small projects with basic electronics principles and components.

You can focus also on the history of electronics (you can use the document "[A brief history of electronics](#)"). (30 min)

Do an [Introduction workshop](#) (you can use the document "[Getting started with electronics](#)") to explain [components](#) and tools (you can use the document "[Basic electronic components](#)") and what they can be used for including safety instructions on soldering and electronics (use the document "[Safety instructions on soldering](#)") (1 h)

Step 2: How to solder (1 -2 h)

Every participant may start a little project like soldering [artistic things out of different components](#) to make the participants feel good in soldering and have fun being creative (1 h)

Step 3: Projects (2 h)

After the first attempts you now can proceed with a more advanced project like solder a winkthing (you can use the document "[Winkdings](#)") (1,5 h), or solder another cool project like Piepsthing (you can use the document "[Piepsthing Hardware](#)") (1,5 h)

Knowing that the participants now really like soldering and electronics you can slightly proceed with more input on different components and what they are used for. (0,5 h)

Step 4: More lessons (2 h)

You present the different lessons on different parts of electronics; you can decide together which one you want to look closer following the lessons plans in the document "[Electronics Class](#)", the rest of the lessons can be done at home.

Step 5: Own projects (2 h)

In the last step, let the participants think of their own little projects and how they want to implement them into lessons. Make 2 or 3 groups of teachers and let them do a lesson and present it (you can be inspired by some works such as "[Magic LEDs Box. Entertainment Device](#)" or "[Lightbox](#)")

Resources:

Handouts

Step1

- [25 Makerspace Projects For Kids](#)
- [A brief history of electronics](#)
- [Getting started with electronics](#)
- [Basic electronics components](#)
- [Safety instructions on soldering](#)

Step3

- [Windings](#)
- [Piepsthing Hardware](#)

Step4

- [Electronics Class](#)

Step5

- [Magic LEDs Box. Entertainment Device](#)
- [Lightbox](#)

Extra resources

- [Basic Electronics](#)
- [Build electronics circuits](#)
- [Soldering is easy: here's how to do it](#)
- [Soldering Tutorial for Beginners: Five Easy Steps](#)
- [Electronics components](#)
- [Learn Electronics With These 10 Simple Steps](#)
- [4 tips for teaching kids how to build electronics](#)



Module 6

WEARABLES/E-TEXTILES



MODULE 6 – WEARABLES/E-TEXTILES

Introducing to Wearables/E-Textiles

Wearables are considered disruptive technologies as they have changed our lifestyle and created new job opportunities in several sectors of the labour market. These technologies have been massively used even within the maker community as DIY projects (you can use the document "[WEARABLES](#)").

Total Duration: 8 hours

Learning Outcomes:

- The participant will be able to understand the link between wearables/E-Textiles and the standard curriculum.
- The participant will be able to apply methodologies for the assessment of E-Textiles in his class.
- The participant will be able to Assessing student's performance on Wearables / E-Textiles using Formative assessment.

Activity Overview:

In this training, a group of 6 to 8 teachers will learn how to build wearable electronics and program interactions using software with students and how you can implement it into regular lessons.

Tools/Materials needed:

conductive thread / sewing needle / 5" x 5" piece of felt / 5" x 5" piece of felt in contrast colour (optional) / safety pin (optional) / fabric marker (optional) / fabric glue / 5mm LED / 3V coin cell battery / resistor / scissors / multimeter / pliers

Steps:

Step 1: Introduction to the topic (1 h)

Start the training with some information about E-Textiles and Wearables (you can use the document "[General information on E-Textiles and Wearables](#)") and give some historical overview (you can use the document "[A Historical Review of the Development of Electronic Textiles](#)").

Step 2: E-textiles in classroom (2 h)

MODULE 6 – WEARABLES/E-TEXTILES

Watch the video on E-Textiles ([Fabricademy 2020: E-textiles](#)) and then do a presentation on a possible curriculum for E-Textiles in the classroom (use the document "[Possible curriculum for E-Textile](#)" as a reference).

Step 3: Sewing (3 h)

Now do the Sew a circuit course using the document "[Sew a Circuit](#)" with the participants (3 h)

Step 4: More lessons (1 h)

See as well different other courses: (at least 40 h) every participant can do those lessons at home, with the basic knowledge that he gained during the training, by using the following documents:

- [Wearables Electronics Class](#)
- [Fab Academy course](#)
- [Switches, sensors, swatches](#)
- [Soft switches](#)
- [Soft sensors](#)
- [E-textiles – Technical Guide](#)

Resources:

Handouts

Step1

- [General information on E-Textiles and Wearables](#)
- [A Historical Review of the Development of Electronic Textiles](#)

Step 2

- [Fabricademy 2020: E-textiles](#)
- [A possible curriculum on E-Textiles](#)

Step 3

- [Sew a Circuit](#)

Step 4

- [Wearables Electronics Class](#)
- [Fab Academy course](#)
- [Switches, sensors, swatches](#)
- [Soft switches](#)
- [Soft sensors](#)

- [E-textiles – Technical Guide](#)

Extra resources

- [Welcome & Supplies](#)
- [E-textiles – Unit 6 Alternative Curriculum](#)
- [Towards a Curriculum for Electronic Textiles in the High School Classroom](#)
- [Electrifying Engagement in Middle School Science Class: Improving Student Interest Through E-textiles](#)
- [Introducing E-textiles](#)
- [E-textiles files & downloads](#)
- [Electronic Textiles for Exploring Computer Science with High School Students and Teachers to Promote Computational Thinking and Participation for All](#)
- [eTextiles and Wearable Technology](#)
- [Wearable Electronic Intro Projects](#)
- [LED "Handful of Hearts" Gloves](#)
- [Wearable LED Flower Brooch](#)
- [Shirt Circuit: DIY Wearable Breadboard Circuits](#)
- [How To Make an Inductive LED Ring](#)
- [E-textiles, led ideas and projects](#)
- [RECOMMENDED READING AND RESOURCES](#)



Module 7

CNC MACHINING

MODULE 7 – CNC MACHINING

Introducing to CNC Machining

The Computer Numerical Controlled (CNC) mill is a mill which is controlled by a computer. Anything that could be made using a mill can be made more precisely and quickly with a CNC mill.

