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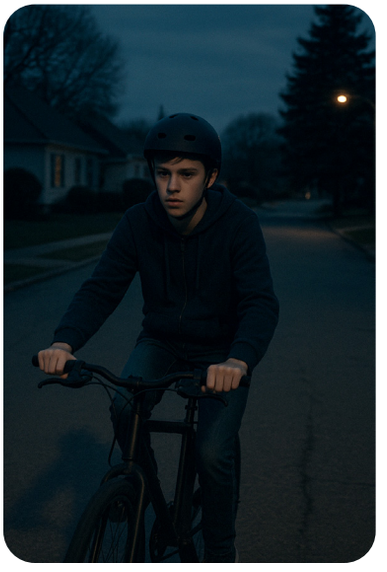
SSC
Secondary STEM Council

Annual Global Design Challenge for Secondary STEM Students

Deadline: December 15, 2025

Night Riders: Engineering Visibility for Safety

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 Secondary STEM Council is again sponsoring the Global Design Challenge (GDC) to provide secondary students with a chance to solve a real problem and demonstrate that everyone can help find solutions to these global challenges. We encourage you to showcase to the world that students are capable of tackling big problems with creativity and ingenuity.

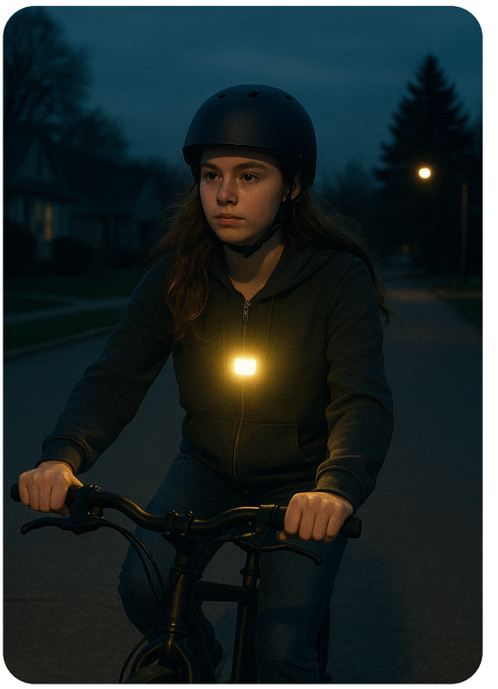


Scenario:
In your hometown of STEMsted, cyclists heading to practice at STEMsted Community Center, commuters biking home from work, and families out for evening rides fill the streets at dusk. Last month, two students from STEMsted High School were nearly hit while biking home after practice. Police reports warn that low visibility is causing more crashes, and many cyclists can't afford pricey lights or gear. The STEMsted city council has turned to you, the next generation of engineers, to design an affordable, low-cost solution that lights up the night.

Challenge:
Working with an engineering design team, design, build, and test a cycling accessory or system that enhances the visibility of cyclists or bikes at night. Your solution should be practical, durable, and cost-effective, which could protect your friends, families, and community.

Limitations:
1. Create a solution that significantly improves cyclist visibility in low-light conditions (dusk, dawn, or after dark).
2. The solution should be lightweight, durable, and simple to use.
3. The solution must be low-cost and made from accessible materials.
4. The solution should be attachable to a bicycle or wearable by the cyclist and remain functional during motion.
5. Test the solution in a simulated low-light environment to demonstrate its effectiveness and durability.

Testing:
Demonstrate how your solution enhances cyclist visibility. Set up a test that simulates nighttime conditions (a darkened classroom, a hallway, or an outdoor area at dusk). It is up to you to test and demonstrate effectiveness, stability, creativity, and resourcefulness. Throughout the testing process, record your observations, measurements, and any adjustments made to your design.



Potential Ways to Test
- Use a flashlight or car headlight simulator to measure the distance at which your solution is visible.
- Attach your prototype to a model bike and test its stability during simulated motion (rolling or shaking).
- Use a camera to record visibility from different angles (front, side, back) in low light.
- Simulate weather conditions (light mist with a spray bottle, etc.) to test durability.

