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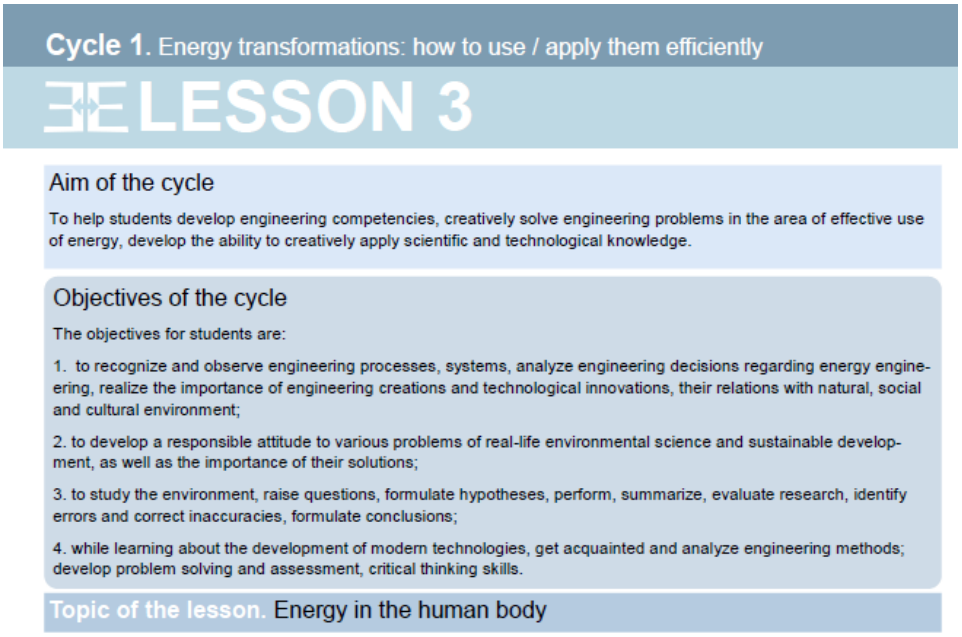
how to raise an Inventor

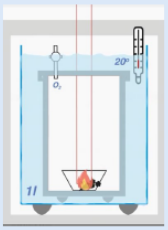
Erasmus+ KA2 Strategic partnerships for school education project
"How to Raise an Inventor. Technology and engineering learning material for schools"

Project no.: 2017-1-LT01-KA201-035284

MODULE DESCRIPTION AND RECOMMENDATIONS FOR TEACHERS

Name of the module	How to Make Ideas and How They Travel
Creators (organization)	KTU Lyceum of engineering (Lithuania)
Main topics	Design thinking, innovative engineering, design ideas and solutions for engineering problems
Available in these languages:	English, Dutch, Polish, Lithuanian, Latvian
Recommended age group	9-13 years old
Length of the course	The course lasts minimum 12 lessons but it might be extended with creative lessons to the entire year. Younger students can take part in the lessons depending on their level of knowledge.
Duration of each lesson or project	Cycle 1. Energy transformations: how to use/ apply them efficiently (1-5 lessons) Cycle 2. Creative engineering and design ideas (6-8 lessons). The lessons may be extended using additional creative tasks (additional 4-5 lessons). Cycle 3. Idea of sustainable development – challenge for science and engineering (9-12 lessons). These lessons might be extended to the entire year, dividing tasks into smaller projects. General duration of one lesson is 45 minutes.
Required hardware	Micro: bit controllers; Ultimaker 2/ 2+ 3D printer (or others regarding the needed parameters), material for 3D printing (3 mm, 60 g (at least 2 units) PLA filament).
Required software	"Scratch" programming language; the webpage microbit.org; programming equipment - QCAD (or Adobe Illustrator, Corel Draw, SketchUP, Paintnet, etc.), programming equipment - Autodesk 123D Design (or Blender, Autodesk Fusion 360, SolidWorks, Autodesk Inventor, MAYA, Autodesk 3DS Max etc., Cura (or SIMPLIFY 3D, Slic3r, Microsoft 3D Builder or others). All programs can be found online. If needed, they might be changed by other programs. If the lessons are taught by a science teacher, he/she should have basic IT skills or should invite IT teachers to cooperate.
Required skill level (pupils)	STEAM knowledge, basics in ICT. The educational process can be implemented flexibly, regarding personal qualities, interests, abilities and experience of students.
Required skill level (teachers)	Certain level of knowledge in STEAM is required. We recommend to include teachers of different subjects – ICT specialists, teachers of engineering, science, media, etc.
Skills developed in the module	Complex engineering problems solving ***** Critical thinking ***** Creativity ***** Human resource management skills *** Cognitive flexibility ***
What pupils will learn?	The module shows how scientific, engineering and artistic creation affect each other synergistically and is the main engine of the contemporary society progress. The module reveals the interdisciplinity of engineering, diversity of the world. When completing the course students will be able to recognize and observe engineering processes and systems, analyze engineering decisions, realize the importance of engineering creations and technological innovations, and their relations with natural, social and cultural environment.
The structure of the course	The course consists of three cycles. The first cycle consists of 5 lessons. The second cycle consists of 3 lessons. The third cycle consists of 4 lessons.