A mill is a subtractive manufacturing process where the raw material is affixed to the table and a drill is placed into a spindle, which rotates the drill. The table moves around in relation to the drill in order to make cuts which removes material from the raw form. Oftentimes the drill has a vertical motion, which simulates raising or lowering the table.

A CNC mill is controlled by a computer rather than manually controlled. A machinist writes a program using a variant of G-code, which is a step by step process describing how to make a part given a piece of raw material of known dimensions. Alternatively, Computer Aided Manufacturing (CAM) converts a CAD drawing into G-code. This eliminates bugs which arises from converting CAD to G-code by hand as well as allows for more complex curves which would take more time to code. After the program is coded and fully debugged, the raw material is fixed onto the table and the origin of the material is found and zeroed on the machine. When the program is run, the computer follows the program line by line and feeds the

instructions to the mill. When the program is completed, the finished part is taken out.

Total Duration: 10 hours

Learning Outcomes:

- The participant will be able to understand the link between CNC milling and the standard curriculum.
- The participant will be able to apply methodologies for the assessment of CNC milling in his class.
- The participant will be able to assess student's performance on CNC milling using formative assessment.

CNC Operations and Programming Preparation:

- Define the basic functions and control panel operations of a CNC machine.
- Select and fasten a raw stock blank in a CNC lathe and mill for machining.
- Identify and set up tooling to cut parts to meet a manufacturing part specification.
- Summarize the principles of CNC setup, operation, and programming.
- Identify common types of tools for milling
- Identify common types of tools for drilling and threading

MODULE 7 – CNC MACHINING

- Identify basic tool holders for milling
- Identify the main groups of cutting tool materials and coatings
- Understand the applications for common milling tools
- Understand the difference between cut speed and feed rate
- Understand the difference between Revolutions Per Minute (RPM) and Surface Feet per Minute (SPM)
- Understand the difference between Inches per Minute (IPM) and Inches per Tooth (IPT)

CNC/CAM Programming:

- Practice writing complex GCode programs for CNC turning centers including inside boring of a radius, inside threading, cutting of inside ring grooves.
- Interpret and demonstrate complex GCode programs for CNC milling centers including using a 4th axis for machining of shaft grooves or locking slots or rings.
- Experiment developing GCode programs to perform secondary operations including tapping, countersinking, counter boring, and threading.
- Describe and illustrate common problems with tooling and fixtures in CNC programming and machining.

Activity Overview:

In this course, a group of 4 to 6 participants will learn everything you need to know to design and create your own CNC cut projects. In the end, you will know several examples on how to implement CNC milling into regular lessons.

Tools/Materials needed:

CNC Mill (for example Shapeoko 3), End Mill for Plywood Cutting, End Mill for Small-Scale Carving, Safety Glasses, Clamps for Work-holding and Assembly, Digital Calipers, Soft Hammer, Plywood

Steps:

Step 1: Getting Started (30 min)

Start with a short video on CNC Milling ("[What is a CNC machining and how it works?](#)"). Then give an historical overview (you can use the document "[Milling](#)") and some general information on CNC Milling (you can use the document "[CNC Machine: Introduction](#)").

Step 2: Safety first (1 h)

Then you will start with an introductory lesson on what safety rules you have to be aware of while milling (you can use the document "[CNC MILL SAFETY](#)").

MODULE 7 – CNC MACHINING

Step 3: Generate a GCode (3 h)

Now get started with GCode and see how to generate one (you can use the document "[Getting started with GCode](#)").

Step 4: Starting the CNC milling (4 h)

After that, start with CNC milling - either using the document "[CNC CLASS](#)" or "[Learn CNC Basics: Big Picture & Concepts](#)".

Step 5: Create own projects (1 h)

In the last step let the participants think of their own little projects that they could implement into lessons - let them work in 2 or 3 groups and present their ideas (i.e. "[Triple CNC Machine](#)" or "[Polar Drawing Machine](#)")

Resources:

Handouts

Step1

- [What is a CNC machining and how it works?](#)
- [Milling](#)
- [CNC Machine: Introduction](#)

Step2

- [CNC MILL SAFETY](#)


Step3

- [Getting started with GCode](#)

Step4

- [CNC CLASS](#)
- [Learn CNC Basics: Big Picture & Concepts](#)

Step5

- 
- [Triple CNC Machine](#)
 - [Polar Drawing Machine](#)

Extra-resources

- [71 cnc projects](#)
- [Introduction to CAD, CAM, and Practical CNC Machining](#)
- [Wk8. Computer Controlled Machining](#)
- [5 Axis CNC Benefits](#)
- [5 Reasons a 5-Axis CNC Machine is actually good for your shop](#)



Module 8

MAKER MINDSET

MODULE 8 – MAKER MINDSET

Introducing to the Maker Mindset

The module is focused on giving an overview of what the Maker Mindset is, the relationship between the maker-based activities with the soft skills the students could gain, so important nowadays for their life and their work, and the challenge to be integrated into the standard curricula.

