



STEM Challenge: Eggstravaganza



Bradly Cusack

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Time Frame 250 minutes

Essential Question(s)

- How can we use the engineering design process to solve real world problems?

Summary

In this activity, students design and construct a protective container to prevent a raw egg from breaking when dropped from a height. They will apply the engineering design process to brainstorm, to create a prototype, to test, and to refine their designs, emphasizing iteration, problem-solving, and teamwork.

Learning Goals

Attachments

- [3-2-1—STEM Challenge.docx](#)
- [3-2-1—STEM Challenge.pdf](#)
- [Activity Slides—STEM Challenge.pptx](#)
- [Engineering Design Process Poster.docx](#)
- [Engineering Design Process Poster.pdf](#)
- [Engineering Notebook Materials—STEM Challenge.docx](#)
- [Engineering Notebook Materials—STEM Challenge.pdf](#)
- [Facilitator's Guide - STEM Challenge .docx](#)
- [Facilitator's Guide - STEM Challenge .pdf](#)
- [Student Checklists—STEM Challenge.docx](#)
- [Student Checklists—STEM Challenge.pdf](#)

Materials

- Activity Slides (attached)
- Facilitator Guide handout (attached; teacher copy)
- Engineering Notebook Materials handout (attached; one per student; optional)
- 3-2-1 handout (attached; one half-page per student)
- Student Checklist handout (attached; one per group)
- Engineering Design Process poster (attached; optional)
- Composition Notebooks (1 per student)
- Pen/pencil
- Sticky Notes and Chart or poster paper (optional)
- Scissors
- Tape or glue
- Materials for STEM Activity: Eggs (6 per group), Cups (assorted sizes; 5 per group), Pipe cleaners (15 per group), Scrap paper (plain, cardstock, or newspaper; 15 sheets per group), Tongue depressors / craft sticks (20 per group), Tape (masking or painter's; 2 rolls per group), Rubber bands (15 per group), Cotton balls or other cushioning material (20 per group), Straws (10 per group), Glue sticks (2 per group), White glue (1 bottle per group), Scissors (1 per student in group), Ruler or measuring tape (1 per group), Timer (shared classroom timer or slide-based timer)

25 minutes

Question

Facilitator's Note: Scaffolding Learning

Once students are comfortable with the process, you can update the question and criteria over time to scaffold their learning and ensure alignment as they grow and advance.

Facilitator's Note: STEM Club Collection

The following activity is only part of a [STEM Club Collection](#) which consists of a variety of possible STEM related activities. We recommend starting with the Introduction to Engineering Design Process resource as it will best prepare students for the flow of each additional activity. Afterwards, feel free to go in any order based on student interest.

Facilitator's Note: Scaffolding

Students will need each step of the Engineering Design Process (EDP) to be scaffolded for the first few activities. Students should become more independent as they practice the EDP and will require less teacher-directed instruction.

Use the **Activity Slides** to facilitate the following STEM Club session. Transition through **slides 2-4** to introduce the lesson title, essential question, and learning objective. The essential question should be the guiding force throughout the activity and can help shape your probing questions as needed. Move to **slide 5** which shows how students should set up the first sections of their notebook. If you are using the provided **Engineering Notebook Materials** handout, pass one copy out to every student along with scissors and tape or glue. Give students time to set up the Question & Brainstorm sections of their notebooks.

Display **slide 6**. Introduce the scenario for this session to the students and remind them to fill in that part of their notebooks Scenario: Today's challenge is all about protecting something fragile. Imagine you are engineers tasked with designing a device that can keep an egg safe when it's dropped from a significant height. Eggs are fragile like many real-world objects we try to protect—such as satellites during transport, or safety equipment like helmets. Your job is to design a protective structure that will absorb impact and prevent an egg from breaking when dropped.

Transition to **slide 7**. Present the criteria for this engineering challenge. Suggested Criteria:

- Your design must keep the egg from cracking or breaking when dropped from [insert drop height—recommend 8–10 feet].
- You may only use the materials provided (e.g., straws, paper, tape, rubber bands, plastic bags, etc.).
- Your design must be small enough to fit in the testing container/within the designated size limits.
- You will have a limited time to plan and build your design.
- Bonus consideration: Can your design use the least number of materials and still protect the egg?

Display **slide 8**. Using the [KWLH Graphic Organizer](#) strategy, have each student go to or create their own KWLH chart in their notebooks by writing the following questions at the top of four columns:

1. Know: What do I know about the task?
2. Wonder: What do I not know (and want/need to know) about the task?
3. How: How will I find the information I need to complete the task?
4. Learn: What have I learned about the task?

