Europeana Learning Scenario

Title:

Experimental Plant Breeding in HyperGravity.

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Abstract

If you want to take your experiments to a higher level of commitment, combine several fields of science. We add biology to STEM, first we build a scientific equipment and use it in research work. We will try to build a Hypergravity_Centryfuge and then grow plants in it in conditions simulating extreme gravity. We will learn about autonomous systems for plants. The aim of the classes is also to show young people a different source in their search for knowledge. Europeana.eu is a reliable and proven source where universities, libraries, schools and museums publish their resources. All the materials published there are of the highest quality, so the teacher does not have to worry about it. In this scenario, various systems of the biosphere using Europeana materials will be presented.

Keywords

Plants, habitat, ecology, climate change, Robotics, Mechatronics

Table of summary

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Subject	**Basics of Mechatronic Systems** **Extra-curricular activities in Mechatronics** (Extra-curricular activities in Technical School)
Topic	Mechatronic and robotic laboratory, Electric Laboratory, Robotics, autonomous systems.
Age of students	15-20 years old (Technical School)
Preparation time	45 min information about robotics (Europeana & own website) 45 min preparation of agar as the basis for the cultivation of watercress in airtight containers for samples.
Teaching time	➢ minimum 675 mins – 5x laboratory block of 3 lessons to build a mechatronic system, ➢ 45 mins - preparation of agar as the basis for the cultivation of watercress in airtight containers for samples, ➢ 45 mins after 5-6 days - opening the containers for samples and measurements of the grown plants, ➢ creating a report / presentation as homework, ➢ presentation in the lesson.

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Online teaching material	HyperGravity-1 HyperGravity-2 HyperGravity-3 HyperGravity-4
Offline teaching material	Laptop/notebook with Mechatronics free software: Arduino, Fusion360, Repetier_Host, Teacher's computer with software and LED screen or projector, Mechatronics Workshop with basic tools
Europeana resources used	Plants in laboratory Botanic Garden-1 Botanic Garden-2 Botanic Garden-3 Botanic Garden-4 Botanic Garden-5

Licenses

Integration into the curriculum

The learning scenario aims to develop STEM skills: math introduction to PCB, programming, spatial imagination, saving and sending a program code, checking a program code on Fritzing software, and sending an appropriate program to print. Students will expand their knowledge of mathematics, physics, coding, biology and the vocabulary related to this topic. Calculations need to be made - conversion of centrifugal force to increased gravity. Students will also practice how to describe the scientific hardware construction carried out and the subsequent experiment with vegetation in hypergravity. Students will learn how to search for and use online sources of information in a foreign language, which is also an important part of the national curriculum. The last element after building the Hypergravity_Centryfuge is a 5-6 day-long cultivation of cress in agar under conditions of increased gravity and normal gravity.

Aim of the lesson

LS will:

- enrich their knowledge of STEM,
- develop their STEM skills: math & physics, biology,
- develop their vocabulary connected with the topic of electronics, mechatronics & robotics and then biology,
- practice describing Cartesian system,
- practice using ICT tools.

Outcome of the lesson

The lesson will result in creating a scientific aid which is Hypergravity_Centryfuge and then growing plants in increased and normal gravity. A simple and inexpensive experimenting system for student project

applications will be presented. The last step will be to create a report on the growth of plants under various gravitational conditions. The report / presentation will be presented in both technical and biology lessons.

Trends

- Project-Based Learning,
- Collaborative Learning,
- Learning and planning with computers app,
- Combination of lecture and workshop issues,

Key competences

- Creativity and Innovation - Students create new ideas using ICT tools and work creatively with others,
- Critical Thinking and Problem Solving - Students analyze information from STEM,
- Communication - Students present 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,
- Basics information about biology.

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. Basic information about Europeana is discussed.	5 min
Introduction to Europeana	From the computer the teacher displays information about the topic lessons from Europeana.	5 min
Lecture about robotics and building equipment	Basic STEM issues concerning PCB, theoretical foundations of operation, schemes and implementation in industry are discussed. Specific solutions of PCB, such as the Fritzing program, production processes performed as well as programming methods are shown. Information from Europeana and teacher's website, waypoint and another website.	20 min
Questions and answers	Students ask questions about issues that their don't understand during the lecture.	10 min
Stage 2	The teacher explains how calculations work, individual functions and their application. Each student has a spreadsheet program turned on on their	10 min

combination of lecture and workshop issues	computer. During these classes, 15 students can be taught simultaneously, one computer with the software for one student (maximum 15 students in one LAB group).	
Searching for information about mechatronics	Each pair of students enters the website in the tab laboratory instructions.	5 min
First student programming & 3D drawing	Together with the teacher students solve a simple coding problem, check the program code Fusion360. They ask questions while doing things.	30 min
Stage 2 **the students themselves program**	During this part of the class, students start to 3D program themselves. They can use the same modules of autonomous systems or make their own project.	45 min
Stage 3 **Students' own work**	The students are divided into workgroups and they deal with several things: calculating centrifugal forces, designing the drive and control system, housing design, and selecting lighting for the appropriate plant growth.	45 min
Stage 4 **Students' own work**	Assembling the device and first working tests.	45 min
Stage 5 **Students' biology experiment**	Preparation of agar as the basis for the cultivation of watercress in airtight containers for samples,	45 min
	after 5-6 days, opening the containers for samples and measurements of the grown plants,	45 min
Stage 6 **Presentation of students' biology experiment**	creating a report / presentation in the lesson.	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 which 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, students perform reports on their work during laboratory classes. In the report, they enter their achievements, attach a screen or program code. They develop applications for further work. Even if the goal is not achieved, there is room for 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.

Teacher's remarks

The lesson presented is the first in a series of exercises in the laboratory, the next lessons are continuation of programming. During the first classes, more emphasis should be placed on the theoretical introduction and interest of the young person in new technologies and making their own structures. More practical applications should be provided.

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 32 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.

Annex

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