Professional Development Situation: Training

Skill Focus: Preparing STEM Learning Opportunities

Time Required: 80 minutes

OUR PERCEPTION OF STEM

Participants will engage in the egg drop challenge to learn to plan and rate STEM learning opportunities on their quality.

Agenda

Welcome—5 minutes
Introduction—5 minutes
See the Skill in Action—10 minutes

- Understanding your Audience's Needs video-based learning module

Hands-On Learning through "Play"—20 minutes

- Egg Drop Activity

Hands-On Learning through "STEM"—20 minutes
Evaluating the Lesson—15 minutes

- STEM Activity Quality Checklist

Conclusion—5 minutes

Materials

- Computer with Internet connection
- Projector and speakers
- Flip chart paper and markers
- Pens for participants
- Paper for name tents
- Materials for Egg Drop Activity
- Understanding your Audience's Needs video-based learning module
- One copy of STEM Activity Quality Checklist for each participant

Before the Session

- **Read this training guide** to become familiar with the content and allow time to personalize the activities to best suit your presentation style. Watch all videos and read informational materials.
    - *Italics indicate text that can be read aloud or emailed to participants.*
- Send reminder email about the training. Determine if any participants require accommodations (sight; hearing; etc.).
    - *The next professional development opportunity to enhance our STEM skills will be on DATE at TIME at LOCATION. Our focus for this session will be "Preparing STEM Learning Opportunities." Let me know if you require any accommodations to participate in the training. I am happy to answer any questions you have and look forward to seeing you at the workshop. I can be reached at CONTACT INFO.*
- Gather all materials needed for the training.
- Develop a list of possible questions participants might have during the training. Create potential responses to be explored through informal conversation. Review any key terms or ideas that may be unclear.
- On the day of the training, test the audio and video equipment.

Training Outline

Welcome (5 min)

- Greet participants as they arrive. Make sure everyone feels welcome and comfortable.
- Introduce yourself and the focus of the session: preparing STEM learning opportunities.
- Ensure participants are aware of the locations of restrooms facilities, refreshments, etc.

Introduction (5 min)

- Pass out paper and pens for participants to make name tents.
    - *On one side of the name tent, write your name and program name, and on the other write two things you look for to know something is a high-quality STEM activity. For example, maybe you look to be sure it is safe.*
- Encourage participants to share their name tents with each other in small groups or have folks walk around the room with them to do introductions.

See the Skill in Action (10 min)

- Cue up the Understanding your Audience's Needs video-based learning module.

    - *As we watch this video we will be listening for things Jean plans for as she prepares to do STEM with youth.* (Possible responses: good materials, extra materials, new materials, and having staff try out the materials.)
- Watch the video.
- Reflect on what Jean talked about.
    - *Did you catch the things Jean does to prepare for learning?* (Possible responses: imagining themselves as youth, having staff try activities with materials youth will have.)
- Watch the video again if needed to allow enough time to process and respond to questions about preparing activities.

Hands-on Learning through "Play" (20 min)

- Introduce the Egg Drop Challenge with the following script:
    - *Before we get started with our STEM activity, let's do a fun warm-up to get to know each other. I have some eggs, tape, popsicle sticks and straws. Today we are going to build something that will protect an egg if it is dropped. Here are the rules: you can build anything you want to, but everyone in your group must participate; you must test your egg over the newspaper (to keep the room clean); and at the end, your egg must be intact. show off what we've done. Remember to introduce yourselves to everyone in your group.*
- Pass out materials to each group:
    - Tape measure
    - 1 egg
    - Strip of tape
    - 10 straws
    - 15 popsicle sticks
    - Newspaper
- Allow 15 minutes to build.
- Test the products by fitting them with the egg and dropping them.
- Reflect by brainstorming the skills used in the activity.
    - *Let's make a list of the skills you used in this activity.*
    - (Possible responses: collaboration, attention to detail, time management, creative thinking, connecting background experience)

Hands-on Learning through "STEM" (20 min)

- Transition to the STEM activity for the afternoon. Ask participants to take apart their designs.

