STEAMTeach

Science | Technology | Engineering | Arts | Mathematics

3D Modelling and Printing

STEAMTeach Austria PDF

PROJECT

PROJECT ACRONYM	STEAMTeach
PROJECT TITLE	STEAM Education for Teaching Professionalism
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REPORT DETAILS

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STATUS	

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1 PROJECT JUSTIFICATION

Trends predict that more and more consumer goods will be produced locally and additive manufacturing reaches many aspects of our lives from producing small items such as replacement parts or jewellery up to large objects such as houses. The ING DIBA Analysis 2017 predicts that this technology will reduce global trading by about 40% in the upcoming future and 50% of produced goods could be 3D printed within the next 20 years. This analysis also shows that teaching and education are among the three most used applications of this technology. Creating useful objects using this technology requires skills from fields from STEAM as materials, forms, machines, and software are involved in the 3D modelling and the production of the model. The European Union developed eight core competencies that should be fostered in education and renewed them in 2018 focusing on basic, entrepreneurial and digital skills as well as languages aiming to enable everyone to participate actively in society. Within these core competencies, especially science, technology, engineering and mathematics (STEM) related skills are emphasized to lead people into careers in STEM fields.

Teachers who want to train their students in these skills need knowledge and tools to do that. However, not only the tools are required but also the motivation, knowledge and skills to use provided tools are required. 3D printing is currently not part of every school's equipment, this technology is rarely found in schools. Not always do teachers possess the intrinsic motivation to find ressources and the courage to master the basics on their own. Apart from the costs of machines, the slow adaptation of such technologies in schools suggests that teachers need support. This course concept investigates which benefits STEAM teachers can expect if they learn about and use 3D modelling and 3D printing and looks at which attributes courses and workshops have that helps them learn about and use this technology in their lessons.

Co-funded by the Erasmus+ Programme of the European Union

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1.1 Project Overview

Participant age: From 20 to 65	***No. of participants:*** Groups of 10 to 20 people	***Duration:*** 5 to 6 hours, 2 parts
Level of knowledge: Basic Knowledge of GeoGebra, PC user, owner and user of a smartphone	***No. of teachers:*** 2 to 3 people would be perfect, one is the minimum	***Type of venue:*** A mix between a computer classroom and a makerspace with 3D printers
Learning methodologies: Collaboratively working on problems, task based	***Involved disciplines:*** all STEAM disciplines are involved	***Technological needs:*** Computers, two tablets, internet, 3D printers
Most emphasised learning methodology: Collaboration and problem based learning, modelling	***Main addressed topics:*** 3D thinking, mathematical modelling	***Estimated project cost:*** 1500 €

2 CURRICULAR CONTEXT

2.1 Key competences

The developed competencies touch literacy, need and use digital skills, foster STEAM skills, require social interaction and communication in a group, and help develop entrepreneurial thinking and can express one's inner thoughts, ideas and culture.

2.2 Content

DISCIPLINE	CURRICULAR CONTENT ADDRESSED
Science	Temperatures, slopes, shrinking of material, chemical components of materials, glass and melting points, ...
Technology	The use computers and CAD programs that are easy to use from 10 years and above
Engineering	The use 3D printers and create models that can be created in the real world
Arts	design objects that not only fulfill a purpose but that also express one's inner world
Mathematics	mathematical modelling, geometry, vertices, calculus, mirroring, scaling, ...

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2.3 Expected learning results

Pre-service teachers should understand that there is a discrepancy between 2D representations of real world objects and the actual 3D object and it is hard work to understand the projection of a 3D object to 2D and of 2D representations and 3D objects. In addition, they should understand and be able to find and/or alter and/or create 3D models that can solve real world problems or visualize a concept that they want to teach their students.

The ultimate goal is that they know how to motivate and enable their students to use this technology to create their own models. This will help their students to develop and use STEAM skills and also understand the importance of STEAM for their future lives.

3 STEPS TO BE EXECUTED

3.1 Step 1: Presenting needs of students and opportunities of the technology

60 minutes are dedicated to showing teachers what benefits they can expect for their students when doing this workshop and learning about 3D modelling and 3D printing.

A general basis of understanding the technology and what benefits in which lesson and to solve which problems will be shown. Teachers will be asked to play with games in groups of 3 that require STEAM to be created and they will learn that by creating resources they can also teach concepts of their subject. Afterwards, they receive more input about the technology and finally get the task to browse a page filled with examples in their groups to get inspiration. They should then present one example and explain why it can be beneficial to their lessons.

10 minutes break.

3.2 Step 2: Basics of 3D Modelling, Developing their First Idea

The next 50 minutes revolve around participants learning and understanding more about what attributes a 3D printable model has, get a repetition on why it can be beneficial for their lessons and their students and create their first models. Introductions into modelling using GeoGebra and TinkerCAD where participants need to create simple objects such as prisms should help them understand representations in 3D.

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They develop their own ideas in groups of 3 and create a GeoGebra book documenting their individual project ideas. Each project must be 3D printable, beneficial to their personal subject and should be producible within 10 minutes of printing time.

10 minutes break.

3.3 Step 3: Software more In Depth

The next 50 minutes should be dedicated to project ideas and more in depth modelling as well as basics of 3D printing. All ideas should be briefly presented and 2 other groups have to give feedback to a presentation so everyone gets feedback.

After the presentations, modelling something more complex and modifying the 3D model in Meshmixer and Repetierhost should help to understand how to refine one's model. Basics of which software is responsible for what in the production process will be presented.

20 minutes break, end of part 1

3.4 Step 4: Designing and Refining the 3D Model, first Print

Groups will have time of 40 minutes to refine their modelling ideas or start to alter simple models they found. All participants will be able to observe a 3D printer in action and get a presentation of an entire process from a 3D model download to the creation of the model with the 3D printing machine with a repetition of all steps of the software.

One group will get a special introduction on how to handle a 3D printer so they can operate the machine in the next step in 10 Minutes. The other groups can commence working on their models.

10 minutes break.

3.5 Step 5: Creating and Evaluating the 3D Object

The last hour of the workshop is dedicated to printing out all developed 3D models. If a group feels ready, they are invited to approach one of the dedicated 3D printing group members and try their print.

They then should evaluate in their group whether the print went fine or if there could be some improvement and then show their solution to another group for feedback.

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4 PROJECT EVALUATION

Ask participants to fill out open questions about 3 days later

5 MATERIALS AND ROOMS

One room as described, enough electricity, W-LAN, about 4 3D printers

6 INSTRUCTIONS ABOUT THE CONSTRUCTION OF PROTOTYPE/SOFTWARE/OTHER

Instructions are provided and collected in GeoGebra books.

7 CONCLUSIONS RECAP & REFLECTION

A recap and a reflection would be nice. I can not draw conclusions now.

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