

Ice Breaker Activity: Exploring Types of Assessments

Overview:

In this two-hour session, participants engage in an activity in which they are challenged to melt an ice cube in three minutes and then reflect (as a group) on what strategies worked best and why. They then take a series of tests (multiple-choice test, enhanced multiple-choice test, justified multiple-choice test, and open-ended test) to assess the knowledge they gained through doing the activity. Participants then discuss the tests from the standpoint of how effectively each is able to measure levels of understanding.

In this way, participants gain an awareness of different types of assessment and their effectiveness in measuring / assessing levels of understanding, with levels ranging from initial awareness through in-depth, lasting understanding. The activity gives participants an opportunity to recognize and reflect upon the important idea that different assessments provide different information regarding student understanding and have different advantages and disadvantages.

Use:

Can serve as a stand-alone activity illustrating the strength and versatility of performance tasks and various other types of assessment. This is a good follow-up to *DMV Discussion*. The level of detail about assessment in this session is geared for a relatively sophisticated and motivated audience who may be more interested in in-depth analysis. For example, the comparison between several different kinds of multiple-choice may not be of interest to all audiences.

Key Concept from Public Understanding Framework Addressed:

Multiple measures

Time Frame: ~2.0 hours

- Introduction (5 minutes)
- Ice Breaker Activity (30 minutes)
- Taking Assessments (25-30 minutes)
- Performance Task (45 minutes)
- Conclusion (10 minutes)

What You Need:

For the presenter:

- o overhead projector
- o extension cord (optional)
- o each of the following overhead transparencies (masters):
 - 1. "Ice Breaker" transparency
 - 2. "Ice Breaker Discussion " transparency
 - 3. "Assessment Comparison" transparency
- o 1 large-tipped marker
- o 1 sheet of butcher paper or large chart paper
- o 1 insulated container for storing ice cubes (*optional*)

For each participant:

- o 1 of each of the following in-class handouts: (masters)
 - "Assessment Comparison"
 - "Multiple Choice Test"
 - "Enhanced Multiple Choice"
 - "Justified Multiple Choice"
 - "Open Ended Response"
 - "Experimental Design Problem"
- o 1 ice cube in a ziplock bag
- o 1 clear plastic cup

For each group of 4-6 participants:

- o 2 tall, clear plastic cups
- o 2 styrofoam cups
- o 1 small, wide-mouthed container of kosher salt
- o 1 measuring spoon, teaspoon size
- o 1 thermometer, reading in degrees Celsius
- o 1 bottle of food coloring

Getting Ready:

Before the Day of the Workshop:

1. **Duplicate handouts.** Duplicate the following handouts for each participant and staple them into a packet:
 - "Assessment Comparison"
 - "Multiple Choice Test"
 - "Enhanced Multiple Choice"
 - "Justified Multiple Choice"
 - "Open Ended Response"

Make one copy for each participant of the "Experimental Design Problem" handout

2. **Make overhead transparencies.** Make one of each of the overhead transparencies listed above.

Immediately Before the Workshop: (20-30 minutes)

- 1. Set up the room.** Arrange the room so groups of 4-6 participants can sit at a table together. If you are in a classroom, move desks together to make “tables.” Tables should be oriented so that all of the table groups can join a large group discussion, and see what’s projected on the overhead.
- 2. Set up overhead projector.** Set up overhead projector at the front of the room.
- 3. Have overhead transparencies on hand.** Place the overhead transparencies (in numbered order) next to the overhead projector.
- 4. Assemble remaining workshop materials.** Have easily accessible all of the remaining workshop materials; ice cubes in ziplock placed in cups, equipment for groups of 4-6 set out on trays.

Introducing the Session (5 minutes)

- 1. Explain goals of the session.** Tell the participants that during this session, they will be experiencing and analyzing a series of different types of **assessments**. If/when participants groan or otherwise lack enthusiasm, comment that now they can imagine how some students feel when they such words in school. Explain that before they will actually be performing these assessments, they will have the opportunity to do a brief learning activity involving something they probably already know a lot about – ice cubes.

