huvi Outdoor Learning Hub

STEAM project
Wind Phone Charger
Teacher`s guide for grades 7-9

Summary

The challenge is for students to design turbine model blades capable of achieving a sufficient rotational speed in the turbine shaft for charging a phone. Teams of engineers will initiate the design process by defining the problem, and conclude with presenting the results of the research. Under a teacher's guidance, students will acquire knowledge about wind and its technological applications. Through experiments, hypotheses are formulated, data tables are compiled based on measurements, and graphs are constructed for students to comprehend the influence of the various parameters of the turbine blades on the rotational speed of the turbine shaft. The acquired knowledge and skills are applied collaboratively in designing and producing prototype turbine blades for the model wind turbine.

Euroopa Liit
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Overview

Age Group: 13-16 years old (grades 7-9)
Subject Areas: Physics, Natural Science, Mathematics, Art and Technology Education, English
Time Required: 10 – 14 class hours (45 min)
Vocabulary: Wind, wind turbine, wind energy, renewable energy, hypothesis, surface area, mass, wind speed, degree angle, rotational speed, design process, anemometer, blade, rotor, engineer, model, prototype, sketch

Project product
Individual: Young Engineer's Notebook (project learning materials, experiments, assignments)
Team: Prototype of Wind Turbine Model Blades
Public: Presentation of the Science Project (in a format agreed upon with the teacher and students, e.g., invite a wind expert to visit or organize a wind energy or science conference)
Authors: Laura Herm, Marko Reedik, Jana Liiv

For Teacher

- STEAM project description of the learning process, along with the milestones and learning outcomes
- Suggested STEAM project lesson plans and activity descriptions
- Diagram - Engineering Design Process
- Evaluation model for the design process

Build Materials

Wind turbine set: wind turbine model, anemometer, wind turbine pole, graph paper, wooden sticks for blade design; USB charging cable, glue gun, blades with variable lengths and sizes, cutting board, clipboard

Additional materials: mobile phone/smart device, ruler, grid paper, cardboard, glue, scale (optional)

Educational Materials

Further Development Possibilities

- Harnessing Wind Energy from School Grounds
- Why Should the School Buy a Wind Turbine? Proposal for the School Principal
- What Size of Wind Turbine Generates the Most Energy?
- Establishing a Wind Farm Nearby - What Size of Park Could Be Built Without Opposition from Neighbours?
- Product Design Specifications Using the Example of a Wind Turbine

21st Century Skills

Creativity and Entrepreneurship ✓
Problem Solving and Critical Thinking ✓
Communication and Collaboration ✓
Information Literacy ✓
Media Literacy ✓
Flexibility and Adaptability ✓
Goal Setting ✓
Socio-Cultural Skills ✓
Productivity and Responsibility ✓

Learning Goals

STEAM Subject	Learning Goals
Science	• Explains the concept of kinetic energy, as well as how a body can only do work if it has energy; • Understands that wind's kinetic energy is converted into rotational energy of the turbine blades; • Formulates research questions based on a problem, plans and conducts experiments, draws conclusions based on measurement results; • Applies the knowledge of a larger surface area and body of lower mass being affected the most by wind when designing turbine blades.
Technology	• Considers the impact of different parameters on the rotational speed of the wind turbine model rotor when designing turbine blades; • Uses ICT tools to answer research questions, carry out the project, and present the research results.
Engineering	• Participates in the design process to create the fastest rotating turbine blade prototypes in collaboration with the team; • Applies mathematical and scientific understanding, and use recyclable materials.
Arts	• Draws sketches of turbine blade designs; • Use effective communication methods and digital media in presenting research results and prototype demonstrations.
Mathematics	• Understands mathematical concepts lsuch as surface area, mass, degree angle, length, and average speed; • Presents measurement data from experiments in tables, and makes graphs based on the data.