Professional Development Situation: Training

Skill Focus: Preparing STEM Learning Opportunities

Time Required: 85 minutes

PREPARING TO SAY "IT'S STEM"

Participants will engage in the straw rocket challenge to learn to prepare and plan STEM learning opportunities.

Agenda

Welcome—5 minutes

Introduction—5 minutes

See the Skill in Action—10 minutes

- Getting Organized to do STEM video-based learning module

Hands-On Learning—40 minutes

- Straw Rockets

Planning A Lesson—25 minutes

- STEM Planning Template

Conclusion—10 minutes

Materials

- Computer with Internet connection
- Projector and speakers
- Flip chart paper and markers
- Pens for participants
- Paper for nametags
- Getting Organized to do STEM video-based learning module
- One copy of Straw Rockets for each participant
- One copy of STEM Planning Template 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.
- 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 ways you get ready to facilitate a STEM activity.*
- 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 Getting Organized to do STEM video-based learning module.

  - *As we watch this video we will be listening the ways that Jaime and Dennis plan activities to engage youth in STEM.* (Possible responses: making it interesting to them, think about what their experience will be like)
- Watch the video.
- Write "Good Planning" on the top of a sheet of poster paper.
  - *What are the things that Jaime and Dennis think about as they plan STEM learning? (They think about what mistakes or issues might come up in the lesson, they try out what the youth are going to be doing to see how it will go, they get a list of materials, they want it to be engaging)*
  - *What other ways might we prepare for youth to try a STEM activity? (Think about how to get everybody participating and equal access to the activity, be sure to address a **learning goal** and plan the best way to achieve that learning goal.)*
- List participant ideas as they call them out. You will return to this list later on.
- Watch the video again if needed to extend the list to 6-8 things.

Hands-on Learning (40 min)

- Participants will now engage in an activity as learners. They will be doing the Soda Straw Rocket design challenge (From NASA and the California Institute of Technology) to figure out an optimal design.
- They will also be thinking about how to plan for this activity with youth after they complete the activity.
  - *Today we are going to engage in a STEM engineering activity together and afterward we will think about what it takes to prepare for an activity like this.*
- Group participants in pairs or triads for this activity, even though it's possible to do with individual students. Pairs or triads are more efficient for recording distance and measurements.
- Pass out materials for the Straw Rocket Challenge and the Data Table (see p.2).
- Engage the participants in the activity while allowing enough time for testing, recording information and drawing conclusions.

Planning a Lesson (30 min)

- Pass out the STEM Planning Template.
  - *We are now going to put on our "facilitator hats" and think about what we would need to do to set up this activity and connect it to STEM in meaningful ways.*

  - *Think about how you would use this activity with your youth. Working with your partners, try to come up with an introduction activity and a meaningful reflection that helps youth connect this activity to STEM.*
  - *Take some time to think about how you might select materials that would be 1) appropriate for your age group, 2) inspiring for young people to work with, and 3) safe.*
- Optional: give participants a copy of the Soda-Straw Rockets activity guide. You can also show the Understanding your Audience's Needs video-based learning module again if participants want to use it to help plan their lesson.

Closure (15 min)

- Show participants a list of engineering design practices from the Next Generation Science Standards.
  - *As a final step, let's step back and think about what engineering design practices how you might include these STEM practices in this activity.*
- Ask participants to include any of these in the "Youth will know how to" objectives box.
- Encourage participants to use this planning template in any situation in which they are hoping to support learning.
- Have participants share their lesson opening and closing ideas.
  - *What are some of the ways you chose to open and sum up the NASA Soda-Straw Rocket Challenge in your lesson plan template?*
  - *As you listen, feel free to "steal" the great ideas you hear.*

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 Opportunities". 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

Soda-Straw Rockets

(Modified from NASA Jet Propulsion Laboratory and Engineering in the Classroom)

Materials

For building

- Straw Rocket Template and Data Logs (from NASA)
- Plastic drinking straws for each participant
- Scrap paper
- Tape
- Scissors
- Data log

For testing

- Tape measure

Tips for Group Leaders

- Rocket launching should take place in an open enough area where students are able to stand out of the way of rockets being launched.
- A gym or indoor courtyard work well. Outside settings may have too much wind and will affect the results (the wind becomes a variable!)

Goals

- Students will understand basic rocket processes as applied to space flight;
- Students will demonstrate the ability to conduct an experiment and analyze and interpret the results.

Student Activity (approx. 45 min-1 hour)

- On the day of the activity, organize students into groups of 4-6. This will encourage cooperative learning and allow students to observe and build rockets with different length nose cones.
- Introduce the activity by telling the students they are about to become rocket scientists! Tell them they will build paper rockets and launch them with soda straws and will have the opportunity to re-design their rockets for maximum flight.
- Ask the students to construct the **same (control)** straw rockets by following the straw rocket template from NASA (they will get to do modifications afterward):

a. Carefully cut out the rectangle. This will be the body tube of the rocket. Wrap the rectangle around a pencil length-wise and tape the rectangle so that it forms a tube.
b. Carefully cut out the two fin units. Align the rectangle that extends between the two fins with the end of your body tube and tape it to the body tube. Nothing should stick out past the body tube! Do the same thing for the other fin unit, but tape it on the other side of the pencil, so you have a "fin sandwich".
c. Bend one fin on each fin unit 90 degrees so that each fin is at a right angle to its neighbor. When you look along the back of the rocket, the fins should form a "+" mark.
d. Using the sharpened end of your pencil, twist the top of the body tube into a nose cone. Measure your nose cone from its base to its tip and record the length on your Data Log (on page 2 of this document) and on the rocket itself.
e. Remove the pencil and replace it with a soda straw. Blow into the straw to launch your rocket! Record the distance it travels on your Data Log.

- Ask students to launch their rockets one at a time and record the distance traveled in centimeters on the data log. Encourage them to include any observations they make as they conduct their experiments.
- Students should conduct five trials of the experiment and record the results on their Data Log.
- Ask the students if they think they can make their rockets fly better by changing one thing about them (wing shape/placement, straw length, weight, etc.).
- Tell the students to go ahead and make the change—remind them that they are changing only one variable (refer to the earlier conversation about controls and variables).
- Ask the students to make a prediction about the distance the new rocket will go. Ask the students to launch their rockets and record the distance traveled in centimeters on the data log handout. Encourage them to include any observations they make as they
- conduct their experiments. Ask the students to compare the data from the original rocket (control) to the new rocket (variable). Ask them to explain the difference in flight.

Reflection Questions

1. What would you change to get an even better flight? Would you go back to the original design?
2. Was your rocket's flight affected by flying it inside or outside? What adjustments could be made based on the location of the flight?
3. What else would you like to change? Why?

STEM Planning Template

Date:	# of Youth:
Activity Name:	Age of Youth:
Learning Outcomes	
STEM Practices After this activity, youth will know <u>how to</u>:	*STEM Concepts* After this activity, youth will know <u>that</u>:
Lesson Design	
Introduction (Hook) _____ minutes	
	Materials needed for this step:
Activity _____ minutes	
	Materials:
Reflection or Assessment _____ minutes	
	Materials:

NGSS Engineering Design Practices

Write down ways that you used the engineering design practices in this activity.

Engineering Practice

Defining a problem	Using what you know to think of a solution
Develop a solution	Compare two ideas to choose the best one
Optimize the performance of our design	Test our design
Note failure points (where our design failed)	Collaborate effectively
Reflecting on how it went	