Total Duration: 4 hours

Learning Outcomes:

- The learner will be able to understand the link between Maker Mindset and maker-based activities
- The learner will be able to apply methodologies for the assessment of Maker Mindset
- The learner will be able to assess student's performance applying Maker Mindset

Activity Overview:

A group of 12 to 16 teachers will learn how to implement the Maker Mindset in the standard curricula.

Tools/Materials needed: pen, paper, scissors and glue, some robotics, hands-on material, 3D printer and vinyl cutting machine, laptops, personal computers and/or tablets with internet connection.

Steps:

Step 1: Introduction to the topic (30 minutes)

First, the trainer gives a short introduction of the module (objectives, timing, resources, and expected outcomes) to make clear what is expected. You can use some videos to make clear what a maker mindset is and why it is important for students, for example: "[Developing a Maker Mindset](#)" and "[Maker Education: Reaching All Learners](#)".

Step 2: Definition of Maker Mindset (1,5 h)

Provide the definition of Maker Mindset and Maker Movement to the teachers, let them read through and then discuss on how each of them would be able to implement this Mindset into their specific subjects and lessons (You can use the documents "[The Maker Mindset](#)" and "[The Maker Movement](#)"). The participants can give feedback and present their ideas.

Step 3: Elaborating possible lessons for class (2 - 3 h)

MODULE 8 – MAKER MINDSET

Teachers will elaborate possible lessons based on maker activities, working in groups of 4 people. The group has to define a little challenge (solving a problem, helping to someone, winning a competition,...) that could motivate young students through maker-based activities with different maker techniques or technologies (hard skills), then identify which soft skills will be developed by the students (you can use the document “[Hard skills and soft skills](#)” to identify them). Discuss how you would assess student’s performance through soft skills. The circular economy and the 3 Rs can be used as references to define the challenge.

Resources:

Handouts

Step1

- [Developing a Maker Mindset](#)
- [Maker Education: Reaching All Learners](#)

Step2

- [The Maker Mindset](#)
- [The Maker Movement](#)

Step3

- [Hard skills and soft skills](#)

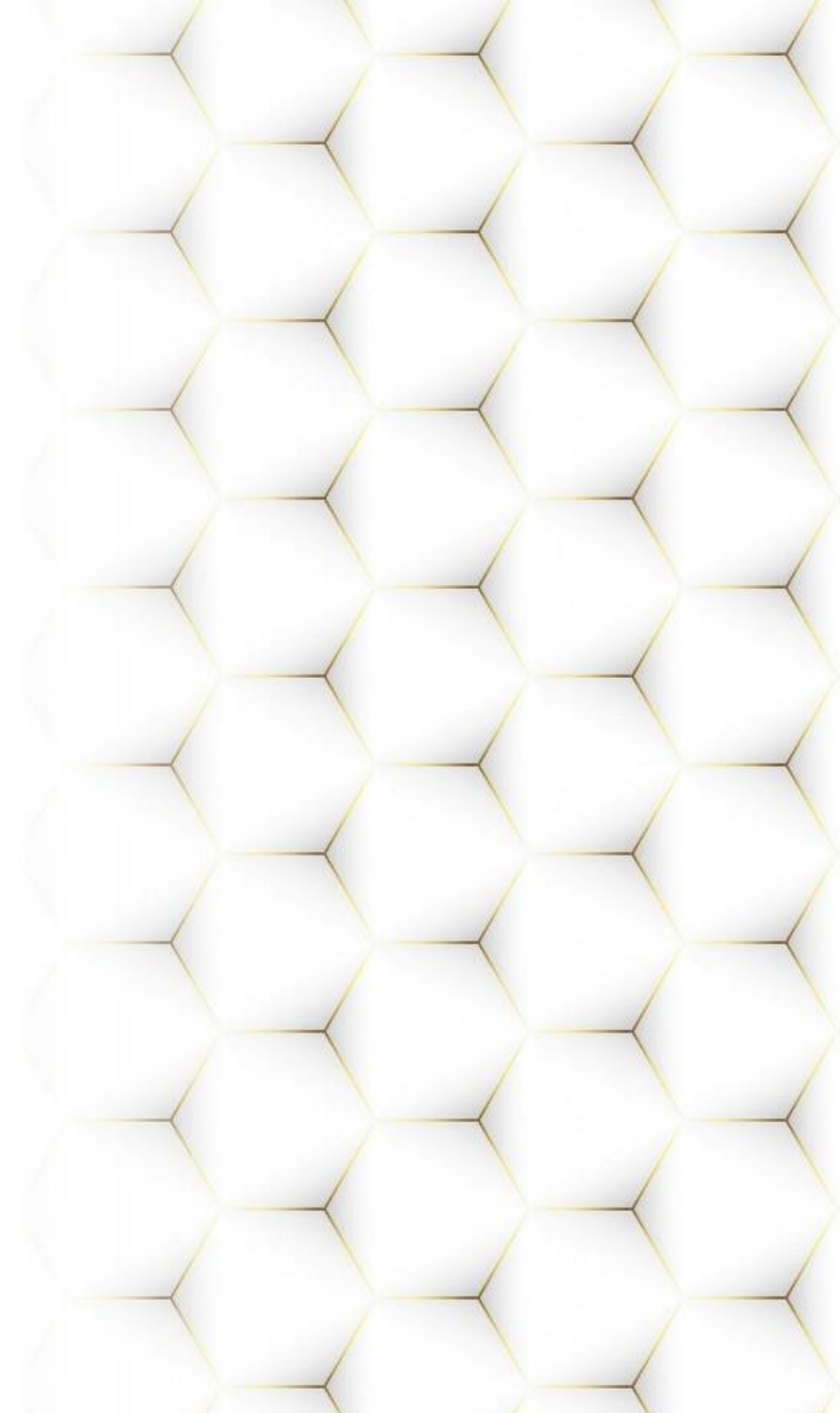
Extra-resources

- [Cultivating the Maker Mindset](#)
- [The maker movement in schools \(TEDx Tokyo Teachers\)](#)
- [Building a Maker Mindset at your school](#)
- [Re-thinking Progress: Circular Economy](#)
- [Reduce, Reuse and Recycle, to enjoy a better life](#)