Guide students through the **K** (What I Know) section by encouraging them to share prior knowledge, experiences, and assumptions related to the problem without judgment. Then, move to the **W** (What I Want to Know) section, prompting them to generate focused, curiosity-driven questions that highlight gaps in understanding. Allow students time to work.

Next, move to **slide 9** and have students interact with their notebook by creating their initial hypothesis or prediction based on their K and W responses. Remind students that this initial prediction will be revised and revisited often throughout the engineering design process.

Facilitator's Note: Pacing

By the end of this phase, students should have a clear picture of the problem and an initial list of questions.

30 minutes

Brainstorm

Display **slide 10** and revisit the KWHL chart introducing the **H** (How I Will Learn) section. Guide students to think about specific strategies they can use to find the answers to their **W** questions. This may include online research, hands-on experiments, interviews with experts, reviewing data, or consulting books and credible websites. Encourage students to match each question with at least one method or resource, considering the reliability and accessibility of their sources. With these strategies in mind, students should begin generating and sharing potential solutions to the problem, using their **K** and **W** entries as a springboard for idea creation. All ideas are recorded without judgment in the space after their KWHL charts to promote creativity and ensure a wide range of possibilities for the next phase of planning.

As students are wrapping up their Brainstorming phase, transition to **slide 11** and remind students to revise their predictions based on the new knowledge gained. Explain that in the real world, scientists do this all the time. A well-trained scientist isn't someone who's always right the first time—they're someone who's willing to update their ideas as new evidence appears. Changing your mind isn't a mistake; it's part of the process and how real discovery happens.

Facilitator's Note: Pacing

During this phase, focus on helping students connect their **W** questions to actionable research strategies in the **H** section of the KWHL chart. Encourage them to think beyond simple internet searches. Consider experiments, direct observation, interviews, and reference materials. Reinforce that brainstorming is a judgment-free zone where creativity is valued over immediate solutions. Your role is to facilitate an inclusive environment where all voices are heard and ideas are recorded. Students will use those ideas to find potential solutions.

55 minutes

Plan and Design

Display **slide 12** which shows how students should set up the next sections of their notebook. Give students time to set up the Plan & Design sections of their notebooks.

Move to **slide 13**. Explain that now students will review their brainstormed ideas and select the most promising option or combination of ideas that best meet the problem's criteria and constraints. Students will draw detailed sketches and model their design, either physically, digitally, or both, to clearly show how the solution will be built.

Facilitator's Note: Optional Tech Modifications

If relevant, consider allowing students to practice using some of the following tech tools to aid in designing their models:

- [Figma](#)
- [Tinkercad](#)

Something to consider when using a tech option is that students may need a refresher on how to calculate scale and ratios.

The plan should include labeled diagrams, a materials list, precise dimensions or measurements, and a step-by-step process for construction. Emphasize clarity—anyone who reads the plan should be able to understand and replicate the design. This phase bridges creative ideas with practical action, ensuring that the concept is ready for the build phase.

As students are wrapping up their Plan & Design phase, transition to **slide 14** and remind students to revise their predictions based on the new knowledge gained.

Facilitator's Note: Pacing

In this phase, guide students to evaluate ideas critically against the original problem statement, criteria, and constraints. Encourage them to combine elements from multiple ideas if it strengthens the design. Model how to create clear, labeled drawings and accurate models, and reinforce the importance of including all necessary measurements and materials. Support students in thinking through the feasibility of their design, considering safety, resource availability, and construction steps before moving forward.

55 minutes

Build and Create

Display **slide 15**, which shows how students should set up the next sections of their notebook. Give students time to set up the Build & Create sections of their notebooks.

Display **slide 16**. Using their completed plan, students begin building the first version of their design: the prototype. They should follow their drawings, models, and step-by-step instructions carefully, using tools and materials safely and responsibly. While building, students should document their progress through photos, notes, or sketches to capture changes or adjustments made along the way. The goal is to create a testable version of the solution, knowing that it may require improvement in later phases.

As students are wrapping up their Build & Create phase, transition to **slide 17** and remind students to revise their predictions based on the new knowledge gained.

Facilitator's Note: Pacing

During this phase, ensure students have access to all necessary materials, tools, and workspace. Reinforce safety procedures and proper tool use before building begins. Encourage students to reference their plan frequently and to problem-solve when unexpected challenges arise. Remind them that prototypes do not have to be perfect—they are meant to be functional enough for testing and analysis. Provide guidance and troubleshooting support while allowing students to take ownership of their build process.

