2026 Global Design Challenge

Elementary

Deadline: December 15, 2026

Lights for Us, Darkness for Them: Engineers Protect the Night

ITEEA Elementary STEM Council

Overview:

In 2008, the U.S. National Academy of Engineering (NAE) identified 14 Grand Challenges for Engineering in the 21st Century. The Grand Challenges were designed to inspire students and educators to think about solutions to the big challenges affecting us all. ITEEA's Elementary STEM Council is again sponsoring the Global Design Challenge (GDC) to provide elementary students with a chance to solve a real problem and demonstrate that everyone can help find solutions to these global challenges. Let's help our students showcase to the world that even our youngest innovators are capable of tackling big problems with creativity and ingenuity.

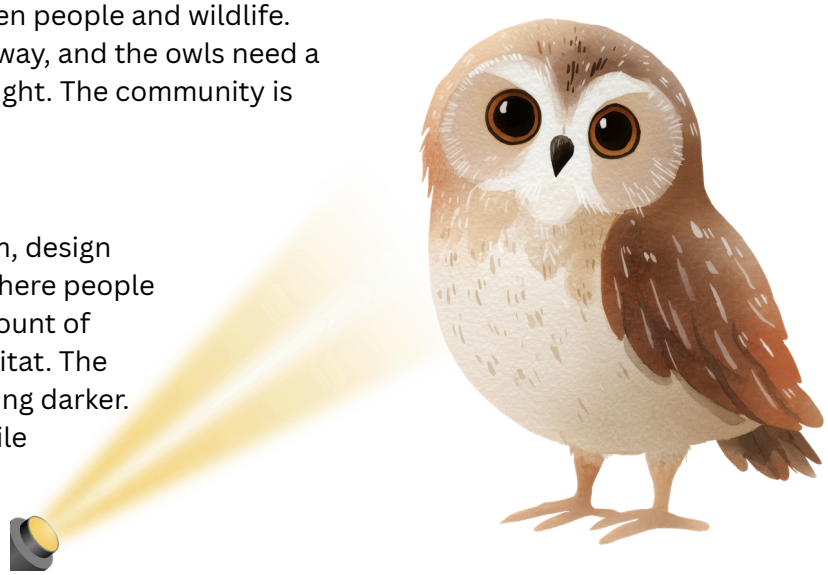
Scenario:

For years, owls have lived in the wooded habitat near your community. They have become an important part of local life. The school even chose an owl as its mascot, and families look forward to hearing and seeing the owls each year. Community members have worked hard to protect the natural area so that people and wildlife can enjoy it for years to come.

Recently, the community completed a beautiful new boardwalk and walking path through part of the nature area. During the day, families, students, runners, and visitors enjoy the path. People wanted to use it in the evening too, but parts of the path were difficult to see after sunset. To improve safety, bright lights were installed along the walkway.

The lights solved one problem, but they created another. The pathway is easier for people to see, but light now spills beyond the boardwalk and into the nearby owl habitat. Artificial light at night can change natural darkness and may affect wildlife that depends on nighttime conditions, especially the beloved owl population.

The community does not want to choose between people and wildlife. People need enough light to safely use the pathway, and the owls need a habitat protected from unnecessary nighttime light. The community is asking for your team's help.



Challenge:

Students, working as an engineering design team, design and build a solution that provides useful light where people need it on a walking path while reducing the amount of unwanted light that reaches the nearby owl habitat. The strongest solution will not simply make everything darker. It must keep useful light on the walking path while reducing unwanted light in the owl habitat.

Suggested materials:

flashlight, work light, drop light, etc., graph or grid paper, low-cost, recycled, repurposed, or readily available materials, paper, LEDs, wire, LED light strips, motion sensors, batteries

Limitations:

1. The designated walking path must remain illuminated while in use by humans.
2. The amount of light reaching the designated owl habitat must be reduced.
3. The solution must use a light source. Teams may not solve the problem simply by turning the light off.
4. The solution must remain stable and function without a person holding it in place.
5. The solution must be tested under the same conditions before and after redesign.

Testing:

Ask your students to create a solution containing two clearly marked areas: a walking path where people need light and an owl habitat where unnecessary light should be minimized. Use the same flashlight or other approved light source, placed in the same position and at the same angle for every trial.

1. First, conduct a baseline test without the student solution. Observe and document how much of the walking path and owl habitat receive light. Then install the solution and repeat the test under the same conditions.
2. A simple low-cost way to document light spread is to place graph paper flat in each test zone. In a darkened room, shine the light from the marked location and count the graph-paper squares that are visibly illuminated. Use the same graph paper and light source at the same distance, room conditions, and method for every trial. Students may also use another consistent teacher-approved method to collect evidence.