Module 9

21ST CENTURY SKILLS



MODULE 9 – 21st CENTURY SKILLS

Introducing to 21st-century skills

21st-century skills comprise skills, abilities, and learning dispositions that have been identified as being required for success in 21st century society and workplaces by educators, business leaders, academics, and governmental agencies. This is part of a growing international movement focusing on the skills required for students to master in preparation for success in a rapidly changing, digital society. Many of these skills are also associated with deeper learning, which is based on mastering skills such as analytic reasoning, complex problem solving, and teamwork. These skills differ from traditional academic skills in that they are not primarily content knowledge-based.

We suggest the following video to have an overview of the 21st-century skills: "[What Are 21st Century Skills?](#)".

Total Duration: 6 hours

Learning Outcomes:

- The participants will be able to describe what the "21st-Century Skills" are and why they are important in educational contexts and in daily life (including work contexts).
- The participants will be able to plan and carry out lessons aiming at supporting the acquisition of 21st century skills
- The participants will be able to evaluate the improvements of the students implementing the 21st century skill into lessons

Activity Overview:

A group of 12 to 16 teachers will learn to improve the pedagogical practice concerning the assessment of '21st-century skills' based on the standard curricula.

Tools/Materials needed: paper, pen, Internet, video projector, mobile devices,

Steps:

Step 1: Introduction to the topic (30 min)

Introduce the module (objectives, timing, resources, expected outcomes) to the participants with a presentation of what '21st-century skills' are (you can use the documents "[Overview of the 21st-century skills](#)" and "[Definition of 21st-century skills](#)").

Step 2: Definition of the 21st century skills' relevance (2 h)

MODULE 9 – 21st CENTURY SKILLS

You can focus on the relevance of 21st century skill for students, teachers and schools. You can check the following supporting documents:

- [How 21st-century skill teaching improves schools](#)
- [Debate on what the purpose of public education should be](#)
- [Arguments supporting teaching 21st-century skills](#)
- [Arguments against the concept of 21st-century skills](#)

Step 3: Elaborate scenarios in which making and 21st-century skills can affect lessons (2,5 h)

After knowing about the definition and the debate and arguments, let the participants build groups and make them elaborate on a teaching scenario in their schools / classes. Considering 21st century skills and Making can work together.

Let them take some examples from the other modules (i.e. 3D printing, laser cutting, E-Textiles, Electronics, vinyl cutter, etc...) and give them further reading such as: "[Methodological principles of educational digital fabrication](#)" and "[Maker Movement Teaches 21st-Century Skills and Encourage Innovation](#)".

Step 4: Presentations and discussion on how to evaluate 21st century skills (1 h)

As an example of how to evaluate 21st-century skills, you can have a look at the research conference in Australia in 2019: "[Teaching and assessing the general capabilities in a secondary school context](#)".

Education researchers, policymakers and private enterprise agree that, in addition to content knowledge, students in the 21st-century need to acquire particular skills to equip them for active citizenship in the modern world. This is a real challenge for teachers today: how do they teach and assess the skills needed to live and work in the 21st-century? This paper will explore the development of Eltham High School's focus on teaching and assessment of collaboration, problem-solving, and critical thinking over the past seven years. It will explore the development of the assessment program, its connection to the school and state curriculum, and impacts on staff and students.

Resources:

Handouts

Step1

- [Overview of the 21st century skills](#)
- [Definition of the 21st century skills](#)

Step2

- [How 21st century skill teaching improves schools](#)
- [Debate on what the purpose of public education should be](#)
- [Arguments supporting teaching 21st century skills](#)
- [Arguments against the concept of 21st century skills](#)

- [21ST CENTURY SKILLS](#)
- [Integrating 21st century skills into education systems: From rhetoric to reality](#)
- [Challenges in integrating 21st century skills into education systems](#)
- [Invent To Learn](#)

Step3

- [Methodological principles of educational digital fabrication](#)
- [Maker Movement Teaches 21st-Century Skills and Encourage Innovation](#)

Step4

- [Teaching and assessing the general capabilities in a secondary school context](#)

Extra-resources

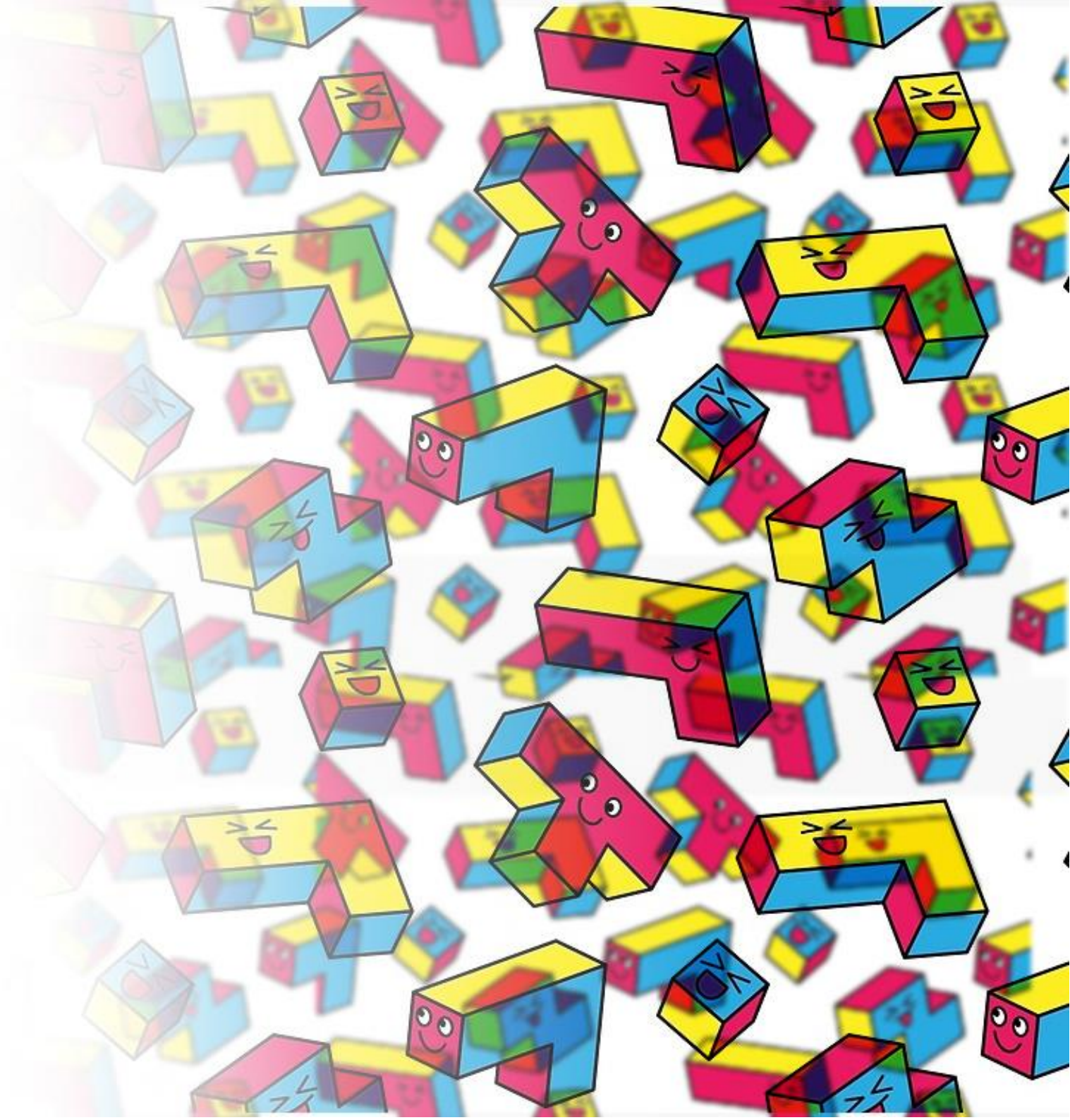
- [Supporting the Development of 21st Century Skills through ICT](#)
- [Example on How to Teach 21st Century Skills in Middle School](#)
- [A 21st-Century Reading List](#)
- [Developing 21st century skills in the classroom](#)





Module 10

THE 4 Cs



Introducing to the 4 Cs

The four Cs (Creativity, Critical Thinking, Communication, and Collaboration) are considered as key competences for 21st-century learners.

- Critical thinking is all about solving problems.
- Creativity teaches students to think outside the box.
- Collaboration shows students how to work together to achieve a common goal.
- Communication lets students learn how to best convey their ideas.

They represent the 21st-century's core competences as part of the 21st century skills.

Creativity and Critical Thinking represent inseparable attitudes and abilities for innovation, which, contrary to popular belief, can be learned, taught and implemented in any classroom.

Communication and Collaboration are fundamental life skills that students can draw from in their everyday experiences at school and shape their ability to live, connect with others and work well in their future. The “Four Cs” strengthen our learners’ ability to find their place – professionally, personally, socially – in today’s fast changing world, while fostering other life-enhancing Cs: curiosity, confidence, caring and cooperation.

We suggest the following video to have an overview of the 4 Cs: “[What are the 4Cs?](#)”.

Total Duration: 10 Hours

Learning outcomes:

- The learner will be able to describe what the “Four Cs” are and why they are important in educational contexts and in daily life (including work contexts).
- The learner will be able to plan and carry out lessons aiming at supporting the acquisition of critical thinking, collaboration, communication and creativity.
- The learners will be able to evaluate the improvements of the 4 Cs in students

Activity Overview:

The activity is intended for a whole class (15/20 teachers). The teachers will understand why the 4 Cs are so important for a modern classroom and have the possibility to focus on the different Cs with specific activities. They will be encouraged to plan and analyse lessons in order to integrate activities stimulating the improvement of the 4 Cs.

Tool/Material needed:

Papers and pen, Internet, video projector, personal computer or mobile devices

Steps

Step 1: Introduction to the topic (30min.)

As a trainer, you should present first an overview of the main topic. You can use, among the other resources, the document “[The 4 Cs](#)” and the presentation “[Overview](#)”.

Step 2: Critical thinking (2 h)

Encourage an analysis and reflection on how to create a critical thinking culture in schools. Use the following tips (you can use the document “[Teaching critical thinking skills to teachers and students](#)”) and let the learners discuss on existing or potential plans and activities suitable for their schools. At the end of the session, the trainer summarises the results in a document including the practical activities suggested by the learners. The trainer can select some videos from this collection for inspiring teachers ([Critical thinking lessons - TED Ed](#)).