What is different about this teaching material comparing to others for the same topic?	This educational material is created regarding the unique experience of engineering education of the first specialized engineering education school in Lithuania, i.e. KTU lyceum of engineering. Most of the provided tasks have been tested working with the lyceum's students and have been evaluated as very successful, interactive, interesting and demonstrating students how to work in real-life situations, helping to realize the interdisciplinity of engineering and possibilities.
What teaching materials do pupils get?	Text, slides, videos, worksheets, presentations. All worksheets are printable.
What teaching materials do teachers get?	Text, slides, videos, worksheets, presentations, teacher's book. All worksheets and teacher's books are printable.
How to reach the material?	http://play.gaminu.eu/ Select preferred language, follow registration procedure and then select this course.
Examples of the material	 ----------

	2. ACTIVITY. PRESENTING NEW MATERIAL (5 MIN.) **2.1. Analysis of the concept of calorie and how a calorimeter works (3 min)** **Question:** • do you know how to measure calories in food? /The tool is called a *calorimeter*/ Slide show *Lesson No 3. Appendix No 1. Calorimeter working principle.*  Lesson No 3. Appendix No 1. Calorimeter working principle. When a ⏸ pause appears, a film is stopped and the following questions are given: **Tip for the teacher** *• It is suggested to show the film with pausing it when the black screen appears. Then students might be given questions — specific and direct questions should help students to find out by themselves how a calorimeter works;* *• a teacher does not provide answers — students are allowed to guess/ answer the questions; if a right answer is not given, students continue watching the film silently. Then the question about what is happening in the film, is posed again.*
Recommended projects	If you have limited time, you may start from the 5th lesson.
Organization of the course	At the end of almost all lessons more important recommendations for teachers might be found, also a lot of information and suggestions are included in the lesson material. It is recommended to teach 1-3 lessons for science teachers, the content might be integrated into formal education science lessons, visiting museums, etc. Starting from the 4th lesson a science teacher should have some basic programming skills or the lessons might be taught by IT teachers who have knowledge in natural sciences. The 2nd cycle lessons should be taught by art teachers cooperating with IT specialists or different subjects teachers should divide the lessons between them. During the 6-7 lessons creative tasks appear which might be extended by the teacher, dedicating more time to the provided material (the cycle may be prolonged from 2 to 4 lessons). For the last cycle (9-12 lessons) all the knowledge acquired during the project modules (micro:bit MAKER lessons, Create an Arm Wrestling Robot, The Art of Making) might be used. If there is a possibility, the lessons of this cycle might be extended to the smaller projects taking place during the entire semester. In order to integrate English, a part of examples of the materials and educational videos are in English. A teacher is expected to have English knowledge of at least B2 level or cooperate with an English teacher.
For teachers with no prior experience in the topic	Recommended literature might be found at the end of the lessons. Certain programs tutorials can be found online (links included in every lesson).
Additional material for teachers	Recommended literature might be found at the end of the lessons. Certain programs tutorials can be found online (links included in every lesson).
Suggested next topics for pupils to get into after this course	Engineering, design, media technologies
Support	If you need assistance with the module, please contact vice-principal Aritone Plungiene or vice-principal Vilda Kiaunyte at KTU lyceum of engineering, by the following emails: aritone@inzinerijoslicejus.ktu.edu, vilda.kiaunyte@inzinerijoslicejus.ktu.edu; We would also be happy to receive your feedback about the module, photos and videos of using our learning material in your classes.