Potential ways for students to conduct testing:

- Place graph paper in the walking-path zone and count the number of squares visibly illuminated before and after the solution is installed.
- Repeat the same procedure in the owl-habitat zone and compare the amount of unwanted light before and after the solution is installed.
- Place identical symbols or small objects at designated points along the walking path and determine whether they remain visible after the solution is installed.
- Test the solution from more than one light position or pathway location to determine whether it continues directing light where it is needed.
- Repeat the final test several times to demonstrate that the results are consistent.

To evaluate criteria, ask students to answer the following questions:

- **Effectiveness:** Does the solution reduce unwanted light reaching the owl habitat?
- **Pathway Visibility:** Does the walking path remain sufficiently illuminated for people to see the designated pathway targets?
- **Stability:** Does the solution remain securely positioned during testing without being supported by humans?
- **Creativity:** Has the team developed an innovative way to manage where light travels?
- **Resourcefulness:** Has the team used materials effectively?
- **Evidence:** Can the team use before-and-after observations or measurements to demonstrate improvement?
- **Presentation:** Can students clearly explain the problem, their design process, failures, redesign decisions, and final solution?

Teacher Notes:

1. Launch the challenge with *Owl Moon* by Jane Yolen, and other children's literature about owls, nocturnal animals, nighttime habitats, or the importance of darkness in nature.
2. Help students distinguish between useful light and unwanted light. The goal is not to eliminate nighttime lighting but to engineer where the light goes.
3. Use the engineering design process as students design their solutions from start to finish.
4. Mark the location of the light source and testing zones so baseline and solution tests can be repeated fairly.
5. Take photos and videos of the students' and their work throughout the design process to document progress.
6. Create a student-led video, 3 minutes maximum, in which students introduce the community problem, show baseline evidence, explain at least one design change, and demonstrate the final solution.
7. Encourage students to discuss trade-offs. A solution that protects the habitat but leaves the path unusably dark has not fully solved the problem.

Content Information for Teachers:

- **Unintended consequences of technology:** Unexpected results that occur when a technology designed to solve one problem creates a new problem or affects people, animals, or the environment in an unforeseen way.
- **Light pollution:** Artificial light that is excessive, unnecessary, or reaches places where it is not needed.
- **Nocturnal Animals:** Animals that are primarily active during nighttime hours.
- **Illumination:** The use of light to make an area or object visible.
- **Reflection:** The bouncing of light from a surface.
- **Light direction:** Light travels outward from a source and can be redirected, blocked, reflected, or diffused by materials and structures.
- **Other concepts for class discussion:** nocturnal habitats, owls, light and shadow, reflection, transparency, opacity, directionality, glare, shielding, human safety, environmental design, trade-offs.
- **Incorporating Children's Literature:** Potential literature should help students connect emotionally with owls, nocturnal wildlife, nighttime habitats, or the value of darkness.

Submission

- Submit a student-led, three-minute maximum video. It should include the problem, engineering design process, quantitative testing evidence, redesign, and demonstration of the final solution.
- Submit the video to **esc@iteea.org** with the subject line: "GDC 2026 Video - Elementary Submission - [School Name]"by December 15, 2026.

The winning team will receive a free one-year Group Membership for their school, an invitation to be part of ITEEA's 2027 STEM Showcase, and one free hotel night at the 2027 Louisville Conference.

For questions about the Global Design Challenge, contact: **esc@iteea.org**.

Standards for Technological and Engineering Literacy (STEL):

Standard 1: Nature and Characteristics of Technology and Engineering

Grades PreK-2

A. Compare the natural world and human-made world.
C. Demonstrate that creating can be done by anyone.

Grades 3-5

E. Compare how things found in nature differ from human-made solutions.
H. Design solutions by safely using tools, materials, and skills.

Standard 7: Design in Technology and Engineering Education

Grades PreK-2

B. Demonstrate that designs have requirements.
C. Explain that design is a response to wants and needs.

Grades 3-5

I. Apply the technology and engineering design process.
J. Evaluate designs based on criteria, constraints, and standards.
K. Interpret how good design improves the human condition.

Standard 8: Applying, Maintaining, and Assessing Technological Products and Systems

Grades PreK-2

A. Analyze how things work.

Grades 3-5

F. Identify why a product or system is not working properly.
G. Examine information to assess the trade-offs of using a product or system