SMART SPACE

Age-group: 12-15 years old
Number of hours: 20 hours

Short description of activity:

In this multi subject project students will research the usage of energy around the world and in their own country. Students innovate smart solutions to save electricity and design smart spaces in which these solutions will be implemented.

CT-competences:

Data collection and Analysis
Analyzing

Patterns

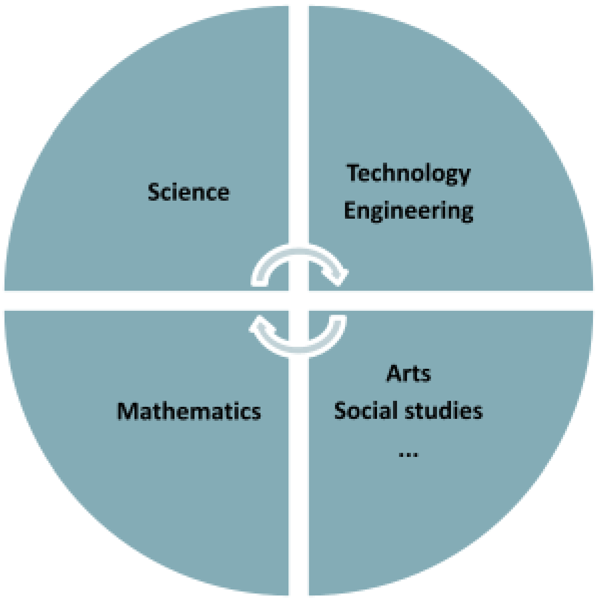
Coding

Debugging

Algorithms

Goals

-Students learn and understand why it is important to save energy and how it is possible via everyday choices. Students are challenged to ponder how much electricity is being used in different parts of the world.
-Students find out, learn and understand renewable energy sources as part of an electricity production.
-Students learn how to calculate the amount of used electrical energy, how much does it cost in different countries and how much money you can save by using smart solutions.
-Students learn and understand the meaning and importance of saving energy via everyday life actions.
-Students learn to design, build and code simple automated smart solutions which tackle the problems introduced in the project



Realistic STEAM-context

Science	Technology - Engineering
environmental issues energy efficiency sustainable development electricity expenditure and cost	smart house solutions automation 3D-designing
Mathematics	**Arts - Social studies**
scale algorithms measuring coding calculating	designing and building smart space choosing suitable materials

Methodology

Based on learning by doing (with different levels: from imitation to creation)

Part	Description	Timing
1	**Introduction/Lights From Space** Multi subject: Science **Lights From Space** Teacher introduces a map of the earth shot at night. Guided discovery. What do you see? How come there is light on some parts and not on the others? Is this sustainable, what could be done? See Appendix 1 **Why is it important to save energy?** Discuss the importance of saving energy and the fact we have only one earth -> sustainable energy usage in everyday life	1hrs
2	**Cost and expenditure of electricity** From this part onwards students will be divided into small groups. **Multi subject: Science/Math** Students will learn about electrical energy: how to calculate the amount of used electrical energy, how much does it cost around the world and in their respective country and how much money you can save by using smart solutions. See appendix 2.	1hrs
3	**How to save electricity in everyday life at school/home** **Multi subject: Math/Science** Students work in groups and find ways to save electricity in everyday life. See appendix 3.	1hrs
4	**Microbit introduction** **Multi subject: Science/Arts and crafts**	1hrs

	Teachers' note: the smart solutions in this project are designed to be implemented with microbit microcontroller. If your school doesn't have microbits you can simulate everything from this project in Tinkercad.com Teacher introduces microbit and students do exercises on how to use it and how to measure light level. **See Appendix 4.**	
5	**Designing the space** **Multi subject: Science/Arts and crafts** Students need to design a miniature space in which the energy saving automated solutions will be implemented (smart lighting is the minimum requirement) See appendix 5.	1hrs
6	**Building the space** **Multi subject: Science/Arts and crafts** Any material can be used (cardboard, clay etc.) in the building process. 3D-designing & printing furniture is also possible, but furniture can also be built out of traditional materials (cardboard, wood). When building it's important to think & plan how to implement smart solutions. Building may require extra time.	2-3hrs
7	**Automated smart solutions** Integrating automated smart solutions. See appendix 6 & 7.	2-3hrs
8	(Optional) Integrating other smart solutions, automated window or door or fan See appendix 8.	2hrs
9	**Testing and debugging** How to code, do you have to change code to get the effect you require? Example: Lights go on too early, change the light level on which lights go on	2hr
10	**Implementing changes**	2hrs
11	**Presentation and Feedback** See Appendix 9?	2hrs

	Students make an expedition for the school and give a tour of the space. Students make a presentation for example with imovie or a virtual tour	

Organization

Materials:

- wood, plastic, cardboard, straws, wire, servos, electric motors, LEDs, popstickels, batteries, hot glue, tape,

Use of ICT:

Microbit for coding of smart solutions, 3D printing for printing parts and furniture (not necessary), makey makey, scratch, project can be implemented without any of the previous but we recommend using microbits. If the school doesn't have microbits everything involving them can be simulated in tinkercad.com

Opening of classroom:

Coaching

Useful questions:

- **1. Introduction/Lights From Space**
    - See Appendix 1

- **2. Cost and expenditure of electricity**
    - See Appendix 2
- **3. How to save electricity in everyday life at school/home**
    - Are the lights on unnecessarily at school or home?
    - What kind of solutions do you already know for saving electricity?
    - How do the automated solutions work? What do they measure?
- **4. Microbit introduction**
- **5. Designing the space**
    - What is the space like? Room, house, road, public space, treehouse, castle? Open or closed?
    - How big is the space?
    - What materials will be used?
    - Is there any furniture etc. in the space?
    - What automated smart solutions will be implemented and how?
- **6. Building the space**
    -
- **7. Automated smart solutions**
    -
- **8. Optional part**
    -

- **9. Testing and debugging**
    -
- **10. Implementing changes**
    -

Stimulation of self-management: (concrete opportunities/remarks adapted to the project)

Stimulation of cooperation: (concrete opportunities/remarks adapted to the project)
Teamwork:
- Groups consist of 3-4 students.
- Competences needed in a group:
    - Decide responsibilities
        - Builder
        - Coder
        - Documenting
        - 3D-designer

        Students have the chance to assign responsibilities for each other. Giving students specific roles and responsibilities assures that every part of the project has a student taking care of that part.

Formative assessment: (concrete description/summary adapted to the project)

Data collection and Data analysis:
- find out the true cost of electricity in your country
- measuring light levels in different conditions and collect data

Analyzing:
- energy expenditure

Patterns:
- lights from space, analysing what is shown in the picture. What is similar for the places that are well lit

Coding:
- microbit

Debugging:
- find errors in microbit coding

Algorithms:

-programming

-Documentation using for example keynote, powerpoint or imovie. Exhibition of the finished spaces.

Adaptations

- **General ideas**: Advanced students can design their own smart solutions with motors, servos and LEDs
- **Ideas with younger/older children: (3-6 <-> 6-9 / 9-12 <-> 12-15)**
  Use only minimum requirements (smart lighting). Give easy to assemble parts for the building. Coding is optional, code can be provided partially. If your school doesn't have microbits, microbit.org can be used to virtually simulate microbits or simulated with tinkercad.com

Tips & tricks

(only mention when relevant, e.g. background information, …)