Group Activity: Analysis and reviews of different Lesson Plans. The learners, divided into groups, start exploring different lesson plans and strategies for improving creative thinking (see the links below). At the end of the activity, each group will present one lesson plan selected. You can use the following suggestions for practical activities:

- [10 Great Critical Thinking Activities That Engage Your Students](#)
- [Teaching Critical Thinking: The Believing Game & the Doubting Game](#)
- [10 Tips for Teaching Kids to Be Awesome Critical Thinkers](#)
- [Annenberg Classroom](#)

Step 3: Creativity (2 h)

Let the teachers reflect on why creativity is critical to the modern classroom through a Kahoot! challenge that the trainer has to prepare in advance. This is a very engaging activity that works for both students and teachers. You can find a complete tutorial here: [How to play a game of Kahoot!](#)

You can use the following statements as a starting point:

Creative thinking encourages children to explore, enquire and discover which are all crucial for innovation.

Because children are more engaged and interested, creative learning gives them a deeper understanding of what is being taught and they retain more of their learning.

Creative thinking encourages children to feel safe in taking risks in their enquiries.

Without feeling, there is right and wrong, children have the opportunity to question and grow.

Creative thinking encourages thinking outside the box and develops problem-solving skills.

Then you could encourage the learners to explore and compare specific lesson plans for improving creativity. You can check the following resources:

- [Practicing Problem Solving Lesson](#)
- [Problem Solving Plans](#)
- [Creative lesson Plan](#)

It can also show some videos to inspire teachers ([Problem solving lessons – TED Ed](#)).

Step 4: Collaboration (1 h)

The trainer will encourage the learners to explore and compare specific lesson plans for improving collaboration in class.

You can find examples here:

- [What Characteristics do You Want on Your Team? A High School Activity to Teach Teamwork Skills](#)
- [Lesson 2 – Team Building and Communication skills](#)
- [Teamwork Lesson for Learning to Work Together](#)

Step 5: Communication (1 h)

The trainer will encourage reflecting on the importance of the communication with a funny video: “[Where did the communication go wrong?](#)”. Then it will encourage the learners to explore and compare specific lesson plans for improving communication during their lessons.

Different kind of communication (you can use the document “[Communication skills](#)”).

MODULE 10 – THE 4 Cs

Step 6: Analysis of a maker-based activity – working group session (2 h)

The learners will be divided into groups. The trainer will select one maker-based activity for each group (if possible focusing on different subjects – you can find examples on IO1 make In Class Competence Map) asking for creating an assessment methodology for that activity highlighting the potential connections with the 4 C's.

- Each group should analyse the activity defining the different steps
- The learners will create rubrics for evaluating the 4 Cs. To do it you can suggest starting from an analysis of the 4 C's definition or of existing rubrics.
- The rubric should be used to plan assessment methodologies (observation, interview, questionnaires) and standards.
- At the end, the learners will have to produce a document describing what they would evaluate during the maker-based activity and how (Learning Outcomes – timing – tools).

Example of Rubrics (k12 – to be adapted)

Credits | Ephrata Area School District

- [K- 12 collaboration](#)
- [K- 12 communication](#)

- [K- 12 creativity](#)
- [K- 12 critical thinking](#)

Resources:

Handouts

Step1

- [The 4Cs](#)
- [Overview](#)

Step2

- [Teaching critical thinking skills to teachers and students](#)
- [Critical thinking lessons - TED Ed](#)
- [10 Great Critical Thinking Activities That Engage Your Students](#)
- [Teaching Critical Thinking: The Believing Game & the Doubting Game](#)
- [10 Tips for Teaching Kids to Be Awesome Critical Thinkers](#)
- [Annenberg Classroom](#)

Step3

- [How to play a game of Kahoot!](#)
- [Practicing Problem Solving Lesson](#)
- [Problem Solving Plans](#)
- [Creative lesson Plan](#)
- [Problem solving lessons – TED Ed](#)

Step4

- [What Characteristics do You Want on Your Team? A High School Activity to Teach Teamwork Skills](#)
- [Lesson 2 – Team Building and Communication skills](#)
- [Teamwork Lesson for Learning to Work Together](#)

Step5

- [Where did the communication go wrong?](#)
- [Communication skills](#)

Step6

- [K- 12 collaboration](#)

- [K- 12 communication](#)
- [K- 12 creativity](#)
- [K- 12 critical thinking](#)

Extra-resources

- [Critical Thinking](#)
- [Creativity](#)
- [Collaboration](#)
- [Communication](#)





Module 11

INFORMAL LEARNING



MODULE 11 – INFORMAL LEARNING

Introducing to Informal Learning

The Informal learning is the learning resulting from daily activities related to work, family or leisure. It is not organised or structured in terms of objectives, time or learning support. Informal learning is in most cases unintentional from the learner's perspective (Cedefop Glossary 2020).

“The movement among “Makers” is one prominent example of today's approach to informal learning and an important arena for cyber-learning advances. Making is “a class of activities focused on designing, building, modifying, and/or repurposing material objects, for playful or useful ends, oriented toward making a “product” of some sort that can be used, interacted with, or demonstrated. From creating new artefacts, hacking software, or repurposing objects, makers are highly motivated, interest-driven learners that seek out new experiences and actively share what they learn in a community (Sherry Hsi, Shuchi Grover, “[The Cutting Edge of Informal Learning: Makers, Mobile, and More!](#)”).

