huvi Outdoor Learning Hub

STEAM project
Windcatchers
Teacher's guide for grades 1–3

Summary

Students familiarise themselves with a boy who harnessed the power of the wind, whose achievements have inspired the world, and reflect on the essential qualities of an engineer and scientist's work. They then step into the roles of engineers and scientists, or perhaps inventors themselves. Their challenge is to construct turbine model blades as a team that are efficient enough to capture wind for the wind turbine. The goal is to generate sufficient electricity for charging a phone. Guided by the teacher, young engineers and scientists acquire knowledge about wind as a renewable energy source and the principles of wind turbine operation, and apply this knowledge in design thinking. Through experiments, students comprehend how scientists ask questions and seek answers through observations and repeated trials.

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Overview

Age Group: 7–9 years old (grades 1–3)
Subject Areas: Natural Sciences, Mathematics, Art and Technology Education, English, Health Education
Time Required: 10–13 class hours (45 min.)
Vocabulary: Wind, wind turbine, wind energy, renewable energy, recyclable materials, wind speed, electricity, design process, design thinking, anemometer, blade, engineer, scientist, inventor, author, model, length, width, adjective

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 and engineer to visit)
Authors: Laura Herm, Jana Liiv

For the 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

Further Development Possibilities

- Wind Turbine Nearby—To What Extent Are Neighbours Opposed to Wind Turbine Installation?

Building 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, cardboard, glue, Scotch or duct tape, dictionary

Educational Materials

I William Kamkwamba—The Boy Who Harnessed the Wind
II Adventure of Word Search
III Windcatchers' Challenge
Experiment 1: Measuring Wind Speed
IV Hello, Wind Turbine and Blades! Let's Get Acquainted
Experiment 2: Efficient Turbine Blades
V From Problem to Solution—Design Thinking
Experiment 3: The Fastest Rotating Wind Turbine
VI Windcatchers' Expert Evaluation
VII Self-Assessment
Additional Tasks: Windcatchers' brain warm-ups

- Blade Artisans—How to Create a Guide for Making Turbine Blades for Fellow Students
- Vital Wind Turbine Data—What Wind Turbine Information and Characteristics Need to Be Described for the Factory to Start Production?

21st Century Skills

Creativity and Entrepreneurship ✓
Problem Solving ✓
Critical Thinking ✓
Communication ✓
Teamwork ✓
Information Literacy ✓
Flexibility and Adaptability ✓
Goal Setting ✓
Responsibility ✓

Learning Goals

STEAM Subject	Learning Outcomes
S cience	• Measures wind speed, records the data from measurements into a table; • Makes initial conclusions about the windiest locations on the school grounds and the performance of the wind turbine based on data; • Understands that engineers and scientists use models, ask questions, and conduct repeated observations and experiments to answer those questions; • Concludes (based on data) that factors affecting the wind turbine's performance are wind speed as well as shape, length, width, and quantity of the blades.
T echnology	• Works safely with simple tools such as scissors, a glue gun, cardboard, and plywood; • Compares the general properties of recyclable materials regarding the production of turbine blades; • Understands the importance of sustainability in the use of different materials; • Works both in a team as well as independently under the guidance of the teacher; • Notices similarities and differences between the blades made by their own team and those made by other teams.
E ngineering	• Using the design thinking process, plans and produces (with the team) a set of turbine blades with a simple design for the wind turbine model; • Presents the turbine blades produced by their team and demonstrates its functionality.
A rts	• Reads study text about William Kamkwamba and observes the various traits and characteristics of people; • Extracts necessary information from the study text about the principles of wind turbine operation and the characteristics of turbine blades to create efficient blades for the wind turbine model;

STEAM Subject	Learning Goals
	• If needed, uses dictionaries to explain unfamiliar words, thereby enriching the vocabulary related to wind energy; • Considers the opinions of the team members both in discussions and presentations of different ideas and solutions; • Expresses themselves clearly and appropriately when presenting project results.
Mathematics	• With the help of the teacher, asks the research questions in order to solve the project challenge; • Understands the importance of mathematics in finding answers; • Uses units of length and units of mass in measurements.