- *Now that we have gotten to know each other, let's do some science and engineering! Please stay in your groups – these will be your engineering teams. Let's use the eggs, tape, popsicle sticks and straws from our warm-up. Now we are going to **engineer** something that will protect an egg if it is dropped.*

- Distribute 1m of tape to each group and a new egg if needed.
- Introduce the criteria for success:
  - *Here are the criteria for success: you can build anything you want to, but everyone in your group must participate because everyone's idea is important; and at the end, your egg must be intact.*
- **Note:** People will catch on that they are doing the same activity. Encourage them to use what they learned from the warm-up to create an even better device.
- Introduce the testing procedures:
  - *In this activity, we are going to measure the maximum height from which you can drop your egg before it breaks. This is how we will quantify the efficacy of your design.*
  - *After you have built your device, please start testing it. You can change your design and test as often as you like. Please keep track of your data. Start by dropping your egg from 20 centimeters and keep increasing the height by 10 centimeters with every try. Let's see how high you can go!*
- After 20 minutes, bring the groups together. Quickly share the data from each group.

Debrief and Compare: Play and STEM (5 min)

- Ask the room to think about the skills they used in the first activity and the skills used in the second one.
  - *What skills did you use in this second activity? (Chart their responses; should be similar to the first list except perhaps with more attention to documentation or measurement)*
- Ask the whole group to compare the two activities.
  - *What was different about the "play" versus the "STEM" activity?*
    - Possible responses: criteria, careful documentation
  - *Is one better than the other?*
    - Possible response: It depends on what your youth are learning to do and where they are in the process of engineering.
  - *How do you think I knew whether or not you were meeting the learning goals?*
    - Possible response: I listened in as you shared what science practices you were listing up here on the chart, I watched to see if everyone was working together, I noticed your documentation strategies.

- *What else would you do to support this activity? Would you add a documentation strategy? Make a data table?*
- *Now that we know that many kinds of activities can count as STEM, let's talk about what elements of this activity are high-quality.*

Evaluating the Lesson (15 min)

- Pass out the STEM Activity Quality Checklist.
  - *We are now going to put on our "facilitator hats" and think about how this activity is a high-quality STEM activity.*
  - *For each indicator, rate it 1, 2, 3, or 4 with 4 being an exemplary activity for that criterion.*
  - *Explain why you chose the rating you did.*
- Optional: give participants a copy of the Egg Drop Activity so they can see it again from a facilitator perspective.
- Debrief. Go indicator by indicator and have people show 1, 2, 3, or 4 fingers for their rating.
- If there is strong disagreement allow people to share their thinking.
  - *We all have different ideas about what good programming looks like because of our experiences. What's most important is to share our thinking with each other so we can help each other grow.*

Conclusion (5 min)

- Return to the list on chart paper labeled "Good Planning."
  - *What other ways can we engage in planning high-quality STEM learning opportunities?*
  - *How can we use the evaluation checklist we developed?*
- Encourage participants to use this checklist in any situation in which they are hoping to support learning.

After the Session

- From notes you took on the pieces of chart paper, compile a list of strategies for organizing, recording and documenting experiments/experiences shared by the group. Share this in your follow-up email to participants.
- Within 2-3 weeks of the training, email participants.
  - *Thank you for your participation in the recent Click2Science training on "Preparing STEM Learning Experiences". I hope you found it useful. Consider meeting with a co-worker, supervisor, or friend to share what you learned. I look forward to continuing our learning at the next session on SKILL/FOCUS on DATE*

at TIME at LOCATION. Please let me know if you have any questions. I can be reached at CONTACT INFO.

Want to Earn Credit? Click2Science has teamed up with Better Kid Care to provide continuing education units. Check it out at: http://www.click2sciencepd.org/web-lessons/about

Egg Drop Activity

Learning Objectives

- Youth will be able to collaborate to develop a packaging design to safely hold an egg as it is dropped from a height.
- Youth will be able to use their resources wisely to complete a challenge.
- Youth will be able to identify a packaging engineer's job duties.

Key Term

Packaging Engineer

Materials

(Each Group)

- Cardboard
- Cotton
- Fabric
- Foam
- Packing peanuts/bubble wrap
- Dowels
- Straw

(Entire class)

- Uncooked eggs
- Tarp
- Tape
- Glue

Advanced Preparation

1. Gather all supplies listed in the materials section.

2. Familiarize yourself with educational pathways to become a packaging engineer and what they do as part of their job.

Introduction (5-10 minutes):

1. Introduce youth to the lesson by asking the following questions:

- When you go to the store to buy a food item like milk or something like toilet paper or a cell phone, does it just come on its own or does it come in some sort of packaging or container?
- What is the purpose of the packaging? What would happen if you didn't have the packaging?
- Who designs that packaging? The product designer? Actually, it's the Packaging Engineer.