Total Duration: 10 hours

Learning outcomes:

- The learner will be able to understand the link between informal learning and maker-based activities
- The learner will be able to apply methodologies for the assessment of the informal learning
- Be able to assess student's performance in an informal learning carried out through maker-based activity using Formative assessment.

Activity Overview:

In this training module a group of 12 to 16 teachers will learn about improving the pedagogical practice concerning the assessment of 'Informal learning' based on the standard curricula.

Materials and Tools needed: papers and pens, personal computers/tablets/laptops with internet connection, beamer.

Steps:

Step 1: Introduction to the topic (2 h)

MODULE 11 – INFORMAL LEARNING

You can present the module and a definition of “Informal Learning”. You can find a complete definition in the document “[Definition of Informal Learning](#)”

As next step, you can start introducing informal learning with a funny and educational informal learning activity as the Marshmallow challenge is. Watch this video “[Build a tower, build a team | Tom Wujec](#)”. Here, you can find the complete guide: “[Run the Marshmallow Challenge: A Facilitative Approach to Maximise Learning](#)”.

At the end of the activity, you can reflect with all the participants on how many competencies can be achieved through the Marshmallow challenge and the importance of informal learning for the development of competences.

You can find inspiring examples here:

- [Let us Talk about the Marshmallow Challenge](#)
- [What The Marshmallow Challenge Can Teach Us About Fostering Team Success](#)

Step 2: Assessment tools (2 h)

You, as a trainer, should present the different Informal learning assessment methodologies. You can use the document “[ASSESSMENT FOR, AS AND OF LEARNING](#)” and the presentation of the “[Assessment tools](#)”

You can now ask the participants to reflect on the assessment methodologies presented and carry out a SWOT analysis considering strengths, weaknesses, opportunities and treats of the methodologies considered. You can find editable templates at “[SWOT Analysis Templates and Examples for Any Situation](#)” website and you can watch the following video to have a clear idea about how a SWOT analysis works “[SWOT Analysis - What is SWOT? Definition, Examples and How to Do a SWOT Analysis](#)”.

The results can be collected and formalised in a final document.

Resources:

Handouts

Step1

- [Definition of Informal Learning](#)
- [Build a tower, build a team | Tom Wujec](#)
- [Run the Marshmallow Challenge: A Facilitative Approach to Maximise Learning](#)

- [Let us Talk about the Marshmallow Challenge](#)
- [What The Marshmallow Challenge Can Teach Us About Fostering Team Success](#)

Step2

- [ASSESSMENT FOR, AS AND OF LEARNING](#)
- [Assessment Tools](#)
- [SWOT Analysis Templates and Examples for Any Situation](#)
- [SWOT Analysis - What is SWOT? Definition, Examples and How to Do a SWOT Analysis](#)

Extra-resources

- [The Cutting Edge of Informal Learning: Makers, Mobile, and More!](#)
- [Project-based learning and work in the classroom: Evaluation of learning success](#)
- [Assessment for Learning Formative Assessment](#)
- [SUMMATIVE ASSESSMENT](#)
- [Summative Assessment in Schools | Definition, Examples & Ideas](#)
- [The Importance of Assessment AS Learning](#)
- [Formative assessment and contingency in the regulation of learning processes](#)
- [Essential Project Design Elements Checklist](#)
- [Dylan Wiliam: What do we Mean by Assessment for Learning?](#)

- [Dylan Wiliam: Feedback on learning](#)
- [Self and Peer Assessment Dylan Wiliam](#)





Module 12

PROJECT BASED LEARNING



MODULE 12 – PROJECT BASED LEARNING

Introducing to Project Based Learning

Project-based learning is a dynamic classroom approach in which students actively explore real-world problems and challenges and acquire a deeper knowledge.

Project-based learning (PBL) is a student-centred pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real-world challenges and problems. Students learn about a subject by working for an extended period to investigate and respond to a complex question, challenge, or problem. It is a style of active learning and inquiry-based learning. PBL contrasts with paper-based, rote memorization, or teacher-led instruction that presents established facts or portrays a smooth path to knowledge by instead posing questions, problems or scenarios.

Total Duration: 8 hours

Learning outcomes:

- The learner will be able to understand the link between projects-based learning and maker-based activities.
- The learner will be able to apply methodologies for the assessment of project-based learning.

- The learner will be able to assess student's performance in project-based learning carried out through maker-based activity.

Activity Overview:

A group of 12 to 16 teachers will learn how to improve the pedagogical practice concerning the assessment of 'Project Based Learning' based on the standard curricula. This module can be held both offline and online.

Materials/Tools needed: paper, pen, internet, PC

Steps:

Step 1: Introduction to the topic (1 h)

You can start defining PBL (project-based learning) using the document "[Project-Based Learning](#)". You can find a full definition here: "[Project-based learning \(Wikipedia\)](#)".

Start a discussion on how PBL would change the methods of teaching of the participants.

MODULE 12 – PROJECT BASED LEARNING

Step 2: See different examples of how PBL and Makerspace fit together (1,5 h)

Following you can find some suggestions:

- [4 ideas for using a makerspace to support PBL](#)
- [An Introduction to Project-Based Learning](#)
- [Project-Based Learning Through a Maker's Lens](#)
- [Maker-Centered Project-Based Learning in Inclusive Classes: Supporting Students' Active Participation with Teacher-Directed Reflective Discussions](#)

Step 3: Practical implementation of project-based learning (4 h)

Teachers should work in groups of 4 participants elaborating a 2 hours lesson including PBL. Here you can find some useful examples using the document "[An Introduction to Project-Based Learning](#)".

