Windmill CORIculum

Explore renewable energy and harness the power of wind with the CORI Windmill design challenge. The Cori Windmill project is designed to seed curiosity, build grit, improve spatial skills, and sharpen problem solving abilities.
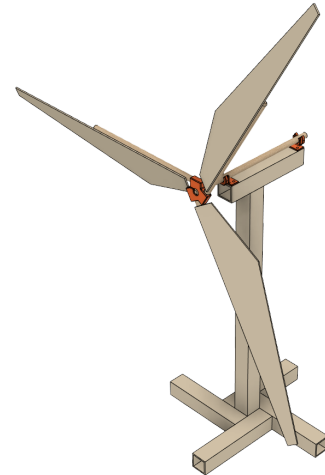
Objective:
Students will go through the Cori Design Process to design the ideal blade for their windmill.

Grades Levels: 2nd - 6th Grade
Lesson Duration: 3-4 hours
Build Time: 45 - 75min

Additional Materials Recommended	
- Hot glue guns - Gluesticks - Scissors - Rulers - Pencils	- Windsource - Floor fan - Art supplies (optional) - Decorate your windmill - Internet (optional) - Access website below - Other blade materials - Aluminum foil, popsicle sticks, straws, paper, etc.

Vocabulary To Explore	Definition
Renewable Energy	energy from a source that is not depleted when used, such as wind or solar power.
Propeller	a mechanical device for propelling a boat, windmill or aircraft, consisting of a revolving shaft with two or more broad, angled blades attached to it.
Windfarm	an area of land with a group of energy-producing windmills or wind turbines.

| Turbine	a machine for producing continuous power in which a wheel or rotor, typically fitted with vanes, is made to revolve by a fast-moving flow of water, steam, gas, air, or other fluid.
Sustainable Energy	resources that can maintain current operations without jeopardizing the energy needs or climate of future generations.
Nacelle	a cover housing that houses all of the generating components in a wind turbine, including the generator, gearbox, drive train, and brake assembly.

Cori Design Process Lesson Plan

Cori Design Process Lesson Plan

The Cori Design Process provides our learners the experience of what engineers, architects, scientists, and makers do everyday. At Cori, we thrive on structuring design challenges and projects that intentionally nurture skills (i.e. critical thinking) and build creative confidence.

For a shorter learning experience (60 - 90min), use the following Cori Windmill Coach's Corner card found HERE.

For a multi-day learning experience, please follow the lesson plan below.
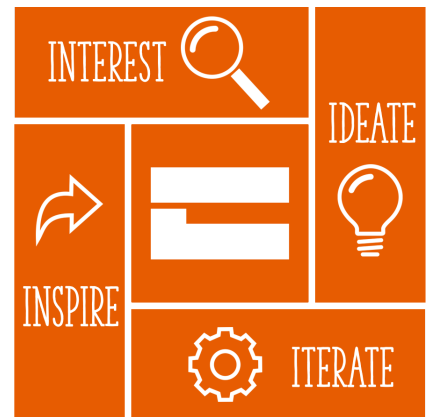
Windmill Challenge Storyline

Humans can no longer use traditional energy resources available to them and must use renewable energy sources like wind to power their homes. You are part of the engineering team who is scouting areas where wind is abundant and is a great place to put your farm of wind turbines. You have limited resources, but are tasked to create an optimal wind turbine design that will harness the wind. What blade design will give you the best rotational energy to harness the power of the wind?

Phase 1: Interest (20-30min)

1. (Optional) Online research: The Office of Energy Efficiency and Renewable Energy has an interactive "How a Wind Turbine" animation for learners to explore wind energy. Check it out and ask questions to build interest:
    https://www.energy.gov/eere/wind/animation-how-wind-turbine-works
    a. Have you seen wind turbines in the real world?

      b.   What are the advantages of using wind energy versus other forms of energy like solar energy?

      c.   What are drawbacks and disadvantages in having wind turbines?

2. (Optional) Have a debate in class to discuss the pros and cons of wind energy.

Pros	Cons
- Wind energy is a renewable resource and sustainable - Good for the environment - Can power remote locations - Reduce dependence of fossil fuels	- Wind fluctuates - unreliable - Expensive technology - Endangerment to wildlife, especially birds - Noise pollution

3. (Optional) Give your students research time with one or more of the following guiding prompts:
   a. What were the most effective windmill designs during the 19th century?
   b. Which states in the US generate the most wind-powered electricity?
   c. What percent of electricity in the US is generated by wind energy?
   d. What are appropriate wind speeds to generate electricity?
   e. Why isn't wind power the most used form of energy?
4. Share the design challenge parameters from the Cori suggested materials list and instructions provided.

Phase 2: Ideate (30min)

1. Explain that there are instructions available to create the base Windmill.
2. However, encourage students to tweak the base to support your windmill tower. What are other creative ways to support the base of the windmill?
3. Have your students draw and sketch out their initial designs on paper and have them share with another student or group of students.

Phase 3: Iterate (45 - 75min)

1. Make sure students are given proper safety instructions prior to starting.
2. Provide students a creative space to build their windmill and have all the tools/materials readily available.
3. Build TIME! Walk around and offer guidance as needed.
4. Have students test out their initial designs with the blade template provided. Use a consistent wind source (floor fan) to test all the windmill projects.
5. Now that you have tested the original blade design, challenge students with a new blade design to see if it spins faster. There are several ways you can change the windmill design. Below are some options to experiment on your windmill.

      a. Tweak template design from instructions

      b. Explore and design new blade shapes

      c. Use different materials like aluminum foil, paper, or popsicle sticks

6. Test out the new blade design and see if you notice any differences. Have a group discussion about your observations.

7. Group Discussion: What are ways we can test how fast the blades are rotating on the windmill?

Phase 4: Inspire (30 - 45min)

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1. (Optional) Once you have found your optimal design, decorate your windmill with paint, markers, and/or other art supplies available in your classroom. Make it uniquely your own creative design.

2. (Optional) It is project testing day and a great opportunity to celebrate all the designs from your class.

      a. Best artistic designs

      b. Most innovative design

      c. Best effort during the four phases

3. (Optional) Have a recording device available to film each windmill in action. We highly recommend using the slow motion capture on your recording device.

4. Final reflection question: Describe your final results and ask what you would do differently next time if you had an opportunity to start over?

Contact us at support@coricreate.com if you have any questions or comments.

www.coricreate.com