Professional Development Situation: Training

Skill Focus: Supporting Documentation of STEM Learning

Time Required: 90 minutes

APPLYING STRATEGIES FOR DOCUMENTING STEM

Participants will document their learning with three activities: "Sink or Float," "Paper Airplanes," and "Amphibian/Fish Comparison". They will also complete a self-reflection and set goals for their practice.

Agenda

Welcome—5 minutes

Introduction —15 minutes

- Name tents
- Self-Reflection

See the Skill in Action—15 minutes

- Sharing and Explaining Findings video-based learning module

Hands-on Learning and Practice (3 stations)—40 minutes

- Sink and Float
- Paper Airplanes
- Comparing Fish & Amphibians

Conclusion—15 minutes

Materials

- Computer with Internet connection
- Projector and speakers
- Flip chart paper and markers
- Pens for participants
- 4 x 6 Index cards for name tents
- Sharing and Explaining Findings video-based learning module

- One copy for each participant of
    - Supporting Documentation of STEM Self-Reflection
    - Types of Documentation to Use with Youth
    - Sink & Float Activity
    - Sink & Float Data Page
    - Paper Airplanes Activity
    - Comparing Fish & Amphibians
- Materials for Sink and Float Station:
    - Small tub or container to hold water
    - Water (enough to fill container 2/3 full)
    - Small objects to experiment with (cork; paperclips; Styrofoam; coins; rocks; sponge; small ball; small cups, etc.)
- Materials for Paper Airplanes Station:
    - Scratch paper for folding airplanes
    - A box of paper clips (all the same size)
    - A measuring tape

Before the Session

- **Read this training guide** to become familiar with the content and allow time to personalize the activities to suit your presentation style. Watch all videos and read informational materials.
    - *Italics indicate text that can 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 "Supporting Documentation of STEM Learning". 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: "Documentation of STEM Experiences".
    - *We will be working together to apply strategies used to support documentation of STEM concepts in multiple formats, particularly symbols, drawings, models, diagrams, charts, tables, text or non-verbal means.*
- Ensure participants are aware of the locations of restrooms facilities, refreshments, etc.

Introduction Activity (15 min)

- Participants will fold a notecard or half sheet of paper into name tent. On the two sides they will write:
    - Their name
    - One way they have youth document their learning
- Ask participants to share their name tent with their "elbow partner" (the person sitting next to them)
- Pass out the Documenting STEM Learning Self-Reflection. Ask participants to complete the self-reflection and have a discussion with their elbow partner.
    - *What do they feel comfortable doing? What questions do they have about strategies on this list?*
        - **Note:** This can also be done before participants come to the training or as people are waiting for the workshop to start.
- **Brainstorm a list of strategies for documenting learning** that people currently ask youth to document their thinking. Examples could include Venn diagrams, drawing pictures of their designs, labeling diagrams, etc. Using chart paper, record their thinking. You can use an organizational strategy like this:

Type of Documentation	During Activity	After Activity

- As you write, prompt participants with open-ended questions:
    - *What are some other ways we could record children's work? (Graphs, charts, diagrams, symbols, pictures/ sketches, video, scrapbooks)*

- *Why is it important to document what we are doing during our experiments/experiences? (It helps youth remember and apply their learning, it is similar to how scientists and engineers do their work.)*
- *How can we preserve this data for each individual child and/or group project? (By keeping vertical files for each child and exploring ways to document projects after they are complete—scrapbooks, memory books, posters, etc., to share with others.)*
- *Does it matter what type of tool (chart, diagram, etc.) we use to record our experiments? Are some better suited for certain experiments than others? (Yes; drawings might be better for engineering design, matrices help us compare multiple items on multiple variables, Venn diagrams help us compare two items on multiple variables)*

See the Skill in Action (15 min)

