STEM Challenge: STEM In Action

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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 will create a short commercial showcasing a STEM invention or solution. They will collaborate on planning, storyboarding, producing, and revising their videos, learning to communicate scientific and engineering ideas effectively.

Learning Goals

Attachments

- 3-2-1—STEM Challenge.docx
- 3-2-1—STEM Challenge.pdf
- Activity Slides—STEM Challenge—STEM in Action.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
- My Checklist—STEM Challenge .docx
- My Checklist—STEM Challenge .pdf
- Pitch Organizer—STEM Challenge—STEM in Action.docx
- Pitch Organizer—STEM Challenge—STEM in Action.pdf
- Shot List—STEM Challenge—STEM in Action.docx
- Shot List—STEM Challenge—STEM in Action.pdf
- Storyboard—STEM Challenge—STEM in Action.docx
- Storyboard—STEM Challenge—STEM in Action.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)
- My Checklist handout (attached; one per group)
- Storyboard handout (attached; one per group plus extras)
- Shot List handout (attached; one per group)
- Pitch Graphic Organizer handout (attached; one per group)
- Engineering Design Process poster (attached; optional)
- Sticky Notes and Chart or poster paper (optional)
- Markers (optional)
- Composition Notebook (one per student)
- Whiteboard or poster board (one per group)
- Dry-erase markers (one set per group)
- Clipboards (one per group; optional for storyboarding)
- Pen/pencil
- Materials for STEM Activity:
    - Cameras, tablets, or smartphones (1 per group); Tripod or stabilizer (1 per group, optional); Lighting (1 small set per group or shared classroom lighting); Microphones (1 per group, optional for clearer audio); Editing software (1 per student or shared per group)

25 minutes

Question

Facilitator's Note: STEM Challenge Collection

The following activity is only part of a STEM Challenge Collection which consists of a variety of possible STEM related activities. We recommend starting with "Engineering Explorers," which is an introduction to the engineering design process 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. For the *STEM in Action* challenge, however, students will get the best results if they have completed at least one other experiment beforehand, as this final activity asks them to draw on earlier experiences when creating their commercials.

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. 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.

Use the **Activity Slides** to facilitate the following STEM Challenge session. Transition through **slides 2-4** to introduce the activity title, essential question, and objectives. 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. Read through the slide content in as much detail as needed.

Transition to **slide 7** and explain the criteria for this engineering challenge to students in as much detail as you think necessary. Encourage students to choose a product that they have already designed from previous STEM Challenges to showcase in their commercial.

Display **slide 8**. Using the KWHL Graphic Organizer strategy, have each student go to or create their own KWHL 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.

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 9** 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.

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 10** 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 11**, pass out a **Pitch Organizer** handout to each group**,** and explain how students will prepare a pitch using a modified 5W Cube strategy. Explain to students how and why one would use a pitch or need to pitch their ideas. Share that, generally, pitches are used to rapidly collect feedback about a design or product and are 30-seconds to a minute long. For their pitch, encourage students to describe their idea, materials needed, and the step-by-step process for completing the project.

Students must have their pitches approved by the teacher in order to present them to the class. After students have had time to prepare their pitches, hold a pitch meeting where an elected group speaker shares the team proposal.

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. Support students in thinking through the feasibility of their storyboard, considering safety, resource availability, and construction steps before moving forward.

55 minutes

Create

Display **slide 12**, which shows how students should set up the next sections of their notebook. Give students time to set up the Create sections of their notebooks. Pass out one copy each of the **Storyboard** and **Shot List** handouts to each group (consider having extras of the Storyboard handout in case groups need to revise their original drafts).

Move to **slide 13**. Explain that now students will review their pitch 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 storyboard their ideas, 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:

- Canva
- Figma

The prototype should include a storyboard and a materials/prop list. Emphasize clarity—anyone who reads their storyboard should be able to understand and replicate the process. This phase bridges creative ideas with practical action, ensuring that the concept is ready for the create phase.

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 creating begins. Encourage students to reference their plan frequently and to problem-solve when unexpected challenges arise. Remind them that drafts 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 create process.

55 minutes

Test and Analyze

Display **slide 14** 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.

If students need a reminder, return to slide 7 to review criteria again. Display **slide 15**. As a group, brainstorm and determine what a successful commercial should look like (i.e. what are important elements to include). When brainstorming, ask students how they would best collect feedback from their peers.

Invite students to put their prototype (storyboard and shot list) to the test, using the criteria and constraints from the Question phase as their guide. “Testing” is essentially gathering feedback from a focus group and should still follow a consistent process so that results are reliable and measurable. Students should gather data through observations and feedback, looking for evidence of how well the storyboard 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 16** and explain that now they need to brainstorm the best mode for representing their collected raw data for analysis. Inform students that these representations will be for group use only and not presented like in other STEM Challenges. Allow students time to brainstorm the best tools for displaying their data. Consider checking in on their ideas periodically.

Facilitator’s Note: Guiding the Activity

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.

The data collection methods should be student-generated, but if they are struggling, consider the following ideas for data collection: students could gather peer feedback, either in quotes or descriptions of facial expressions, and group or code their notes into relevant themes.

25 minutes

Reflect and Improve

Display **slide 17**, 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 18**. Students review their peer feedback data and analyze what feedback to use to revise and iterate their storyboards. Using their peer feedback and new storyboards, students begin to create the first draft of their commercial. They should follow their plans, storyboard, and step-by-step instructions carefully, using tools and materials safely and responsibly. While creating, students should document their progress through photos, notes, or sketches to capture changes or adjustments made along the way. Remind students that the goal of this phase is to make the design more effective, efficient, and reliable before retesting or final presentation.

Facilitator's Note: Optional Tech Modifications

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

- iMovie
- CapCut
- Adobe Premiere Rush for iOS

If you or your students need more scaffolding for video editing check out our educator resource "Videography: Telling One Story at a Time."

Display **slide 19.** Have students return to their KWHL 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 rewriting. Ideally, students will cycle through these last three phases multiple times.

30 minutes

Communicate

Have students present their commercials. Audience members should be actively listening. After each presentation, allow the audience time to engage with a peer review strategy and give the presenting group their feedback. Here are suggested strategies:

- Glow and Grow
- Plus Delta Chart
- SWOT (Strengths, Weaknesses, Opportunities, and Threats)

Resources

- K20 Center. (n.d.). 3-2-1. Strategies. https://learn.k20center.ou.edu/strategy/117
- K20 Center. (n.d.). 5W cube. Strategies. https://learn.k20center.ou.edu/strategy/81
- K20 Center. (n.d.). Adobe premiere rush for iOS. Tech Tools. https://learn.k20center.ou.edu/tech-tool/2518
- K20 Center. (n.d.). Canva. Tech Tools. https://learn.k20center.ou.edu/tech-tool/612
- K20 Center. (n.d.). CapCut. Tech tools. https://learn.k20center.ou.edu/tech-tool/5026
- 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.). iMovie. Tech Tools. https://learn.k20center.ou.edu/tech-tool/636
- 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
- K20 Center. (n.d.). SWOT (Strengths, weaknesses, opportunities, and threats). Strategies. https://learn.k20center.ou.edu/strategy/4056
- K20 Center (n.d.). Videography: Telling stories one shot at a time. Educator Resource. https://learn.k20center.ou.edu/educator-resource/4892