You can support the participants with additional resources such as:

[How Does Project-Based Learning Work?](#)

[How to Get Projects Off to a Good Start](#)

Step 4: Presentation of lesson plans (1 h)

Every group can show the others their ideas on lessons on PBL with short discussion afterward.

Resources:

Handouts

Step1

- [Project based learning](#)
- [Project-based learning \(Wikipedia\)](#)

Step2

- [4 ideas for using a makerspace to support PBL](#)
- [An Introduction to Project-Based Learning](#)
- [Project-Based Learning Through a Maker's Lens](#)
- [Maker-Centered Project-Based Learning in Inclusive Classes: Supporting Students' Active Participation with Teacher-Directed Reflective Discussions](#)

Step3

- [An Introduction to Project-Based Learning](#)
- [How Does Project-Based Learning Work?](#)
- [How to Get Projects Off to a Good Start](#)

Extra-resources

- [Project-Based Learning Research Review](#)
- [Project Based Learning: Explained.](#)
- [Ten Free Project Based Learning Resources That Will Place Students At The Center Of Learning](#) by Michael Gorman
- [Stanford FabLearn Paulo Blikstein On the Efficacy of Maker Ed: It's About Process, Not Products](#)
- [TEDxManhattanBeach - Paulo Blikstein - One Fabrication Lab per School: the FabLab@School project](#)
- [Study Confirms Project-Based Learning Has a Positive Impact on How Students Learn Science and Math](#)





Module 13

INTERDISCIPLINARITY

MODULE 13 – INTERDISCIPLINARITY

Introducing to Interdisciplinary

The Maker movement is based on a collaborative learning model, promoting cross-sectional knowledge and addressing it in an interdisciplinary way. If we transfer this idea to the academic curriculum competences, teachers could work from different subjects with a common educational objective, allowing a global development of the learning.

Total duration: 2,5 hours

Learning outcomes:

- The learner will be able to understand the link between Interdisciplinary and maker-based activities.
- The learner will be able to apply methodologies for the assessment of interdisciplinary.
- The learner will be able to assess student's performance applying interdisciplinary.
- Identify the basic phases of an interdisciplinary maker project.
- Understand the roles of the teacher during an interdisciplinary maker project.
- Identify different evaluation tools for this type of project.

Activity Overview:

A group of 12 to 16 teachers will learn how to implement the interdisciplinary in the standard curricula.

Materials/Tools needed:

- pen, paper, scissors and glue
- hands-on material
- laptops, personal computers and/or tablets with internet connection

Steps:

Step 1: Introduction to the topic (20 minutes)

As a first step, you can give a short introduction of the module and a definition of what interdisciplinary is. You can use the following video "[The Importance of Interdisciplinary Learning](#)"

Step 2: Definition of the phases that have to be followed (40 min)

Introducing the 8 phases that have to be followed to do an interdisciplinary project. You can use the document "[The interdisciplinary maker project](#)"

Step 3: Role of the teacher, resources and elaborating possible lessons for class (1,5 h)

Concerning interdisciplinary, teachers should work in groups of 4 people trying to set up a 2 to 3 hours lesson (you can use the documents "[The role of teacher](#)" and "[Resources to create a project](#)").

Resources:

Handouts

Step1

- [The Importance of Interdisciplinary Learning](#)

Step2

- [The interdisciplinary maker project](#)

Step3

- [The role of teacher](#)
- [Resources to create a project](#)

Extra-resources

- [PROJECTS](#)
- [Introducing the Beyond Rubrics Toolkit](#)
- [Rubistar](#)
- [ForAllRubrics](#)



Module 14

NETWORKING



MODULE 14 – NETWORKING

Introducing to Networking

A network of teachers that aims to share best practices with respect to educational contents, such as project results, lab activities, subject assignments, video-tutorial, etc. is one of the pillar methods in order to improve the teaching quality and to be more efficacy to contrast students drop out problem. Our focus is to deal with maker base activities as they give evidence to be effective in order to motivate students to learn important skills. The maker based activities are very connected to the scientific subjects of the school, such as maths, electronics, informatics and mechanics, therefore most of the teachers in scientific subjects are very interested in being able to share projects and contents about their topics.

Total Duration: 3 hours

Learning Outcomes:

- The participants will be able to be connected to existing making networks.
- The participants will be able to create their own making network.

Activity Overview:

A group of 12 to 16 participants elaborate networks concerning making, maker community, platforms, schools and teachers to prevent early school leaving.

Material/Tools needed: mobile devices or laptops/personal computers with internet connection

Steps:

Step 1: Introduction to the topic (20 min)


Start giving some general information on Connection and Networking (use the document "[Connection and Networking](#)").

Step 2: Discover different platforms (1 h)

Continue with the presentation of different platforms and let the participants experience the different platforms. You can use the document "[Platforms aiming to share user-created digital design files](#)"

Step 3: Maker communities (40 min)

Introduce the participants to the maker community. Use the document "[Maker Communities](#)" to discover some communities of makers in Europe

A woman with dark hair tied back, wearing safety glasses and a grey long-sleeved shirt, is focused on her work in a workshop. She is standing at a workbench with various tools and equipment. In the background, another person is visible working at a similar station. The scene is lit with warm, overhead lights, and the overall atmosphere is one of a busy, creative workspace.

Step 4: Elaborate the network (1 h)

Let the participants think of their own existing networks and how to extend them according to the input given - let them work in groups to elaborate the network.

Resources:

Handouts

Step1

- [Connection and Networking](#)

Step2

- [Platforms aiming to share user-created digital design files](#)

Step3

- [Maker Communities](#)

