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ESC 2024

ITEEA's Elementary STEM Council's Sixth Annual Global Design Challenge for Elementary STEM Students

Deadline: December 15, 2024

Join the Shoreline Stronghold and Defend Our Treehouse from Rising Tides!

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 cause 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) for Elementary STEM to provide students with a chance to solve a real problem and show the world that everyone can help find solutions to these global challenges. Elementary Students, let's showcase to the world that even our youngest innovators are capable of tackling big problems with creativity and ingenuity.

Scenario:
In the classic story retold by Norma Green, *The Hole in the Dike*, a young boy heroically saves his town from flooding by plugging a hole in the dike with his finger until help arrives. Now, imagine that a similar problem has arisen, but this time it's not a dike threatening your town—it's encroaching water threatening your cherished treehouse fort on the shoreline! Due to heavy rains and rising water levels, the pathway to your fort has become waterlogged and treacherous. If action isn't taken soon, your shoreline retreat could become inaccessible.

Challenge:
Working with a small group, your job is to engineer a solution to manage the water to ensure safe access to your shoreline treehouse fort. Using materials provided, design and build a model of a solution that will effectively keep the pathway leading from the shoreline to your treehouse accessible.

Limitations:
1. Create a solution that will effectively keep the walkable pathway leading from the shoreline to your treehouse accessible.
2. The solution should divert or drain the water, or otherwise ensure a safe pathway to the treehouse fort.
3. This solution should be stable and able to withstand the water flow without collapsing.
4. Test the solution in your own classroom and determine its effectiveness.

Test:
Demonstrate how your solution will work. Set up a test that simulates the rising water on the pathway from the shore to your treehouse (simulated waves, or storm surges, or flooding, etc.). 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.

Effectiveness: Does your solution effectively divert or drain the water away from the pathway to the treehouse fort, or otherwise ensure a safe pathway to the treehouse?

Stability: Is your design stable and able to withstand the water flow without collapsing?

Creativity: Have you used innovative and creative ideas in your design?

Resourcefulness: Have you made efficient use of the materials you chose?

Presentation: Can you explain your design and its function clearly to others?

Examples of Possible Ways to Test

- In a terrarium, a tub, or a kiddie play pool, you might simulate wave action by gently pouring water from a container onto a small section of sand or soil representing the shoreline. Then you could measure the distance the water travels inland on the "pathway" before reaching the treehouse. Next, with your solution in place, gently pour the water again and measure the distance the water travels.
- Using a 13x9 baking pan or small tub, you might simulate wave action by filling the pan halfway with water and using a plastic bottle to create waves by gently pressing and moving the bottle back and forth. Measure the distance the water travels before and after your solution is in place.
- Use a spray bottle to simulate a storm surge, observing how your design holds up under increased water flow and pressure.
- Build a simple wave tank creating paddle movement to simulate wave action. Use a clipboard or cut a piece of plywood or foam board to fit the width of the tank. This will serve as the wave paddle. Attach a handle to the paddle, allowing it to be moved up and down to generate waves manually. Fill the tank with water to the desired level. Use the paddle to create waves by moving it up and down at a consistent pace. Alternatively, use the electric pump or motor to automate wave generation. https://youtu.be/Xrs-Wbh-qCo?feature=shared

Teacher Notes:

1. You may want to launch the Global Design Challenge by reading *The Hole in the Dike* retold by Norma Green and illustrated by Eric Carle.
2. Use the engineering design loop while students are designing their solutions from start to finish.
3. Take many pictures and videos throughout the design process.
4. Create a student-led video in which students share their experiences through the design process, ultimately leading to the final solution (3 minutes maximum).
5. In the video, the students will present their solution with a defense of their design and an explanation of the way the solution solves the problem in a formal pitch to an audience. Recording this in front of an authentic, live audience would be ideal.

Content Information for Teachers:
You may want to equip the students with essential content knowledge, ensuring they are well-prepared for problem-solving:
Erosion: The process of breaking down of land or structures by natural forces such as water or wind.
Shoreline: The boundary between land and water, where the land meets the sea, a lake, or river.
Breakwater: A structure built offshore along a shoreline to protect coastal areas from the fore of waves and reduce erosion.
Storm Surge: The ocean water rises higher than normal because of a big storm. It can cause the water to come up onto the land and make everything very wet and sometimes cause flooding.

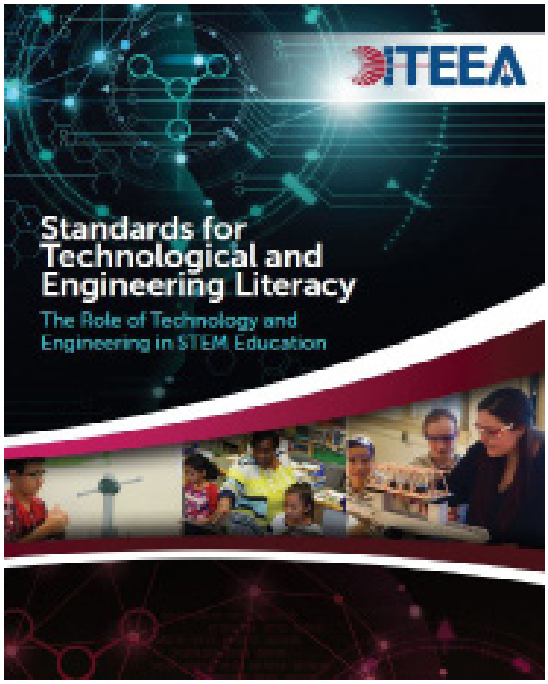
Other concepts for class discussion: riprap, revetments, living shoreline, geotextile bags, gabions, etc.

Incorporating Children's Literature: ***T****he Hole in the Dike* retold by Norma Green and illustrated by Eric Carle; *The Raft* by Jim LaMarche; and *A Drop Around the World* by Barbara McKinney

STEL Standards

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 things that are human-made, noting differences and similarities in how they are produced and used.
F. Describe the unique relationship between science and technology, and how the natural world can contribute to the humanmade world to foster innovation.
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.
G. Apply skills necessary for making in design.

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.

Go to https://tinyurl.com/ITEEAGDCESC2024
For questions about the Global Design Challenge contact
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