

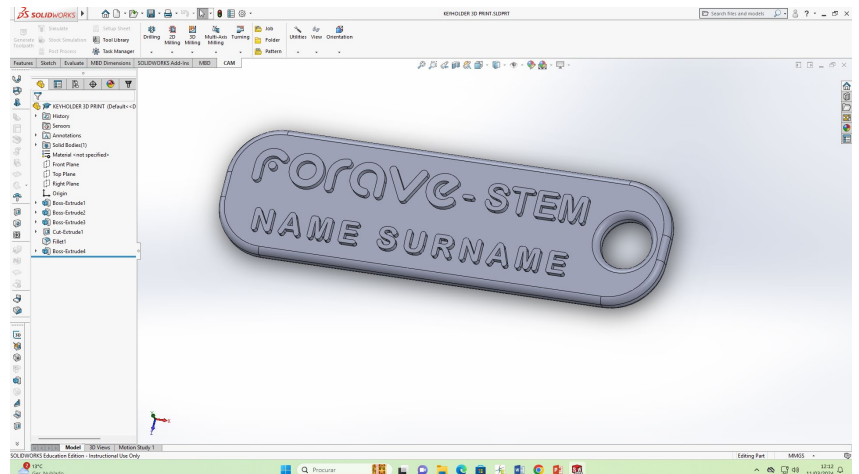
Learning Unit	
Subject	3D Printing
Title	3D Prototype Design and 3D Printing
Author	Rafael Pinheiro
School	FORAVE – Associação para a Educação Tecnológica do Vale do Ave
Description of the unit	This unit aims to teach secondary students to design 3D prototypes using SolidWorks and to use 3D printers.
Contents	<ul style="list-style-type: none"> ● Drawing a 3D model ● Printing a real 3D prototype
Learning Outcomes / Skills	<ul style="list-style-type: none"> ● Students will be able to: <ul style="list-style-type: none"> - Know the environment and the commands of a 3D modelling software Design - Know the working of a 3D printing machine
Target students/class	High school (15 – 17 years old)
Prerequisites	ICT skills
Time expected	2 hours
Interdisciplinary links	Science, ICT
Methodology	Group Work Creative problem-solving and decision-making
Human Resources (internal and/or external)	Technical subject teacher and ICT Teacher
Resources	Computer with SolidWorks software and Ultimate Cura software
Lesson Plan	<p style="text-align: center;">Lesson 1</p> <p>This lesson demonstrates and explains the SolidWorks software working environment and its basic commands. To better understand the capabilities of SolidWorks software it is suggested that students watch the following video: https://www.youtube.com/watch?v=31H72qQ8qYw</p>



Learning Unit

After watching the video, students are asked to run the SolidWorks software and a pre-prepared file of a 3D prototype design.

The 3D model drawing should be similar to that of the image below.



In the 3D prototype drawing, the students are asked to personalise it with their names. Each step of this task is explained as students perform it.

To conclude the lesson, students are asked to save each part of the 3D prototype in the .stl extension. Again, each step of this task is explained as students perform it.

Lesson 2

Students are asked to run the software Ultimaker Cura. This software will allow us to slice the prototype and prepare it for the 3D printer so that it can be read and printed correctly.


Students are instructed to perform the following steps:

1. Open the stl file in Ultimaker Cura and place it in the correct position.
2. Change the necessary parameters for optimal printing.
3. Click save file to get a .gcode file and choose the folder where you want to download the file.
4. Copy the gcode file onto the memory card that you will insert into the printer.

After this task is completed, students are shown how to set up the printer, in our case an ender 3 Pro Printer, but this activity can be different if another 3D printer is used.

Students are instructed to perform the following steps:



Learning Unit	
	 <ol style="list-style-type: none"> 1. Put the memory card into the printer and browse the menu options. 2. Set up the printer so that it recognises the 0,0 coordinates. 3. Select “Prepare” in the menu options and then the “Autohome” option. The 3D printer will start to calibrate the bed and extruder. <p>When this process is complete, we press “Print from TF” and select the correct file. The 3D printer will start printing.</p>
21st Century Skills	<p>Critical thinking: students will be able to analyse data during practical experiments and communicate their conclusions.</p> <p>Collaboration: students will be able to collaborate within their groups and with others and help each other understand the content and experimental activities.</p> <p>Communication: Students should be able to share conclusions and doubts with their classmates and teachers.</p> <p>Media and technological proficiency: students will be able to use online sources to clarify doubts.</p> <p>Technology literacy: students will be able to use different technological tools to perform the tasks.</p>
Assessment	<p>Formative Assessment:</p> <ul style="list-style-type: none"> ● Attendance ● Responsibility ● Autonomy ● Participation in classes ● Participation in the activities ● Critical spirit, participation, behaviour.
Remarks	--

3D PRINTING



3D PRINTING

- OPEN THE FILE PROVIDED IN THE SOFTWARE “SOLIDWORKS”;
- CHANGE THE NAME IN THE FILE PROVIDED;
- SAVE THE FILE IN .STL;
- MAKING "SLICE" IN SOFTWARE “CURA”;
- PRINT THE FILE WITH THE EXTENSION.STL



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1. Say if the following statements are True or False. Correct the False ones.

- When we want to print a prototype we have to export the file in .stl format.
- Cura Ultimaker Software has parameters that we cannot change
- When we use SOLIDWORKS the object moves only on the vertical axis.
- With Creality CR5H printer we cannot print in two colors
- We can place the prototype anywhere on the 3D printer bed

2. Choose the best option. Justify your answers.

- In which format do we export the prototype in TinkerCAD?
 - .SVG .STL .GCODE
 -
- What is the file format that the 3D printer can run?
 - .GCODE .OBJ .SVG
 -
- What option of the printer menu can be used to place the extruder at coordinates 0,0?
 - Autohome Disable Steppers Preheat PLA
 -
- What is the optimal temperature of the 3D printer bed?
 - 60° 220° 145°
 -
- What is the optimal temperature of the extruder nose of the 3D printer?
 - 60° 220° 145°