Ice Breaker Activity (20 minutes)

- 1. Introduce the Challenge.** Display overhead transparency #1, “Ice Breaker” and challenge the participants to melt an ice cube in three minutes or less, using only the materials provided—a cup and a ziplock bag. Tell them that they will begin as soon as everyone has their materials and they should let you know—by raising their hands—when they have accomplished the task.
- 2. Pass out the ice cubes.** Quickly distribute the ice cubes and cups to each participant and then give the signal to begin. Allow about five minutes for most people to complete the task.

NOTE: They may want to add hot water or gather other materials – remind them they may only use what you have provided. There will be probably be someone who gets the idea to try to break the ice cube into pieces – this is indeed the fastest way to melt it without using an outside energy source.

3. Discuss in small groups. Display the overhead transparency #2, “Ice Breaker Discussion.” Ask them to share with their table groups the different strategies they used to attempt to melt the ice cube. Have them use the following prompts to guide their discussion:

- Which cubes melted first?
- Which strategies for melting the ice cube were the most successful?
- What is your explanation for this? Are there other ideas that could help explain what worked?
- What are some possible science concepts involved in doing this activity?

4. Large group discussion. Lead a brief discussion with the whole group based on the above questions. When they get to the point of generating explanations, encourage them to talk about what happens to the surface area of an ice cube when you break it up into pieces and how that might affect the rate of melting. Allow adequate time for robust, open-ended discourse on the topic. Make sure to note on the butcher paper some of the larger science concepts they have touched on in their discussion.

Taking and Analyzing the Assessments (25-30 minutes)

- 1. Introduce Assessment Types and a process for analyzing them.** Display overhead transparency #3, “Assessment Comparison.” Tell them they will now have a chance to experience for themselves the various assessment types listed on this chart. They will be doing this not primarily to evaluate what they have learned about ice cubes melting, but in order to try to analyze the purposes behind and effects on the learner of each type of assessment tool.
- 2. Pass out the packets.** Distribute the packets containing the different types of assessments and the Assessment Comparison chart. Explain that they will now have about 15 minutes to complete the assessments and fill out the Assessment Comparison chart. Ask them to try to pay attention to their individual experience as a learner as they take each test. They should fill out the appropriate column for each assessment type before proceeding to the next one.

NOTE: You may want to assure them that no one will be looking at their answers after they complete the tests.

- 3. Debrief the possible purposes of the assessments.** After they have completed the tests, lead a discussion using overhead transparency #3, “Assessment Comparison” chart. Go over each of the different types and fill in the appropriate column on the chart as participants give their reactions to taking the tests.
- 4. Summarize the discussion.** Reiterate that each of these tests gives us different kinds of information about student understanding. Make the point that when teachers use a variety of assessment methods in their classroom, they gain a richer picture of what their students know and are able to do.

NOTE: This would be a good time to take a break in the activities if you are allowing time for a break.

Experiencing a Performance Task (45 minutes)

- 1. Explain the Performance Task.** Tell the participants that they will now experience a different type of assessment activity—called a performance task. This assessment is very different from the others, in that it will be done with a group of “students.”
- 2. Question prompt about ice melting in fresh and salt water.** Tell the participants that in their small groups they will be trying to answer the following question:

Will an ice cube melt faster in fresh water or salt water? Why do you think this will happen?

First they will make a prediction and then use the equipment provided to design an experiment that will help to answer the question.

- 3. Show materials for experiment.** Indicate the items provided on the trays and the container of fresh ice cubes at the front of the room. Explain that they will have about 30 minutes to design and do their experiment—and come up with an explanation for the results. Have them send one person from their group to the front of the room and pick up the materials for their experiment.

- 4. Groups do their investigations.** Circulate among the groups to make sure they have made their predictions before starting the experiment and that they have fully planned out their procedure. Ask questions as they are working to guide them in their thinking about the discrepant phenomenon. You can give hints to try not to think about the typical use of salt to melt ice on the roadway. Ask if they've thought about how differences in density might affect the melting process.

