



*A STEAM project for Empathy, Resilience and Creativity*

## INTRODUCTION TO 3D DESIGN

### Author(s)

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### Summary

This lesson is designed to introduce teens to the basics of 3D printing. Participants will learn how 3D printing works, how to use 3D modeling software to design objects, and how to operate a 3D printer. The lesson will also cover safety considerations and best practices for using 3D printers.

Agenda:

1. Introduction to 3D printing: This section will cover the basics of 3D printing, including the history of 3D printing, how it works, and what it can be used for.
2. 3D modeling: Participants will learn how to use 3D modeling software to design objects for 3D printing. They will learn about different software options and how to create simple 3D models.
3. Best practices: Participants will learn best practices for using 3D printers, including how to properly clean and maintain the printer, how to select the right filament, and how to troubleshoot common issues.
4. Q&A: The seminar will end with a Q&A session where participants can ask any remaining questions they may have.

Learning Outcomes: By the end of the seminar, participants will have a basic understanding of 3D printing and how to use 3D modeling software and operate a 3D printer. They will also be familiar with safety considerations and best practices for using 3D printers.

### Key elements

Key elements	<i>3D printing / 3d printers / problem solving / CAD design / CNC manufacturing / design softwares / simulation systems</i>
Subject	Technology /ICT
Topic	<i>Introduction to 3D Design</i>

Age of students	11-17	
Preparation time	8 h	
Teaching time	3-4 h	
Online material	teaching	<a href="https://www.tinkercad.com/circuits">https://www.tinkercad.com/circuits</a> AUTODESK's Fusion 360
Offline material	teaching	ppt 3D design

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## Trends

Bioprinting / Hybrid Manufacturing / Sustainability / Industry 4.0 / Education and Hobbyist 3D Printing / On-Demand Manufacturing

## 21<sup>st</sup> century skills

Creativity / Problem-solving / Critical thinking / Collaboration / Communication / Digital literacy / Design thinking / Project management / Adaptability / Attention to detail / Spatial reasoning / Perseverance / Innovation / Time management / Environmental awareness

## Lesson Plan

Name of activity	Procedure	Time
Introduction to Problem Solving and algorithmic thinking	<p>Using the .pptx material guide your class through the basic meanings of problem solving, algorithmic thinking and algorithm theory.</p> <ol style="list-style-type: none"> <li>1. Introduce your students to the concept of “Problem” and redefine what we perceive as a problem. Linger on how you can approach the process to find different solutions.</li> <li>2. Define the notion of an “algorithm” and how we can employ algorithms to enable problem solving</li> </ol>	15min
Introduction to Technical Design	<p>Using the .pptx material guide your class through the basic meanings of engineering design, mechanical design and the thinking process for 2d representation.</p> <ol style="list-style-type: none"> <li>1. Introduce your students to the concept of “Projective Theory” and explain this theory both from the math and sketch scope.</li> <li>2. Define the concepts of views and sections when designing 3d, always connecting it with the notions of projection level and viewing angle.</li> <li>3. Choose a simple everyday object, such as a lego brick, and proceed to an “Object Study” where you see the differences between all the new concepts you introduced to them, collectively as a class.</li> </ol>	15min
Software and Printing	<p>Start by explaining the concepts of CAD- Computer Aided Design and CAE- Computer Aided Engineering notions.</p> <p>Continue with a historical retrospective in order to emphasise on the importance of this sector.</p> <p>Mention the software available for both 2D and 3D design and their possibilities.</p> <p>Explain the use of a 3d printer and highlight the differences between 3d printing and CNC Manufacturing (additive / subtractive manufacturing).</p>	15min
Applications of 3d printing technologies	<p>In order to raise your students’ interest, cite some of the most intriguing and common applications of 3d printers. Indicatively use examples from the industry, architecture, medicine etc.</p>	5min
Software Demonstration	<p>Familiarise your class with the software you are about to use. Indicatively AUTODESK’s Fusion 360 (free educational licence) or as an online alternative <a href="https://www.tinkercad.com/circuits">https://www.tinkercad.com/circuits</a> (free</p>	15min

	and online).	
Application	<p>Choose an easy- medium object to guide your class to a step by step implementation and design, depending on the age and experience range of the students. Ensure that you are familiar with the design yourself in order to better assist your students' comprehension.</p> <ol style="list-style-type: none"> <li>1. Emphasise on the basic layout of the software (planes, tools, orientation)</li> <li>1. Start with the 2d design without many details, using the appropriate tools</li> <li>2. Transcend to the 3d object using the main command <b>Extrude</b></li> <li>3. Add details such as new bodies, holes or more complex edges. It is recommended that you use an additive approach when designing.</li> </ol>	25 min
3d printing Demonstration	<p>If you have a 3d printer available, devote some time to demonstrate to your class the basics for operating a 3d printing.</p> <ol style="list-style-type: none"> <li>1. Participants can learn how to operate a 3D printer, including how to load filament, prepare a print bed, and start a print job. They can also learn about common issues that can arise during printing and how to troubleshoot them.</li> <li>2. Cover safety considerations when using 3D printers, including proper ventilation, fire safety, and avoiding burns.</li> <li>3. Show best practices for using 3D printers, including how to properly clean and maintain the printer, how to select the right filament, and how to troubleshoot common issues.</li> </ol>	

### Assessment

Here we include as an example the image of a rubric teachers can use to assess their students:

Kahoot

### Students' and teachers' feedback after the implementation of the Learning Scenario during the Pilot phase of the project

#### Student feedback

## **Teacher's remarks**

### **About STEAM EmbRaCe project**

This Learning Scenario has been created in the framework of the STEAM EmbRaCe project.

STE(A)M EmbRaCe aims to promote inclusion by engaging and inspiring students from different backgrounds. Students work on real-world STE(A)M problems, which will help develop their cultural empathy, resilience, and creative thinking. The idea is to create digital content which will be ready to be used by teachers in any classroom setting. More specifically, the project will allow the development of a 7-week course and teacher training on how to use the developed material with students.

Find out more about the STEAM EmbRaCe project:

<https://steamingthefuture.gr/steam-embrace/>

## **Annex 1**

## **Annex 2**