

Europeana Learning Scenario

Title: 3D printing-modern available technology of the future.

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Summary

Table of summary

Subject	Operation of machines and electrical devices (subject in Technical School)
Topic	Mechatronics and robotic laboratory, Electric Laboratory, Robotics, 3D printer.
Age of students	16-20 years old (Technical School)
Preparation time	45 min preparation of laboratory stands
Teaching time	135 min – laboratory block of 3 lessons
Online teaching material	Teacher's own website: http://marcinjablonski.rwbb.pl/ http://marcinjablonski.rwbb.pl/instrukcje-lab/ http://marcinjablonski.rwbb.pl/?attachment_id=562
Offline teaching material	Laptop/notebook with Mechatronics equipment – 3D printer “Prusa i3” and dedicated software for accessories (Repetier_Host), basic workshop tools (pliers, putty), solvent (extraction gas), 3D printing glue or hairspray.
Europeana resources used	3D printed models: https://www.europeana.eu own searching: “3D printer”, “3D model” https://www.europeana.eu/portal/en/record/9200579/rwppn3wu.html?q=3D+printed#dcId=1556474947557&p=1

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Integration into the curriculum

The learning scenario is supposed to develop the STEM skills: mathematical introduction to 3D printer, programming, spatial imagination, saving and sending the program code, checking the program code on the “Repetier_Host” software and sending the correct program to the 3D printer. Students will expand their knowledge of math, physics, coding and vocabulary related to these topics. Students will also practise how to describe the Cartesian coordinate system in “Repetier_Host” App and how to react in typical situations in 3D printer coding. Students will learn how to look for and use online sources of information in a foreign language which also constitutes an essential element of the national curriculum. Working in pairs students will learn how to negotiate and discuss ideas presenting arguments for and against.

Aim of the lesson

Students will:

- enrich their knowledge of STEM,
- develop their STEM skills: math & physics, coding,
- develop their vocabulary connected with the topic of mechatronics & robotics,
- practise describing the Cartesian system,
- practise using ICT tools.

Trends

- Project-Based Learning,
- Collaborative Learning,
- Learning in pairs,
- Combination of lecture and workshop issues.

21st century skills

- Creativity and Innovation - Students create new ideas using ICT tools and work creatively with others,
- Critical Thinking and Problem Solving - Students analyse information from STEM,
- Communication - Students presents their ideas, listen effectively, use communication for a range of purposes (combination of lecture and workshop issues),
- Collaboration - Students work in pairs to accomplish a common goal and share responsibility for collaborative work (one didactic device for two students),
- ICT Literacy - ICT tools are used to research, organise, communicate and evaluate information.

Activities

Name of activity	Procedure	Time
Stage 1	Starting classes, checking the presence of students.	5 min
Introduction to the Europeana Collections	Students browse the website as an introduction to the lecture part of the class. Some basic information about Europeana is discussed.	5 min
Introduction to the Europeana	From the computer teacher displays information about the lesson topic from Europeana.	5 min
Lecture about the 3D printer	Basic STEM issues concerning the 3D printer, theoretical foundations of operation, schemes and implementation in industry are discussed. Specific solutions of the 3D printer, such as Prusa i3, production processes performed by them as well as programming methods are shown. Information from Europeana and www.marcinjablonski.rwbb.pl website.	20 min
Questions and answers	Students ask questions about issues that they do not understand during the lecture on 3D printer issues	10 min
Stage 2 combination of lecture and workshop issues	The teacher explains the operation of the "Repetier_Host" program, individual functions and their application. Each pair of students have the "Repetier_Host" program enabled on their computer. During these classes, the teacher can teach 6 students at the same time, the school has 3 3D printer devices.	10 min
Searching for information about coding	Each pair of students enter the website www.marcinjablonski.rwbb.pl in the tab laboratory instructions, opens topic 23 - " Wydruk 3D PL-EN " – English or Polish version.	5 min
First student programming	Together with the teacher students solve a simple coding problem, check the program code in the 3D printer. They ask questions while doing things.	30 min
Stage 2 Some of the answers have to be included in the laboratory manual of my authorship	During this part of the class, students start to program themselves. They mark the points characteristic for the arm in the Cartesian system (X, Y, Z positions), enter the characteristic parameters. During this part, students think in a creative and innovative way. They try to solve the tasks set for them. Some of the answers have to be included in the laboratory manual of my authorship. Some of the issues remain open to their own creative inventiveness. Thanks to that, we develop logical thinking. In this part of the class the teacher becomes only an adviser for the students. He becomes a model that stimulates them to independent creative thinking.	45 min

Assessment

After conducting a series of classes in the laboratory, a test of a given topic is planned. Students will also receive lectures on what elements of the course more emphasis should be placed. The questionnaire will be carried out anonymously.

***** AFTER IMPLEMENTATION *****

Student feedback

After completing the course based on the acquired knowledge, own notes, access to websites, each student performs a report on his/her work during laboratory classes. In the report, he/she describes his/her achievements, attaches a screen or program code. He/she develops applications for further work. Even if the goal is not achieved, there is room for some error analysis and making corrections to the next programming activities. The report is sent in the electronic form to the email address of the teacher. The next stage will be familiarizing with the mini CNC machine.

Teacher's remarks

The lesson presented is the first in a series of exercises in the laboratory, the next lessons are continuation of programming. In the first classes, more emphasis should be placed on the theoretical introduction and interest of the young person in new technologies, such as the spontaneity of 3D printers. More practical applications should be provided. It is necessary to consider carrying out a training trip to a company with a 3D printer in its machine park.

About the Europeana DSI-4 project

[Europeana](#) is Europe's digital platform for cultural heritage, providing free online access to over 53 million digitised items drawn from Europe's museums, archives, libraries and galleries. The Europeana DSI-4 project continues the work of the previous three Europeana Digital Service Infrastructures (DSIs). It is the fourth iteration with a proven record of accomplishment in creating access, interoperability, visibility and use of European cultural heritage in the five target markets outlined: European Citizens, Education, Research, Creative Industries and Cultural Heritage Institutions.

[European Schoolnet](#) (EUN) is the network of 34 European Ministries of Education, based in Brussels. As a not-for-profit organisation, EUN aims to bring innovation in teaching and learning to its key stakeholders: Ministries of Education, schools, teachers, researchers, and industry partners. European Schoolnet's task in the Europeana DSI-4 project is to continue and expand the Europeana Education Community.