huvi Outdoor Learning Hub

STEAM project
Wind Powered Classroom
Teacher`s guide for grades 4-6

Summary

Students will explore various ways to use wind as a natural resource, and analyse common misconceptions about the use of wind energy and wind turbines. Thereafter, they will begin to research the factors that need to be considered in order to place a wind turbine in the school vicinity to supply their classroom with electricity. They will study and explore the wind conditions around the school grounds, compare the results with data from weather portals, and conduct a simple attitude survey among various target groups within the school community. Like engineers, they will design blades for the wind turbine and test their efficiency. Finally, they will assess the electricity consumption of their classroom based on electrical power needs and calculate how many wind turbine models are required to meet this demand. Additionally, they will assess where such a wind farm could be established around the school.

Euroopa Liit
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Overview

Age Group: 10-13 years old (grades 4-6)
Subject Areas: Natural Science, Mathematics, Art and Technology Education, English, Social Studies
Time Required: 12 – 18 class hours (45 min)
Vocabulary: Wind, kinetic energy, electricity, molecules, wind turbine, wind rose, public opinion survey, report, brainstorm, target group, wind turbine blade, unit square method, efficiency, power, watt, misconception, sketch, wind farm

Project product
Individual: Young Engineer's Notebook (project learning materials, experiments, assignments)
Team: Prototype of Wind Turbine Model Blades, Attitudes Survey, Wind Park Plan
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 organise a wind energy or science conference)
Authors: Laura Herm, Jana Liiv

For Teacher

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

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, flipchart

Additional materials: mobile phone/smart device, ruler, grid paper, cardboard, glue

Educational Materials

I Defining the problem
II How does wind move things?
Experiment 1. How does wind move things?
III Wind energy and related myths
IV Planning a wind turbine installation on the school grounds
Experiment 2. Local wind condition
Experiment 3. The attitude of local community towards the installation of a wind turbine
Experiment 4. Properties of wind turbine rotor blades
V How to design wind turbine blades?
Experiment 5. How do the designed blades work?
VI Does our wind turbine create enough energy to power the classroom?
VII Presentation of research results
VIII Self-Assessment
Additional Tasks: Wind Engineer`s Brain Warm-Ups

Further Development Possibilities

- Community Conference for Raising Wind Energy Awareness
- Establishing a Wind Farm Nearby
- Designing Wind Turbines with Different Power Capacities
- How to be a good wind energy sales agent?

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
S cience	• Collaboratively formulates the research problem and project objective; • Defines the problem and formulates research questions based on it; • Gathers information about wind energy and critically evaluates the reliability of the sources with the help of the teacher; • Observes and describes the behavior of natural and artificial objects, such as wind turbines, influenced by the wind; • Collects data to assess wind conditions and the efficiency of turbine blades and utilises weather portals and technology tools for analysis and collaboration; • Understands that to supply wind energy to the classroom, it is necessary to collect evidence-based data, conducts repeated experiments, and recognises that engineers' and scientists' solutions are based on systematic research; • Understands, through the example of wind turbine construction, the relationships between human activity and the environment within the community.
T echnology	• Uses appropriate recyclable materials (cardboard, plywood) in crafting the blades; • Follows safety rules when using tools (paper knife, scissors, hot glue, tape); Applies knowledge of wind and kinetic energy, local wind conditions, school grounds, and preference research in designing the blades.
E ngineering	• Designs and crafts simpler blades as a team for the wind turbine model, applying design thinking, and organises prototype testing; Presents the resulting turbine blades created through their teamwork and demonstrates its functionality; • Identifies opportunities for further development, and, if necessary, improves it.

STEAM Subject	Learning Goals
Arts	• Draws the blade design based on group discussion outcomes; • Conceptualises the suitability of the wind turbine for the local environment, including through design aesthetics and art, and engages in discussions evaluating the turbine's suitability for the school grounds; • Expresses research findings clearly and comprehensibly and uses appropriate vocabulary.
Mathematics	• Creates a wind rose diagram based on data; • Calculates the wind turbine blade's surface area using the square meter method; • Mathematically compares the power of the classroom's electricity consumers to that of the wind turbine module and calculates how many wind turbine modules would be needed to supply the classroom with electricity.