- Introduce the video.
  - *In the video, you will see a facilitator supporting youth in documenting results of an exploration.*
- Ask participants to take note of:
  - *Materials used to organize the activity*
  - *Materials used to document the experiment*
  - *What the adult says/does*
  - *What the children say/do*
- Watch the skill video (under Step 3) in the Sharing and Explaining Findings video-based learning module. Pause or repeat the video if needed for clarity or to emphasize a behavior.
- Discuss the following questions:
  - *What type of activity were they doing?*
  - *What documentation practice did they use to record the results of the experiment?*
  - *What type of materials did they use to organize themselves?*
  - *How could they document the experiment to share with others later?*

Hands-on Learning (40 min)

- Participants will conduct three experiments and record data for each. There are three stations: Sink and Float, Paper Airplanes, and a Comparison Activity. Direct participants to use the Types of Documentation to Use with Youth to think about which type of documentation should/could be used for each of the stations. There are two pages to this sheet.

- *We'll focus on the first page for our purposes today. Take this with you and utilize the second sheet when you are beginning new experiments/projects with youth in your setting.*

- The Hands-on Activities should be set up ahead of time into 3 stations:
  - Sink and Float
  - Paper Airplanes
  - Comparison
- Station #1 is a Sink and Float experiment. Ask participants,
  - *Which type of documentation could be used in this case? In other words, which type would best show the results of the Sink and Float experiment? (tallies, bar graph)*
- At Station #2, participants will experiment with Paper Airplanes. Participants will make one paper airplane and try different numbers of paper clips on it to optimize its distance.
  - *Based on the information in the chart, which type of documentation could be used if you wanted to show which airplane flew the farthest if you added different amounts of weight with paperclips? (scatter plot)*
- At Station #3, participants compare characteristics of fish and amphibians to discover similarities and differences between them.
  - *Based on the information in the chart, which type of documentation could be used in this case? (Venn diagram*)
- Split into the three stations (count off participants or another quick way to transition them to stations).
  - *You'll have a few minutes to experiment with the materials. Record your data/results with the information provided at the station as well as the Youth Science Journal. Be sure to record information in more than one way—written, sketch, symbol, or something else.*
- As participants work, move about the stations to ensure any questions are answered regarding the purpose of the station or how to record/document the information.

Conclusion (15 min)

- Post another piece of chart paper. You will now brainstorm ways to document youths' learning in these and other activities. Highlight that participants have reviewed how to document individual activities.
  - *How might you record entire projects or multiple steps of a project?*
  - *How might we share this information with others?*
  - *Who else can youth share their designs and thinking with?*

- Record the information as participants share their responses. Include other ideas of content if people are having difficulty coming up with ideas (photos, posters, scrapbooks, newsletters, brochures, flyers, family event focused on an experiment, etc.). Also, talk about keeping vertical files for each child or project, journals, notebooks, etc.
- Set goals for practice. Ask participants to share their learning with an elbow partner.
    - *What did you get out of this training?*
    - *What will you use?*
    - *How can you support your partner?*
- Ask volunteers to share their goals to the whole group.
- Thank participants for their time.
- Collect the chart paper and type up participant thoughts to send in a follow-up email.

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 along with the Types of Documentation to Use with Youth handout. .
- Within 2-3 weeks of the training, email participants:
    - *Thank you for your participation in the recent Click2Science training on "Supporting documentation of STEM Learning". I hope you found it useful. Attached are some strategies the group discussed during the training. Consider meeting with a co-worker, supervisor, or friend to share what you learned. I look forward to continuing out 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

Supporting Documentation of STEM Self-Reflection

Circle the number that best describes your practice. There are no right or wrong responses.

1= not at all true 3=somewhat true 5= very true

1 2 3 4 5 I encourage children to communicate in written or spoken form

1 2 3 4 5 I encourage children to describe their observations precisely

1 2 3 4 5 I encourage children to clarify their thinking and to justify their arguments

1 2 3 4 5 Notebooks are used in the setting to model the importance of the scientific process and as an essential tool in engineering

1 2 3 4 5 Youth are asked to use diagrams, maps, and other models as tools to help them elaborate their ideas and present them to others

1 2 3 4 5 I support youth in conveying STEM concepts through symbols, models, or other non-verbal language.