55 minutes

Test and Analyze

Display **slide 18** which shows how students should set up the next sections of their notebook. Give students time to set up the Test & Analyze sections of their notebooks.

Display **slide 19**. As a group, brainstorm and determine what a collection tool (i.e. table or graph) would look like. If needed, model what data would look like within your chosen tool.

Invite students to put their prototype to the test, using the criteria and constraints from the Question phase as their guide. Testing should follow a consistent process so that results are reliable and measurable. Students should gather data through observations, measurements, and feedback, looking for evidence about how well the design performs and where it might fall short. The purpose of this phase is to learn from the prototype, not to prove it's perfect.

As students are wrapping up their tests and data collection, transition to **slide 20** and explain that now they need to brainstorm the best mode for representing their collected raw data for analysis. If needed, review the examples on the slide. Allow students time to brainstorm the best tools for displaying their data. Consider checking in on their ideas periodically. They can use the variables table to outline what variables their experiment(s) yielded and what they would change in the future.

As students are wrapping up their Test & Analyze phase, transition to **slide 21** and remind students to revise their predictions based on the new knowledge gained.

Facilitator's Note: Scaffolding

If additional scaffolding is required, consider a whole class examination of possible collection tools.

Before testing begins, help students review the original criteria so that they know exactly what success looks like. Provide clear testing procedures and make sure they are applied consistently for all groups. Encourage students to collect both quantitative data (numbers, measurements) and qualitative data (observations, feedback). Ask probing questions like, "What does your data tell you about the design?" or "What patterns do you notice?" This will prepare them to make informed improvements in the next phase.

25 minutes

Reflect and Improve

Transition to **slide 22** and remind students to revise their predictions based on the new knowledge gained.

Display **slide 23** which shows how students should set up the next sections of their notebook. Give students time to set up the Reflect & Improve sections of their notebooks.

Display **slide 24**. Students review their test results and analysis to determine how well their prototype met the criteria and constraints. Using their collected data, they identify specific strengths to keep and weaknesses to address. Students then propose targeted changes to improve the design, considering materials, measurements, features, or construction methods. Remind students that the goal of this phase is to make the design more effective, efficient, and reliable before retesting or final presentation.

Display **slide 25**. Have students return to their KWL charts and direct them to complete the “L” column: “What I learned.”

Facilitator’s Note: Pacing

Guide students to base their improvement decisions on evidence rather than guesswork. Ask questions like “What change would give you the biggest improvement for the least effort?” or “Which weakness is most important to fix first and why?” Encourage them to prioritize changes that directly address test results. Remind students that this phase is part of the iterative nature of engineering: each cycle makes the design stronger. If time allows, support them in creating an updated plan, drawing, or model before rebuilding. Ideally, students will cycle through these last three phases multiple times.

30 minutes

Communicate

Display **slide 26** which shows how students should set up the next section of their notebook. Give students time to set up the Communicate section of their notebooks.

Display **slide 26** and instruct students to reflect and plan how they would communicate their experience in a real-world setting.

Facilitator's Note: Scaffolding

Encourage students to choose a communication format that best fits their audience and resources. This could include slide decks, posters, videos, written reports, demonstrations, or even digital portfolios. Remind them that strong communication isn't just about the final product; it's about showing their thinking, decisions, and problem-solving skills along the way. Consider adding opportunities for peer-review and feedback during practice presentations to strengthen clarity and delivery.

Resources

- K20 Center. (n.d.). 3-2-1. Strategies. <https://learn.k20center.ou.edu/strategy/117>
- K20 Center. (n.d.). Canva. Tech Tools. <https://learn.k20center.ou.edu/tech-tool/612>
- K20 Center. (n.d.). Elevator speech. Strategies. <https://learn.k20center.ou.edu/strategy/57>
- K20 Center. (n.d.). Figma. Tech Tools. <https://learn.k20center.ou.edu/tech-tool/3756>
- K20 Center. (n.d.). Glow and grow. Strategies. <https://learn.k20center.ou.edu/strategy/4962>
- K20 Center. (n.d.). KWHL graphic organizer. Strategies. <https://learn.k20center.ou.edu/strategy/127>
- K20 Center. (n.d.). Plus delta chart. Strategies. <https://learn.k20center.ou.edu/strategy/2904>