Note: Contrary to what most people predict, the ice cube in the fresh water will melt faster than in the salt water. This is actually because the colder water melting from the ice sinks to the bottom in the fresh water cup- cold water is more dense than room temperature water. This sets up a current that allows for mixing the water on which the ice is floating – continually putting the ice cube in contact with the warmer water. Because the salt water is more dense, the fresh cold water melting from the ice in the salt water cup just sits on top and creates a cold layer next to the ice cube.

- 5. Groups make a poster.** As you notice the experiments being finished, pass out a piece of chart paper and a marking pen to each group. Have each group make a poster representing their ideas about what is going on the two cups of water. Ask them to try to draw a picture of what they think is happening.

- 6. Large Group discussion.** When most of the experiments are completed and posters up, have a discussion with the whole group about the results of the experiment. Ask them whether they answered the initial question and if it matched their predictions. Then have a few representative groups to share their explanations for the results and why they think this is happening.

Discussing the Performance Task as an Assessment Tool. (10 minutes)

- 1. Debrief using Assessment Comparison chart.** Have participants refer back to their assessment comparison charts and fill in the column for the experimental design problem – which is a type of performance task.

- 2. Share reactions to the performance task.** Lead a discussion giving participants the opportunity to bring up the advantages and disadvantages of using performance tasks as an assessment. Make sure they mention that one of the strengths of the task was they were able to learn something as they were doing it.
- 3. Sum Up Different Types of Assessment.** Remind the participants that they have experienced some of the strengths and weaknesses of various assessment types. A teacher who is well versed in the appropriate uses of these assessment techniques can provide the right opportunities for students with different learning styles and levels of understanding.

Looking at Kinds of Understanding – 10 minutes

- 1. Explain different kinds of understanding from *Understanding by Design* page 10.** Draw three concentric rings on a piece of chart paper and title it “Kinds of Understanding.” Label the outer ring as “worth being familiar with,” the middle ring as “important to know and do,” and the inner ring as “enduring understanding.” Clearly teachers cannot address every small bit of knowledge with their students, so they must make some choices based on the kind of knowledge needed for students to be successful in science.
- 2. Define the terms.** Something that is “worth being familiar with” represents the kind of broad-based knowledge covered such as the history of science, or some basic science terminology. The “important to know and do” ring specifies the critical knowledge and skills necessary to accomplish key tasks in science, such as designing experiments. The smallest ring “enduring understanding” characterizes the big ideas and concepts in science that we really want students to be able to grasp, apply to new learning situations, and remember so these concepts can be developed and extended in later grades and careers.
- 3. Examine the kinds of understanding approached by different types of assessments.** Each of the assessment types we’ve experienced can be mapped onto the “Kinds of Understanding” chart. Ask participants which kind of assessment they think is best for collecting evidence of these different types of understanding in students and write them on the chart. Paper and pencil tasks such as true/false quizzes, multiple choice, enhanced multiple choice, and justified multiple choice could be used for assessing large and middle ring understanding. Open-ended response, performance tasks, experimental design problems and projects can be used for assessing middle and center ring understanding.

Experimental Design Problem

Will an ice cube dissolve faster in salt water or fresh water? Why?

Make a prediction:

Design and conduct an experiment that will support or disprove your prediction. Be sure to list your materials, write your procedure, gather and interpret your data and use evidence to support your conclusion. Use science concepts in your explanation.

Ice Breaker

Directions:

- At your table you will find ice cubes and zip-lock bags. Take one of each.
- Place the ice cube in the zip-lock bag.
- Melt the ice cube as quickly as possible. You will have 3 minutes.
- You may use only the implements at your table for this activity.

Ice-Breaker Discussion

Share at your table groups the different strategies you used to melt the ice, and respond to the following questions:

- Which ice cubes melted first?
- Which strategies for melting the ice were successful?
- Why?
- What possible science concepts, or “big ideas”, are embedded in this activity?

Assessment Comparison Chart

	Multiple Choice	Enhanced Multiple Choice	Justified Multiple Choice	Open Ended Prompt	Performance Task
Assesses Factual knowledge					
Assesses Conceptual understanding					
Able to learn from assessment					
Provides motivation					
Liked it/ Didn't like it					

Assessment Comparison Chart

	Multiple Choice	Enhanced Multiple Choice	Justified Multiple Choice	Open Ended Prompt	Performance Task
Assesses Factual knowledge					
Assesses Conceptual understanding					
Able to learn from assessment					
Provides motivation					
Liked it/ Didn't like it					

Multiple Choice

1. How many sides to an ice cube?
 - A. 4
 - B. 6
 - C. 8
 - D. 16

2. Wind blown across the surfaces of an ice cube would
 - A. not change the rate of melting.
 - B. increase the rate of melting.
 - C. decrease the rate of melting.
 - D. make the ice heavier.

3. Transpiration is
 - A. the process of dying.
 - B. the way to get from point A to point B.
 - C. vapor particles traveling across a membrane.
 - D. what happens when water reaches 100°C.

4. If you broke the cube into two pieces, the two pieces would
 - A. melt at the same rate.
 - B. melt at a faster rate.
 - C. melt at a slower rate.
 - D. stick together

Enhanced Multiple Choice

Choose the best answer based on the following scenario:

For their science fair project, Mary and Kim decided to see who could melt an ice cube in a plastic bag the quickest. Mary decided to put her ice cube in the oven at 250°F, so as not to melt the plastic bag. Kim decided to put his ice cube on the windowsill in the sun. The following are their results.

Time taken to Melt an Ice Cube

	Trial 1 10 am	Trial 2 12 noon	Trial 3 2 pm	Trial 4 4 pm
Mary oven at 250°F	14.7 min.	14.9 min.	15.2 min.	14.5 min.
Kim in the sun	14.9 min.	14.8 min.	14.4 min.	15.2 min.

1. The fastest way to melt an ice cube in a plastic bag is:
 - a. in the sun at 2 PM.
 - b. in the sun at noon.
 - c. in the oven anytime.
 - d. none of the above.

2. All of the following can explain Mary's data except:
 - a. Not all ice cubes are exactly the same size.
 - b. The actual temperature in the oven could vary.
 - c. It is difficult to tell exactly when ice has melted.
 - d. Ice melts more slowly at different times of the day.

- e. Kim's data varied probably because:
 - a. Energy released by the sun varies throughout the day.
 - b. The energy reaching the ice varied throughout the day.
 - c. It takes more energy to melt the ice in the morning.
 - d. None of the above

- c. Mary and Kim could melt the ice even faster if:
 - a. The ice were not in a plastic bag.
 - b. The ice cube was first cut into smaller pieces.
 - c. More energy was used.
 - d. All of the above.

Justified Multiple Choice

Please circle the best answer for each of the following items. Use your understanding of science to support your answer.

1. Wind blown across the surfaces of an ice cube would
 - A. not change the rate of melting.
 - B. increase the rate of melting.
 - C. decrease the rate of melting.
 - D. make the ice heavier.

Science "reason" _____

2. If you broke the ice cube into two pieces, the two pieces would
 - A. melt at the same rate.
 - B. melt at a faster rate.
 - C. melt at a slower rate.
 - D. stick together.

Science "reason" _____

3. In the morning there was a light fog over the surface of the outdoor ice skating track. What could explain this?
 - A. the air on the surface of the track was cooler than the air above.
 - B. the ice was melting and turning to steam.
 - C. the ice was rough and needed to be smoothed.
 - D. the track was frozen and absorbed heat.

Science "reason" _____

Open Ended

Describe/design a way to bring an ice cube from home to school without the ice cube melting. Explain your design/idea and tell why it will work. Your answer will be assessed on how well you show your understanding of science and on how well you can explain it to others. You may include a picture to help explain your answer.