Professional Development Situation: Training

Skill Focus: Reflecting and Processing STEM Experiences

Time Required: 90 minutes

DISCOVERING SKILLS

Participants will practice facilitating the Paper Structures activity to incorporate reflection for STEM learning.

Agenda

Welcome – 5 minutes

Introduction – 15 minutes

- Checklist: Reflection

See the Skill in Action – 10 minutes

- Creating Opportunities for Youth to Reflect video-based learning module

Hands-on Learning and Practice – 30 minutes

- Paper Structures Activity Instructions

Reflection - 15 minutes

- The Reflective Process
- Reflection Page

Conclusion - 15 minutes

Materials

- Computer with Internet connection
- Projector and speakers
- Flip chart paper and markers
- Pens for participants
- One copy of Checklist: Reflection for each participant
- One copy of The Reflective Process for each participant
- Creating Opportunities for Youth to Reflect video-based learning module
- Materials for investigation
    - Paper Structures Activity Instructions
    - Images of Famous Structures

- Reflection Page
- Newspaper for each group
- Masking tape for each group

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 "Reflecting and Processing STEM Experiences." 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: "Reflecting and Processing STEM Learning".
- Ensure participants are aware of the locations of restrooms facilities, refreshments, etc.

Introduction (15 min)

- **Have participants build name tents**.
  - *Fold your name tent and write on it so your name is on one side. On the other side, write down answers to these questions:*
    - *What is reflection?*
    - *How do you use reflection in your setting? (on your own, with youth, etc.)*
- Have participants turn to their elbow partner.

- *Ask your partner, "How do you reflect? How do you help youth reflect?"*

- Now ask the room to share some of their ideas.
  - *Did anyone change their mind by hearing their partner's ideas? Did anyone gain new ideas?*
- **Introduce the purpose** of self-reflection.
  - *An important aspect of reflecting and processing includes listening and understanding other people's viewpoints. When we hear what others have to say about their experience, we can gain a deeper understanding of a situation and how they interpreted the information.*
- Hand out the Checklist for Reflection. Ask participants to read it and reflect on their practice.
  - *Think about each of these facilitation skills for supporting reflection. Which are easy for you? Which are difficult? Mark each one with a rating system: five stars for deeply part of your practice, one star for not part of your practice.*
  - *What else might you want to learn more about?*

See the Skill in Action (10 min)

- Cue up the Creating Opportunities for Youth to Reflect video-based learning module.
- Play the video under step 3.
- Ask participants what they noticed.
  - *What did you see the facilitator doing with youth?*
- Re-watch the video.
  - *How does the adult help support youth to think about the structure?*
  - *What, specifically, does the adult say?*
  - *What are youths' ideas?*
  - *What from the Checklist do you recognize in the facilitator's practice?*
- Transition to hands-on learning.
  - *Today we will develop strategies to help youth process their learning.*

Hands-on Learning (30 min)

- Participants will be engaging in a hands-on activity similar to the one in the video, called Paper Structures.
- Divide participants into groups of four.
- In each group, choose one person to be the group leader. This person will guide the others in doing the paper structures activity.
  - *We are going to use newspapers and masking tape to build a table. We will test the 'strength' of the table using various objects (books, paper, etc.). Photos of famous structures (Eiffel Tower, St. Louis Arch, etc.) can be examined to gain ideas or inspiration for building the table. Groups will formulate questions about*

the experiment (How should we build it? What should we pay attention to? How much weight will it hold? etc.).

- Distribute the materials so that each group has enough to work with:
  - Masking tape
  - Newspapers
  - Paper Structures Activity Instructions
  - Images of Famous Structures
- Groups will have 15 minutes to build.
- The group leader should continually ask reflective questions of the rest of the group.
  - **Optional:** The group leader role can be changed to different group members during the building time so that multiple people get a chance to lead others in reflective practice. Do this every 5 minutes.

Reflection (15 min)

- Pass out The Reflective Process handout. Look at the diagram.
  - *Did you complete these steps?*
  - *What parts did you skip?*
  - *What parts were most useful in helping you think about structure?*
- Ask participants to think about the steps of that activity.
  - *What steps were there to that activity? Did you notice them?*
    - *(Introduction, developing questions/predictions, trying it out, and reflection)*
  - *How can we ask youth to reflect multiple times during activities?*
- Pass out the Reflection Page handout. Ask participant to complete it based on their STEM design learning task.
  - Possible responses:
    i. Science: thinking about materials and toughness
    ii. Technology: using objects to solve problems
    iii. Engineering: designing and testing something's strength
    iv. Math: calculating how much tape we needed
- Ask participants to brainstorm ways youth might reflect on their learning during different parts of the activity. They might include:
  - Writing in a journal
  - Asking youth to nominate a group member for a "Most Valuable Partner" award for being supportive, etc.
  - Explaining what happened
  - Writing three things they want to try next time

    - Thinking of 3 tools or materials they would want to use if we did this activity again.
- Note that reflection does not have to wait until the end of an activity; we can reflect on learning during learning activities, also. Multiple kinds of reflection support learning in high-quality STEM learning environments.