1 2 3 4 5 I support and facilitate youth in recording data or observations about events, actions, and objects

1 2 3 4 5 Each child in the setting has a vertical file to archive charts and observations (A collection of resource materials, such as pamphlets, clippings from periodicals, and mounted photographs, arranged for ready reference, as in a library or an archive.)

1 2 3 4 5 Journals with visual depictions are present in the setting

1 2 3 4 5 I encourage children to journal or use other means of documenting data and observations to model the importance of the scientific processes

1 2 3 4 5 I encourage youth to create diagrams and to represent data and observations with plots and tables, as well as with written text, in journals

1 2 3 4 5 I support youth in recording data or observations about events, actions, and object.

Types of Documentation to Use with Youth

The way information is recorded and shared should be determined based on what type of documentation will best express the experience.

The 'raw data' can be recorded using tally marks, bulleted points, or just writing down the data. The raw data can then be put into a format (chart, graph, diagram) to reflect and analyze the information. Through reflecting and analyzing information, conclusions about the experiment/experience can be made and shared with others.

Type	Uses
Venn Diagram	To compare the characteristics of two things. To show the similarities and differences between two things. To show the logical relationship between two things.
Scatter Plot	To compare two variables and their effect on a phenomenon. Example: how speed is affected by weight when testing a model car.
Line Graph	To show changes over time (or experiments)
Bar Graph	To show differences between two or more variables
Pie Chart	To show proportion (how much of something takes up the whole of it)
Tallies	To record a unit of information (how many times something happens)

Sink & Float

Activity Instructions

You will now investigate the relationship objects have with sinking and floating. I will give each of you a bag of objects. First, you will sort the objects into what you think will sink and float.

Then you will experiment to find out what sinks and floats. You can also use plastic cups to try to make “floaters” into “sinkers” and vice versa. Record your observations on the following page.

Sink & Float Data Table

Our Predictions

Write the objects in each column that sink and float:

Sinkers	Floaters	Not sure

Our Test Results

Sinkers	Floaters	Not sure

STEM Paper Airplanes Activity

In this activity, you will make paper airplanes and weight them in order to maximize difference.

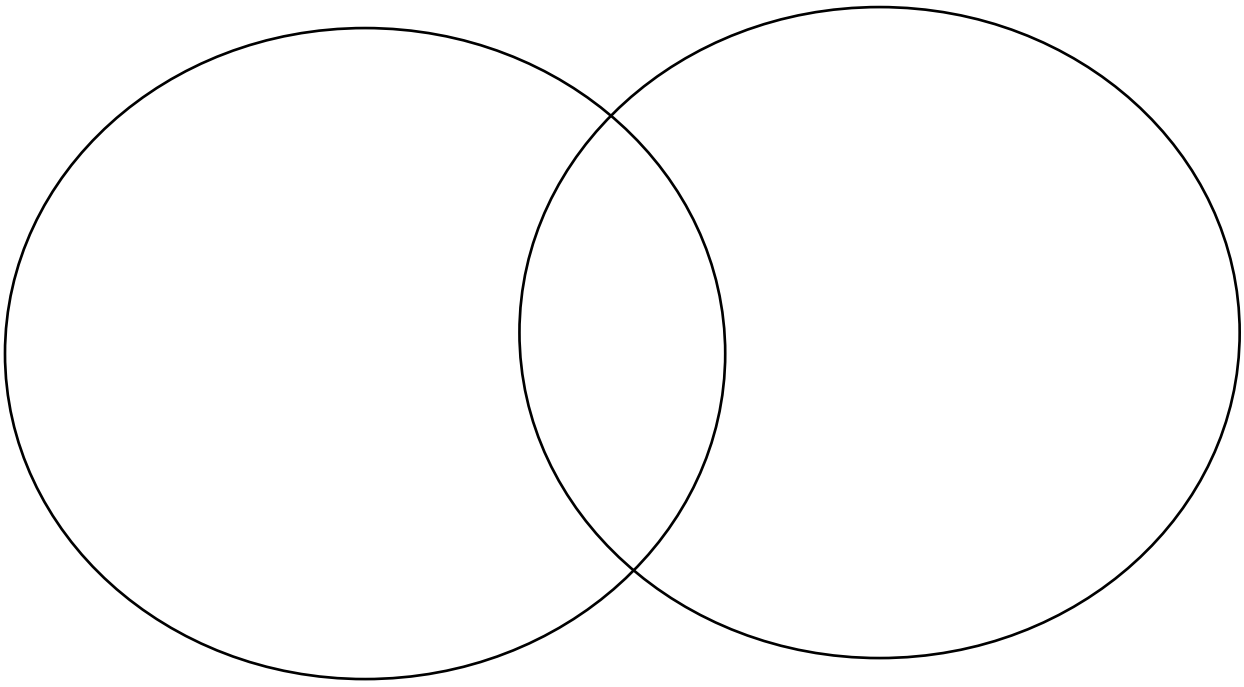
Pretend you are an engineer whose job it is to get a plane to glide without refueling. Design a paper airplane, and then i9se this table to tally how far paper airplanes go when they have the number of included paper clips.