Evaluation Criteria:
Effectiveness: Does your solution make the bike or cyclist clearly visible in low-light conditions?
Stability: Does the solution remain functional and secure during simulated bike movement?
Creativity: Have you incorporated innovative ideas in your design?
Resourcefulness: Have you used affordable and sustainable materials wisely?
Presentation: Can you clearly explain your design's function and impact to an audience?

Teacher Notes:
1. Introduce the challenge with *The Boy Who Harnessed the Wind* by William Kamkwamba and Bryan Mealer to highlight innovation with limited resources.
2. Encourage students to interview local cyclists or community members to inform their designs.
3. Use the engineering design process to guide students from problem identification to testing and iteration.
4. Document the process with photos and videos.
5. Create a student-led video (3 minutes maximum) where students present their solution, defend their design, and demonstrate its effectiveness in a formal pitch (ideally to a live audience).
6. Encourage students to discuss how their solution could be used in their own community.
7. Submit the video link to lrcheek@uark.edu with the subject line "GDC 2025 Video Submission – [School Name]."

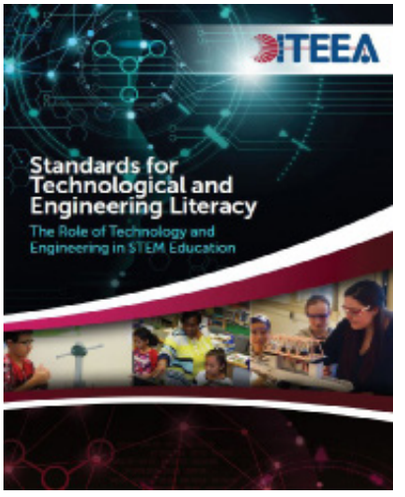
Content Information for Teachers
You may want to equip students with essential content knowledge to prepare them for problem-solving:
- Visibility: How light reflection and illumination improve detection in low-light conditions.
- Sustainability: Designing solutions that minimize environmental impact.
- Human-Centered Design: Creating solutions that meet user needs (e.g., affordability, ease of use).
- Photometry: Measuring light intensity and visibility range.
- Other concepts for class discussion: Reflective materials, LED technology, aerodynamics, potential energy, battery efficiency, weather resistance, angular momentum, gyroscopes
- Incorporating Literature: *The Boy Who Harnessed the Wind* by William Kamkwamba and Bryan Mealer

STEL Standards

Standard 1: Nature and Characteristics of Technology and Engineering
Grades 6-8
J. Develop innovative products and systems that solve problems and extend capabilities based on collective needs and wants
L. Explain how technology and engineering are closely linked to creativity, Which can result in both intended and unintended innovations.

Grades 9-12
Q. Conduct research to inform intentional inventions and innovations that address specific needs and wants.
R. Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.

Standard 7: Design in Technology and Engineering Education
Grades 6-8
Q. Apply the technology and engineering design process.
R. Refine design solutions to address criteria and constraints.
S. Create solutions to problems by identifying and applying human factors in design.



Grades 9-12
W. Determine the best approach by evaluating the purpose of the design.
Y. Optimize a design by addressing desired qualities within criteria and constraints.

Standard 8: Applying, Maintaining, and Assessing Technological Products and Systems
Grades 6-8
H. Research information from various sources to use and maintain technological products or systems.

Grades 9-12
N. Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.
P. Apply appropriate methods to diagnose, adjust, and repair systems to ensure precise, safe, and proper functionality.

Submission:
Submit the video link to lrcheek@uark.edu
Subject line: GDC 2025 Video - Elementary Submission – [School Name]
Deadline: December 15, 2025.

The winning team will receive a free one-year Group Membership for their school, an invitation to be part of ITEEA's 2026 STEM Showcase, and one free hotel night at the Virginia Beach Conference.

For questions about the Global Design Challenge contact
Dr. Leah Cheek at lrcheek@uark.edu