Conclusion (15 min)

- Guide participants to think about the **time, materials, and questions to ask youth** to support them to reflect on their learning. Brainstorm a list of reflection questions you might use with youth.

After the Session

- From the discussion of what strategies for reflection are useful, compile a list of strategies to share with participants. 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 "Reflecting and Processing STEM 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

Checklist: Reflection

Each statement below reflects skills or components of Reflecting and Processing STEM Learning. Review the list to think about what you might want to learn more about.

- Reflecting on science and its processes
- Helping children reflect on science and its processes to continue the work of a project or idea
- Helping children make meaning of their experiences to give them personal significance
- Helping children gain purpose and deeper understandings about what they are doing by adding complexity to the experience
- Asking guiding questions to help children make sense of and process what is happening during explorations
- Encouraging children to reflect on what they have learned at the end of each activity
- Asking questions of myself; other colleagues; children (about our experiences
- together)
- Offering meeting groups with children to encourage them to think forward
- Providing time for individual as well as group reflection
- Asking questions beyond the activity they did (helping to make connections to other experiences)
- Offering ideas to children about how to write about their STEM learning experiences
- Helping children build upon knowledge in meaningful and relatable ways
- Guiding students through group reflection and or advisory panels

Paper Structures Activity Instructions

Materials

- Newspapers (enough for building with)
- Masking Tape
- Photos of famous structures (Eiffel Tower; St. Louis Gateway Arch, etc.)
- Heavy objects of various sizes (books, stones, etc.) to test strength of the structure

Instructions

- Group children in pairs or groups of 4.
- Provide a set of materials to each group.
- Ask children to examine the photos and use the newspaper to build a 'structure' or table
- Use the objects (or find others in the setting) to test the strength of the structure/table
- Have children reflect and discuss throughout their building process.

1. What is important about the following?
    a. Balance
    b. Symmetry
    c. Wide base
    d. Height
2. What materials seem best to build with?
3. How do these things help support the strength of the structure?

For more ideas about structures to use in your setting or with parents, try the following website: http://peepandthebigwideworld.com/media/pdf/peep-event-structures.pdf
http://www.click2sciencepd.org/web-lessons/about

Images of Famous Structures

All images from Wikimedia Commons.

(Clockwise: Leaning Tower of Pisa, Stonehenge, Tower Bridge – London, Burj Khalifa – Dubai, Eiffel Tower, St. Louis Archway)

Reflection Page

<table>
<tr><th>What did you observe?</th><th>How does it relate to STEM?</th><th>What could you try next?</th></tr>
<tr><td rowspan="2"></td><td>Science

Technology

Engineering

Math</td><td></td></tr>
<tr><td>Questions to Explore</td></tr>
</table>

The Reflective Process

When facilitating the Reflective Process (with learners or facilitators), the following sequence is suggested as a way to create an expectation of participation and sharing among individuals.

Each person should be asked to answer each question before the next question is asked of the group. This systematic approach allows the reflection and processing to 'build' on each person's experience and interpretation. As the group becomes more accustomed to sharing ideas, the structure can become more 'loose,' but initially, a similar process shown here can provide structure to the reflective process. This process doesn't need to wait until the activity is finished; **reflection should happen during all parts of the activity**.

Resources: Reflecting and Processing STEM

The importance of Reflection:

Bell, P. (2010). Scientific arguments as learning artifacts: designing for learning from the web with KIE. International Journal of Science Education, 22 (8), pp. 797-817.

Driver, R., Asoko, H., Leach, J., Scott, P., Mortimore, E. (1994). Constructing scientific knowledge in the classroom. Educational Researcher, 23 (7), pp. 5-12.

http://journal.naeyc.org/btj/vp/pdf/Voices_Abramson_Co-Inquiry.pdf

The importance of questions:

Church, E. (2001). Building Language Through Asking Questions. Early Learnerhood Today, 15(6), 50.

Danko-McGhee, K. & Slutsky, R. (2007). Floating Experiences: Empowering early learnerhood educators to encourage critical thinking in young learner through the visual arts. Art Education, March, pp. 13-16.

Forman, G. (1989). Helping learner ask good questions. The Wonder of it: Exploring how the World Works, Redmond, Washington: Exchange Press, pp. 21-24.

Websites:

Asking questions:

http://teachingmahollitz.wordpress.com/2011/05/16/teaching-kids-how-to-ask-good-questions/ http://www.scilearn.com/blog/6-steps-to-help-students-ask-better-questions.php http://www.ascd.org/publications/educational-leadership/nov99/vol57/num03/Helping-Students-Ask-the-Right-Questions.aspx

Experiments and Explanations:

http://kids.niehs.nih.gov/