Number of Clips added for weight								
2 clips								
1 clip								
0 clips								
	1	2	3	4	5	6	7	
Distance Airplane Traveled (in complete feet)								

Comparing Fish & Amphibians

Use the information provided here to complete a Venn Diagram.

Class of Vertebr.	Characteristics						Examples
	Habitat	*Type of Blood*	*Body*	*Breathing Organ*	*Reproduction*	*Fertilization*	
Fish	Water	Cold	Covered with scales	Gills	Lays eggs	External fertilization	Eel Fish
Amphibians	Water and Land	Cold	Covered by skin	Gills (tadpole) Lungs (adult)	Lay eggs	External fertilization	Todd Frog
Chart in part reproduced from form2notes.blogspot.com							



Write a statement comparing and contrasting fish and amphibians:

Supporting Documentation Goal Setting Handout

Supporting Documentation of STEM Learning requires:

Time—for children to explore materials alone, with partners, in whole groups, with adults; to document what they have learned; to share with others and develop deeper understandings; to make connections with relatable content
Space—the space to write or draw
Materials—to organize thoughts; to record/document results; to discover next steps in project work; to write about experiences
Questions—open-ended questions and statements to push youth' thinking as they document their learning

Think of ways you can offer Time, Space, Materials, and Questions to help children Document STEM Learning in your setting. Develop 1-2 goals to focus on within the areas of Supporting Documentation of STEM.

Time:
I want to focus on_____
I will _____
_____
_____

Space:
I want to focus on_____
I will _____
_____
_____

Materials:
I want to focus on_____
I will _____
_____
_____

Questions I can use:

1. _____

2. _____

Resources: Supporting Documentation for STEM

Ashbrook, P. (2010). Documenting learning. *Science & Children*, *48* (3), p. 24.

Kroeger, J. (2006). Documentation: A hard place to reach. *Early Childhood Education Journal*, *33* (6), pp. 389-398.

Bers, M. U. & Portsmore, M. (2005). Teaching partnerships: Early childhood and Engineering youth teaching Math and Science through robotics. *Journal of Science Education and Technology, 14* (1), pp. 59-73.

Benenson, G. (2001). The unrealized potential of everyday technology as a context for learning. *Journal of Research in Science Teaching*, *38* (7), pp. 730-735.

McGinn, M. K., & Roth, Wolff-Michael, R. (1999). Preparing youth for competent scientific practice: Implications of recent research in Science and Technology. *Educational Researcher*, *28* (3), pp. 14-24.

Forman, George. (1986) Observations of young children solving problems with computers and robots. *Journal of Research in Childhood Education*, *1* (2) pp. 60-74.

Websites:

http://www.citytechnology.org/kids
Use Educator's link for simple experiments.

http://www.sciencekids.co.nz
Wide variety of Science related experiments, lessons, images, and videos.