2. Explain to the students that they will be taking on the role of a packaging engineer. A packaging engineer designs packages and/or containers for things like food, clothing,

electronics, and toys. They work with product designers and look at costs when designing their packaging.

3. Introduce the challenge to youth:

> "A local farmer requests your expertise as packaging engineers to help with transporting eggs from the farm to the store. As packaging engineers, your challenge is to design a container to transport the eggs safely without breaking."

4. Youth will work in groups to design a package for holding a single egg that can be dropped from a specific height without allowing the egg to break.

5. Review the Engineering Design Process and emphasize to youth that they will be following all the steps in the process to create their package/container.

6. Lead a discussion using the following prompting questions to help youth make connections to prior knowledge related to the challenge and to make predictions about what they think will happen.

- If your challenge is to prevent an egg from breaking, let's think about what causes an egg to break. What are the different ways to break an egg? How and why do those methods break the shell?
- How do people package or transport fragile items, such as eggs, in order to keep them from breaking?

Brainstorming and Design (10 minutes):

7. Give youth 10 minutes to brainstorm and sketch a design for their container. As they are working, ask them open-ended questions about their design.

- How does your design work?
- Why did you decided to build your design that way?
- What materials are you planning to use? Why did you choose those materials?

Build (15-30 minutes):

8. Give youth 15-30 minutes to build their packaging. As they are working, ask them open-ended questions about their container.

- Can you describe the different parts of your packaging and their purposes?
- What do you think will affect the results of each test?

Test and Present (10 minutes):

9. Once each team is done building their design, have youth brainstorm 2-3 tests to determine how effective their packaging is. The entire group will decide how each group will measure and record the results of each test.

10. Ask each group to come up to the front of the class and describe the elements of their design before putting their packaging through the test.
11. Test the packaging using the tests the group developed.
12. After each group tests their design, ask them to share with the entire group what about their design allowed it to be successful or unsuccessful at keeping the egg from breaking.

Redesign (10-15 minutes):

13. Based on the results of the testing phase, allow youth to redesign aspects of their package. Emphasize that they should use knowledge gained from observing how their own package and the other groups' package designs performed during the testing phase.
14. Once they have completed their redesign, youth will test their new packaging to see how it compares.

Reflection and Discussion (10-15):

15. Follow up the activity with a think-pair-share about the design process. For each question, give youth 30 seconds to think about the answer on their own, 2 minutes to discuss in pairs, and then have pairs share out their answers with the large group. This will give all youth the opportunity to voice their thoughts about the activity. These times are suggested guidelines. Please adjust them based on your students' needs and the nature of the question you are asking them to reflect on. Some possible discussion questions include:

- Which design worked the best? Why do you think this design was the best?
- What elements from other groups' packages could be combined to improve your packaging design?
- What other materials would have helped your design?
- In real life, eggs are not sold individually. How would you design packaging for a half a dozen or a dozen eggs?

Science and Engineering Connections:

In today's activity, youth played the role of packaging engineers. Packaging engineers balance a variety of criteria when considering how to package a product, including the attractiveness of the packaging material, how well the packaging protects the product, and cost effectiveness of the packaging material. Packaging engineers come from a variety of backgrounds, including material sciences and industrial engineering.

STEM Activity Quality Checklist

Rate the activity according to the following criteria.

4: Exemplary for this criterion
3: Suitable
2: Needs some adaptations
1: Needs major adaptation before teaching

Rating	To what extent does the activity:
	Relate to a STEM Career? Describe:
	Connect to the everyday lives of youth? Describe:
	Contain a strong, interesting hook? Describe:
	Contain time for reflection? Describe:
	Allow for group collaboration? Describe:
	Encourage authentic engagement in science practices? Describe:
	Connect to STEM principles or "big ideas" that youth engage with? Describe:
	Get youth moving and actively involved with STEM? Describe: