Session 9: Assessing for Learning

Contents

Session Overview

This session provides participants with background on and experiences with the important topic of assessment. The session begins with a group assessment activity in which participants review and discuss the topics covered thus far in the course. They examine a real-world example of being assessed and think about some of the reasons for using particular assessment methods.

Participants learn the advantages of using different types of assessment measures and how they can reveal a broader range of understanding and skills. They also examine student work samples to evaluate how well they reveal student ideas in science.

Throughout the session participants gain a sense of the importance of formative classroom assessment and how it can best be used to support student learning.

Background Information for the Presenter

Assessment of student learning is a complex and sometimes controversial topic, especially in an era of increased emphasis on standardized testing and school accountability. Yet assessment is an essential part of education—both to gain insight into student learning progress and—as is sometimes forgotten—into whether or not teaching strategies and curricula are appropriate and effective.

Grant Wiggins, a leading commentator on issues in educational assessment, notes that the root of the word "assessment" derives from "to sit with." In its original sense, it speaks to connecting with the person being "assessed" in such a way as to gain a close understanding of what they know and understand. From this perspective, teachers are constantly assessing students as they assign tasks and pose questions designed to uncover their understanding. However, educators do need support in developing the knowledge and skills required to effectively plan for assessment, observe learning, analyze and interpret evidence of learning, provide feedback to students, and support them in self-assessment.

The purpose of assessment is to gather **evidence of learning**—whether it is provided to teacher, student, parent, district, state, or nation. It's important that learning be recognized for the complex process it is. Assessment should probe for depth of learning, apply appropriate measurement techniques, and understand that the full range of learning includes critical thinking, conceptual understanding, basic skills, and factual information.

Using Multiple Measures

Educators use a variety of ways to assess what students know. Some of these methods resemble traditional tests; others aren't always recognizable as such. One of the current "best practices" in education is to try to use a balance of different kinds of assessments in order to test for a broad range of student knowledge and ability. The idea is that multiple assessment measures are needed to attain a more complete and accurate assessment of student learning.

Using multiple measures may include: (a) administering a test comprised of various components or different types of assessment items, i.e., open-ended response, enhanced multiple choice, constructed response, performance task, etc. (b) using different types of measures within the classroom across the school year, or (c) looking at different levels of assessment across the larger education system, i.e., the classroom, district, state, and nation). Wiggins and many other educators believe, for example, that "tests" should be administered in settings that enable the student to explain or clarify answers. More than this, they argue strongly for assessments that allow students to demonstrate the full range of their abilities in the performance of a real-world related task.

Wiggins notes, "There is room for the quiet techie and the show-off prima donna in plays; there is room for the slow, heavy lineman and for the small, fleet pass receiver in football. Why must all students be tested in the same way and at the same time? Why should speed of recall be so well rewarded and slow answering be so heavily penalized in conventional testing?"

This practice is also supported by the research related to developing expertise in a subject or a field. Experts are defined as those who can "transform" important knowledge and facts into usable conceptual understandings that allow one to solve new problems. This process is also referred to as *transfer* and supports the trend in using *authentic* assessments—where the learner is asked to apply what they've learned to a task they have not yet encountered.

Using a balance of different kinds of measures allows educators to gather multiple forms of evidence about student learning and allows students to demonstrate understanding through a variety of different formats, modalities, and testing situations.

Assessments Should be Valid for Their Intended Purpose

A related idea in assessment is that a teacher should select assessment tasks and prompts based on their intended purpose. Each kind of assessment has advantages and limitations. Different types of assessments are best suited to different realms and kinds of knowledge, therefore, the type of assessment that is used depends on what information is desired.

For instance, it's important to find out that children know their math facts; it's also important to find out that children know how to think critically and solve complex problems. Carefully designed multiple-choice and short answer questions can be helpful for assessing factual and some conceptual knowledge. Open-ended prompts can be useful for uncovering students' initial ideas and possible misunderstandings. Many standardized tests are designed to help make comparisons between different groups of students. Performance tasks, portfolios of work over time, and presentations of individual or group projects are useful for assessing complex reasoning and the ability to apply one's understanding of concepts. Thus the kind of test or assessment method that is most appropriate depends on the kind of learning a teacher wants to assess and the goals for the use of the assessment information.

Current Emphasis on Formative Assessment

Best practices in teaching recommend that formative assessment should be woven into *all* stages of learning: **before** new material is presented (to assess current knowledge), **during** the learning process (to monitor how well a student is grasping a concept), and **after** the lesson has been taught (to see how well the student understands the new material, and to assess the effectiveness of the teaching). This lets a teacher evaluate and modify the learning experience in time to make a difference—rather than discover a problem just as it's time to move on to another subject.

Curriculum-embedded, formative assessment practices create a continuous flow of information between teacher and student in order to guide the next steps in learning. For this reason, it's also important to actively involve students in the assessment process. Scoring guides and rubrics, as well as direct teacher feedback, are shared with students to help them envision performance goals and understand what is needed for improvement. In this way, students understand the work standards that are expected of them, and formative assessment information can be an important guide for instructional improvement for both the teacher and the student. By allowing students to be more in charge of their learning, their motivation to learn is greatly increased.

Assessment *for* learning is when students have:

- understanding of instructional goals
- opportunity to develop skills and knowledge necessary to achieve goals
- ownership of their learning
- motivation to learn

In fact research has shown that, when carried out effectively, formative classroom assessment that includes constructive feedback to students significantly raises the levels of student achievement. In this sense, quality formative assessment is indistinguishable from good teaching practices.

Teachers using formative assessment to support learning must:

- Develop clear learning goals for students
- Provide opportunities to learn content in a deep way
- Align assessment tasks with curriculum (what is taught) and instruction (how it is taught)
- Embed assessments at key points throughout instruction
- Make changes to curriculum, instruction, and assessments based on feedback from students

Teachers may also use *summative* assessments to measure student progress at the end of a unit of instruction. These kinds of assessments are more typically included in curriculum programs and textbooks, and are designed to help determine what students have learned from the instructional materials. Because they occur after instruction, when students are preparing to move on to other topics, they have a distinctly different purpose than formative assessments. They do provide feedback to the teacher about the success of the lessons, but this information can only guide instruction for the next time the materials are used, which is often not until the following school year. In this case, summative assessment can be referred to as assessment *of* learning, in direct contrast to formative assessments that are used throughout instruction as assessment *in support of* learning.

Materials and Preparation

Materials Needed

For the Class:
• an LCD projector (or overhead projector)

For the Assessment Carousel:
- 10–15 large sheets of butcher paper—one for each question or topic and some extra sheets in case students run out of room.
- felt-tip marking pens—a different color for each group of 4-6 students
- masking tape for posting butcher paper

The following slides (or transparencies): 1 each of the following:
- Goals for the Assessment Carousel
- Defining Assessment
- Purpose of Assessment
- Two Kinds of Tests
- Full Range of Learning
- Different Kinds of Assessments
- Formative Assessment
- Looking Student Work
- Research about Assessment
- Examples of Assessment Strategies

For the Looking at Student Work activity:
(Samples of student work from a variety of assessments)
For each group of 4–6 participants:
2 manila folders
2 sets of student work from an assessment task
2 copies of the sheet describing the assessment task

Preparation

Before the Day of the Workshop:

1. **Make handouts**. For each participant, duplicate one copy of the following handouts:
   - "Looking at Student Work" sheet
   - "Examples of Assessment Strategies"

2. **Prepare slides or overhead transparencies**.

3. **Assemble student work folders.** Obtain and/or select six to eight samples of student work, either from the sample assessments included here, or from a representative classroom source. Duplicate two sets of identical student work for each group of four to six participants and place them in labeled manila folders. Make two copies of each sheet describing the assessment task and context (see the "Looking at Student Work" handouts) and place them into the corresponding folders.

For the Assessment Carousel:

1. Decide how many "response sheets" you would like to use. The number will depend on the number of participants in the class (teams of no fewer than three and no more than five will rotate around the room—your minimum number of response sheets should equal the number of teams you have—each team needs to be at a response sheet). The number you decide on also will depend on the number of topics you want the teams to respond to. (See list of possible topics below.) Somewhere between 6 and 10 is probably a good range.

2. Label each piece of butcher paper with the topic or questions you would like your students to respond to. Number each sheet so that you can easily assign groups to a starting point. Post these charts along the walls, spreading them out around the room as much as possible.

Possible Pedagogical Content Topics:

- Nature and Practices of Science
- Teaching Approaches
- The Learning Cycle Model
- Constructing Understanding - Constructivism
- Questioning Strategies
- Promoting Discussion
- Teacher Response Strategies
- Planning and Classroom Management Strategies
- What makes a good science lesson?
- Assessing for Learning

Pedagogical Content Not Explicitly Addressed in the course:

- Equity Issues in Education
- Multiple Intelligences
- Developmental Theory
- Inquiry

Possible Science Content Questions:

- What concepts should be taught in Chemistry K-5 (or whatever grades are appropriate for your audience)?
- What concepts should be taught in Physics K-5?
- What concepts should be taught in Astronomy K-5?
- What concepts should be taught in Life Sciences K-5?
- What are general science concepts that should be taught in K-5?

***Note**: We've included a listing of possible topics and questions, but be sure to choose topics and questions that reflect what you've taught in your course, and what you'd like them to be thinking about for the rest of the course. You'll need to eliminate some of these or add some of your own.*

Immediately Before the Workshop: (20–30 minutes)

1. Set up LCD (or overhead) projector at the front of the room near where you will stand.

2. Assemble student work sample folders and instruction sheets.

3. Have the handouts easily accessible at the front of the room.

Instructor's Guide

Session Objectives

In this session, participants:
— have the experience of being assessed themselves as part of their exploration of the topic of assessment
— have the opportunity to teach each other
— review the course topics before applying them in designing their own lessons
— gain information about assessment and how this arena of education is changing
— learn how they can use some of these principles and practices in assessment to support student learning

In this session, the instructors:
— become aware of what the class has learned about the topics addressed in the course, as well as those that have *not* yet been addressed
— use this information to inform how to adjust instruction in the remainder of the course

Session Activities at a Glance

Assessment Carousel and Discussion

First, participants take part in an *Assessment Carousel* activity, designed to gain information on what they have learned in the course thus far. They then discuss the experience, and the goals behind it.

Introduction to Assessment

After a brief definition of assessment, participants begin a discussion about the value of the two kinds of driving tests given at the Department of Motor Vehicles—a multiple choice test about the laws related to driving and the performance test in which a person must actually drive. This leads to the general conclusion that different kinds of tests test for different kinds of knowledge—and both kinds are important.

At this point we offer a definition of assessment and its purpose to gather evidence of student learning. The presenter then introduces important assessment approaches that exemplify sound instructional practices—the importance of assessing the full range of learning, the value of using the right assessment for the right purpose and the benefit of using continuous formative assessment in order to inform instruction.

Looking at Student work

To gain some firsthand experience with assessment, the group is given a collection of actual student work from various assessments devised by previous course participants. By examining and discussing the student work in small groups, they learn what they reveal about students' knowledge and also reflect on the effectiveness of the assessments to reveal evidence of student understanding.

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Assessment in Context
The class discusses what was learned from examining the student work and evaluating the assessments.

Conclusion
The presenter concludes the session by presenting research findings about the value of formative assessment—assessment *for* learning as opposed to assessment *of* learning. Students receive a handout listing several examples of different kinds of authentic assessment techniques that can be adapted for use in a wide variety of situations.

Time Frame

Total Workshop: 2 hours
- Assessment Carousel and Discussion (50 minutes)
- Introducing Assessment (20 minutes)
- Looking at Student Work (40 minutes)
- Assessment in Context (10 minutes)
- Conclusion (5 minutes)

Introduce Session

Assessment Carousel

1. Introduce group assessment activity. Tell participants they'll be taking part in a group assessment activity. Point out that this assessment will not be testing their individual knowledge, but the knowledge of the class, and they will work in teams to respond to a series of prompts about some topics that are important to teaching.

2. Display paper charts and prompts. Show them the large sheets of paper with topics and questions posted around the room. Read each one out loud. Point out that most of the sheets deal with topics that have been addressed in the course (e.g., "Learning Cycle "), but that some will be challenging them to stretch their knowledge (e.g.: "What are concepts to teach in Astronomy in grades K–5?").

3. Assign teams for rotation and explain task. Assign teams or have the students count off, up to the number of response sheets you have posted. Let them know that their group will be assigned to begin at one of these sheets. Explain that each group will have a specific color of marking pen to share, and they will use it to record their groups' responses to each of the questions or topics listed. When they arrive at each sheet of paper, the group will brainstorm and record everything they can remember about the topic.

4. How to indicate agreement/disagreement. When they arrive at a station where others have already recorded their responses, their first task will be to read all the previously recorded statements on the sheet. If their group generally agrees with a statement, they should make a "+" (plus) sign next to it. They may

also add to the statement. If they disagree with a previously recorded statement, their group should make a "-" (minus) sign.

5. Explain timing. They will have only a few minutes to respond to each prompt and you'll make an announcement when it's time for the groups to rotate to the next question or topic. Indicate the direction in which they will be rotating. They will have approximately five minutes at their first station, but as the activity progresses, it will become more difficult to come up with new statements, so you will give them slightly less time to write.

6. Ask if there are any questions and begin rotation. Tell them they may begin brainstorming and writing. Announce the rotation time approximately every 3–5 minutes, reminding them in which direction to rotate.

7. Read comments at final station. When every group has had the chance to respond to each topic, and has returned to their original sheet of paper, give them some time to read what the other groups have written. After a few minutes, have them return to their seats for a discussion of the activity.

Discussing the Assessment Carousel

1. Large group discussion. Ask the class what they got out of doing the assessment activity. Invite them to comment on the process and how they responded when told this was an assessment.

> ***Note:*** *If you or your students have questions about any of the statements, the group that wrote them can be identified by the color of pen they were written with.*

2. Discuss Goals. Ask what they think the goals of the assessment might have been. After accepting several responses, display the slide, *Goals of the Assessment Carousel*, and read each point aloud:

> Allows participants to:
> • experience being assessed
> • learn from each other
> • notice interconnections between topics
> • review the course topics to prepare for teaching
>
> Helps instructors:
> • find out what the class has learned
> • uncover knowledge about the topics *not* yet addressed
> • evaluate and adjust instruction in the course

Introduction to Assessment

1. Importance of Assessment. Point out that assessing student learning in the context of teaching is crucial to teaching in a constructivist learning environment.

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As we've discussed, it's necessary to be aware of students' thinking and ideas to help them to better understand science.

2. Define assessment. Display the slide *What Do We Mean by Assessment?* and explain that anything a teacher does to reveal student understanding can be considered an assessment. Emphasize that traditional assessments, such as tests, are not the only way teachers can find out about what students know. In this session they'll be exploring some different types of assessment methods and trying to evaluate what kind of information they provide about students' knowledge and progress.

3. Point out purpose for classroom assessment. Display the *Purpose of Assessment* slide. Emphasize that the purpose of the types of assessments we will be examining today is to provide evidence of student learning and progress. It will be helpful to think of the student work they examine as pieces of evidence from which we try to draw conclusions about their understanding.

4. Display DMV testing example. Project the slide *Two Kinds of Tests*, and ask participants to spend just a few minutes, in groups of four to six, discussing the two questions at the bottom. After several minutes, regain attention. Ask for several volunteers to share some of what was discussed in their group.

5. Different kinds of tests assess different kinds of knowledge. Summarize by saying that each kind of test is appropriate—depending on the kind of knowledge involved. In the case of driving, it is hard to imagine not testing in both ways, for both kinds of knowledge.

6. Introduce notion of full range of learning. Display the *Full Range of Learning* slide.

Full Range of Learning

Facts

Basic Skills

Conceptual Understanding

Critical Thinking

Point out that all kinds of learning are important, from mastery of factual information to the understanding of complex concepts and thinking skills. To develop competence in an area of learning, students must have both a deep foundation of factual knowledge, and a strong conceptual framework.

The key to expertise in a subject is developing a rich conceptual understanding of important information, transforming it from a set of facts into usable knowledge. And unlike pure acquisition of factual knowledge, the mastery of concepts improves the learner's ability to transfer their learning to solving new problems.

7. Different assessments have specific advantages and limitations. The kind of test or assessment method that's most appropriate depends on the kind of learning a teacher wants to assess. Display the *Each kind of Test…* slide and point out that multiple-choice and short answer questions are quite adequate for assessing learning related to factual information and basic skills. However, performance tasks, like driving a car, are better for assessing the kinds of complex reasoning and thinking that ensure that students understand and can apply their knowledge.

8. Balance of testing methods. Say that one of the current practices in education is to create a balance of different kinds of assessments so we can test for a broader range of student knowledge. For instance, it's important to find out that children know their math facts (like driving laws); it's equally important to find out that children know how to think critically and solve complex problems (like driving itself).

9. Introduce Formative Assessment. Display the *Formative Assessment* slide. Another current practice is an emphasis on formative classroom assessment. This means that assessment should occur continuously in small ways throughout a unit, rather than only through a long test at the end of a unit. This ensures that information learned through assessment informs the teacher of how best to modify the learning experiences to address areas students are not grasping, and provides a more complete picture of each child's abilities and needs. Students also need input and feedback along the way in order to learn how to progress. When teachers take the time to do this, formative assessment can also provide important information for students to be more successful.

> ***Note**: You may want to contrast formative with summative assessment here to help participants understand that summative assessments have the purpose of assessing achievement at the end of a unit or semester. As such, this type of assessment information cannot be used to modify instruction or provide feedback to students.*

Looking At Student Work

1. Introduce purpose for next activity. Explain that in order to provide some experience with evaluating evidence from assessments, the next activity will involve them in analyzing and trying to draw conclusions from some samples of student responses to assessment tasks.

2. Describe a process for looking at student work. Display the *Looking at Student Work* slide. Tell participants that you will give them two identical folders with student work for their table. Inside they'll find a sheet describing the grade-level of the students and the context in which the assessment was given. Have them work in groups of four to six to look at and discuss the student work.

Looking at Student Work
1. Read, sort and discuss the student work.
2. Use the handout to guide your discussion.
3 Rotate through other assessment samples.

3. Review instructions on handout and explain each step. Distribute the *Looking at Student Work* handout and go over each of the steps described. They will first read through the samples and try to sort them into high, medium, and low responses. This will help them to begin discussing evidence of student learning. Next they'll look at the responses more closely and try to also evaluate the assessment itself based on the criteria listed. Tell them they'll also have a chance to briefly look at some other assessment samples if there is time. Ask if there are any questions about what they will be doing.

4. Small groups begin discussing student work. Distribute the two student work folders to each group. Let them know they will have about 25 minutes to discuss the student work at their table.

5. Provide assistance as needed. Circulate to each group and clarify the task or answer any questions as they come up. Check in to see how each team is progressing with their analysis.

6. Have groups rotate through tables. As small group discussions are winding down or when there are about 10 minutes left for this part of the session, tell participants they may move to other tables and briefly examine the other samples of student work. Ask them to try to get a sense of the different types of assessments and the kind of information they each provide.

Assessment in Context

1. Lead a whole group discussion about the student work. Get the whole groups' attention and have them sit at their tables with their small group. Ask:

- What issues came up as you were looking at the student work?
- Were you able to see evidence of student learning?
- What kinds of things made the assessment effective or not so effective?

2. Student work was selected to provide for rich conversations. Make sure participants realize that these assessments are not perfect nor were they selected to be examples of how to write good assessments. The purpose was to become aware of the analytical processes that go into thoughtfully examining the results from student assessments. Emphasize that it takes quite a bit of practice to make valid inferences about student understanding and what this may mean about both the instruction and the assessment of the concepts addressed.

Concluding the Session

1. Mention current research about formative assessment. Display *Research about Assessment* slide. Explain that formative classroom assessment can be very effective for helping students learn, when it includes providing feedback to students. In this way, students understand the work standards that are expected of them. For these students, the formula for high-quality work is not a mystery. When students are actively involved in assessing their own performance they have a better sense of what is expected and how it can be achieved. And by allowing students to be in more charge of their own learning, their motivation to learn is greatly increased. This is what is meant by assessment *for* learning as opposed to assessment *of* learning.

2. Describe assessment strategy examples. Reiterate that the best assessment activities are integral parts of the curriculum, rather than tests administered externally and out of context to students. Point out that with activity-based science, traditional short-answer paper and pencil tests are even more distant at being able to assess what we hope students will gain from these experiences. Display the list of different types of assessment strategies from the "Assessment Strategies" handout. Explain that these are some examples of authentic assessment tasks that can provide the teacher with the kind of information she needs to adjust her instruction. What makes them "authentic" is that they directly relate to the curriculum that has been taught and they emphasize skills needed to be successful both in school and in life.

> ***Note**: If you are assigning the assessment development task and the related paper (see "Going Further" on the next page), then you can mention that these are examples of strategies they might want to use with their students. Also emphasize that they will use the same process of analysis when looking at their own student work and discussing the implications.*

3. Participants reflect on learning about assessment. Ask participants to do a "Quick Write" about any new or reinforced understandings regarding assessment that they have gained as a result of this session. Allow about five minutes for participants to record their thoughts.

Going Further

Design an Assessment Task

As an optional assignment, you could have participants develop and administer an assessment task related to whatever unit they are currently teaching, or may be teaching in the future. They should collect the student work and try evaluate the responses just as they did in this session. If you want a more in-depth assignment, we have included the requirements for writing a reflective paper about their assessment in the ***Course Resources*** section. In a three to five page paper they are asked to describe:

- Goal(s) for the Assessment
- Evidence of Student Understanding
- Modifications or improvements to the assessment, and
- Possible changes in teaching or instructional goals

Critiquing Assessments

Obtain sample questions from actual tests that are in use in your local district or state, and ask the participants to critique and evaluate them according to the criteria described in the "Looking at Student Work" handout. You may also want to have participants try to revise the assessments so that they would provide more formative information about student learning.

Presentation Slides

— Goals for Assessment Carousel
— What do we mean by assessment?
— What is the purpose of assessment?
— Two Kinds of Tests
— Learning is a complex process…
— Different Kinds of Assessments
— Formative Assessment
— Looking at Student Work
— Research about Assessment
— Examples of Assessment Strategies

Goals for Assessment Carousel

Allows participants to:

- experience being assessed
- learn from each other
- notice interconnections between topics
- review the course topics to prepare for teaching

Helps instructors:

- find out what the class has learned
- uncover knowledge about the topics *not* yet addressed
- evaluate and adjust instruction in the course

What do we mean by assessment?

- Anything designed to reveal student understanding
- Could be formal … (tests, quizzes, portfolios, projects, etc.)
- Or informal … (listening to students, questioning strategies, etc.)

What is the purpose of assessment?

… to gather evidence of student learning

Two Kinds of Tests

After a person learns to drive, he or she goes to the Department of Motor Vehicles to be tested. There, the person takes two different tests to demonstrate his or her capability to be a licensed driver.

One test is a multiple-choice test. The person must correctly answer questions about the laws related to driving.

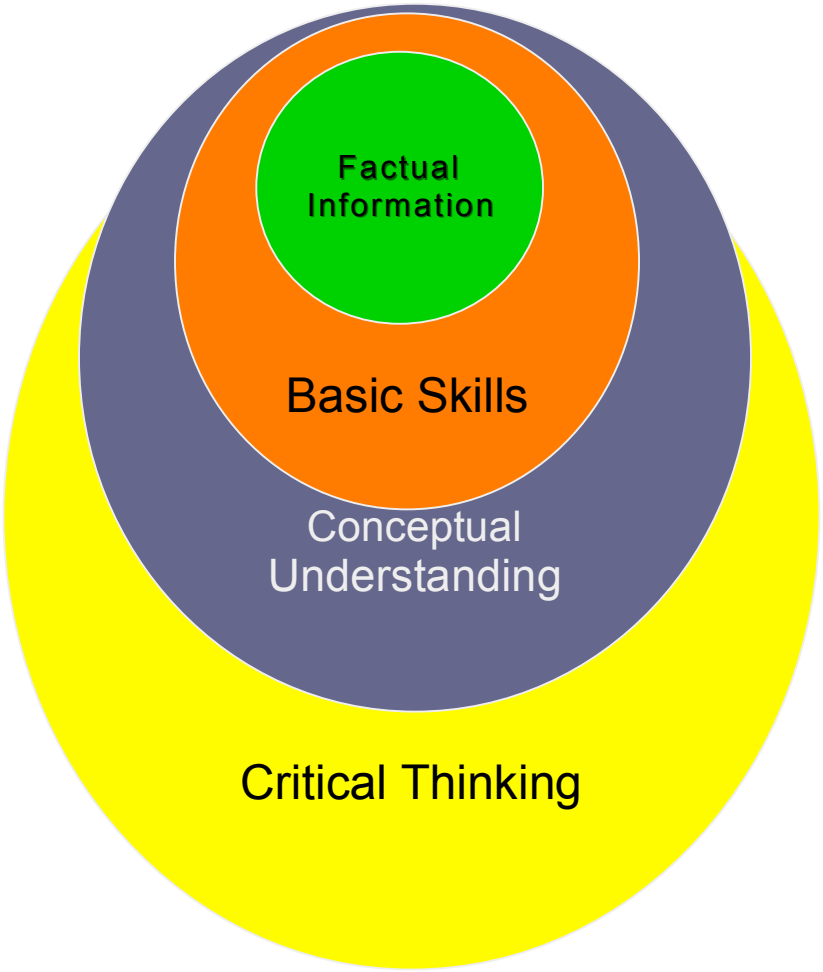
The other test is a performance test. The person must skillfully drive a car in a variety of road situations.

- Which test do you think is most important?

- Would you feel confident in knowing that a new driver had been tested in only **one** of these ways?

Learning is a complex process…

The full range of learning includes:



Different kinds of assessments have advantages and limitations:

Multiple-choice/short answer tests are good for measuring factual information and some basic skills, but not so good at measuring other things, like complex thinking.

Performance tasks are good for measuring conceptual understanding and complex thinking, but are not an efficient way to measure other things, like factual information.

Formative Assessment

- Occurs before, during, and after learning
- Serves as a guide for modifying instruction
- Provides feedback to students

Looking at Student Work

- Read, sort, and discuss the student work.
- Use the handout to guide your discussion.
- Rotate through other assessment samples.

Research about Assessment

- When carried out effectively, formative classroom assessment that includes constructive feedback to students raises the levels of student achievement.

- Assessment ***for*** learning is when students have:
  - understanding of instructional goals
  - opportunity to develop skills and knowledge
  - ownership of learning
  - motivation to learn

Examples of Assessment Strategies

Journal Writing
Letter Writing
Advertisements
Reflection Prompts
Game Playing
Prior Knowledge
Model Making
Explorations
Experiments
Investigations
Conventions Conferences Debates
Applications
Teacher Observations

Session Handouts

– Looking at Student Work

- Magnets
- Dissolving and Evaporation
- Air Worksheet
- Cause and Effect
- Phase Change
- Phases of the Moon
- Liquid Explorations
- Chemical Reactions and Atoms

– Instructions for Looking At Student Work

– Examples of Assessment Strategies

Looking at Student Work

1. Read the information provided about the assessment and the context in which it was given.

2. Sort the papers. Look through the student work and see if you can group them into high, medium and low performance on the task.

3. Examine the student responses in greater detail according to the criteria listed below:

- Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?
- Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?
- Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?
- Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?
- Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?
- Problems—Were there any issues or problems with the assessment? How could the task be improved?

Instructions for Looking at Student Work

Read the information provided about the assessment and the context in which it was given. Look through the student work samples and see if you can group them into high, medium, and low performance on the task. Then look at the student responses in greater detail.

Assessment #1: Magnets
Grade level – 3rd
GEMS Activities – *Sifting Through Science*

Context: Assessment was given in two stages—first they were told to invent, draw, and label a new tool using magnets, later they were asked to label the north and south poles of magnets and to draw the magnetic field on a "planet."

Some criteria for evaluating and discussing the assessment:

1. Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?

2. Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?

3. Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?

4. Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?

5. Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?

6. Problems—Were there any issues or problems with the assessment? How could the task be improved?

Instructions for Looking at Student Work

Read the information provided about the assessment and the context in which it was given. Look through the student work and see if you can group them into high, medium and low performance on the task. Then look at the student responses in greater detail according to the criteria listed below.

Assessment #2: Dissolving and Evaporation
Grade level – 1st
GEMS Activities – *Involving Dissolving*

Prompt: Give your ideas about dissolving and evaporation.
Context: Assessment was given after students experienced several lessons about dissolving and evaporation.

Some criteria for evaluating and discussing the assessment:

1. Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?

2. Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?

3. Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?

4. Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?

5. Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?

6. Problems—Were there any issues or problems with the assessment? How could the task be improved?

Instructions for Looking at Student Work

Read the information provided about the assessment and the context in which it was given. Look through the student work and see if you can group them into high, medium and low performance on the task. Then look at the student responses in greater detail according to the criteria listed below.

Assessment #3: Air Worksheet
Grade level – 4/5th
GEMS Activities – *Matter: Solids, Liquids and Gases*

Context: Students had explored the *Matter* unit (designed for grades 1–3) as well as *Crime Lab Chemistry*. The teacher asked them to add in standards-based concepts about atoms and molecules, as related to states of matter.

Some criteria for evaluating and discussing the assessment:

1. Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?

2. Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?

3. Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?

4. Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?

5. Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?

6. Problems—Were there any issues or problems with the assessment? How could the task be improved?

Instructions for Looking at Student Work

Read the information provided about the assessment and the context in which it was given. Look through the student work and see if you can group them into high, medium and low performance on the task. Then look at the student responses in greater detail according to the criteria listed below.

Assessment #4: Cause and Effect
Grade level – 1st
GEMS Activities – *Secret Formulas*
Prompt: Write or draw a cause and an effect that you noticed over the weekend.
Context: Students had experienced several lessons where they predicted the effects of adding various ingredients to their mixtures. The instructors emphasized the principle of cause and effect through leading several discussions about how the ingredient (sugar) was the cause of the perceived effect (sweetness). This assessment was given to see if they could generalize the idea of cause and effect.

Some criteria for evaluating and discussing the assessment:

1. Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?

2. Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?

3. Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?

4. Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?

5. Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?

6. Problems—Were there any issues or problems with the assessment? How could the task be improved?

Instructions for Looking at Student Work

Read the information provided about the assessment and the context in which it was given. Look through the student work and see if you can group them into high, medium and low performance on the task. Then look at the student responses in greater detail according to the criteria listed below.

Assessment #5: Phase Change
Grade level – 4th
GEMS Activities – *Secret Formulas*: Ice Cream

Context: The assessment was given after the class witnessed a demonstration of condensation using: a cup of water at room temperature, a cup of water with ice, and a cup of water with ice and salt.

Some criteria for evaluating and discussing the assessment:

1. Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?

2. Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?

3. Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?

4. Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?

5. Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?

6. Problems—Were there any issues or problems with the assessment? How could the task be improved?

Instructions for Looking at Student Work

Read the information provided about the assessment and the context in which it was given. Look through the student work and see if you can group them into high, medium and low performance on the task. Then look at the student responses in greater detail according to the criteria listed below.

Assessment #6: Phases of the Moon
Grade level – 3rd grade
GEMS Activities – *Space Science Sequence*

Context: The assessment was given after students' verbal responses in class seemed to show an understanding the various aspects of the phases of the moon.

Some criteria for evaluating and discussing the assessment:

1. Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?

2. Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?

3. Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?

4. Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?

5. Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?

6. Problems – Were there any issues or problems with the assessment? How could the task be improved?

Instructions for Looking at Student Work

Read the information provided about the assessment and the context in which it was given. Look through the student work and see if you can group them into high, medium and low performance on the task. Then look at the student responses in greater detail according to the criteria listed below.

Assessment #7: Liquid Explorations
Grade level – 1st
GEMS Activities –Swirling Colors, Rain Drops & Oil Drops

Context: The following prompts were read out loud to the class, one at a time.

1) Name and/or draw a solid and a liquid.
2) Draw a leveled spoon.
3) Draw the Swirling Colors Plain water cup.
4) Draw the Swirling Colors Salt water cup.
5) Draw the Swirling Colors Bubble water cup.
6) What was the shape of the water drop looking at table level?
7) What was the shape of the oil drop looking at table level?
8) What did you observe when the cup of oil and water were poured together?
9) Draw a dissolved solution of Tang.
10) Draw a solution of Tang not dissolved.

Some criteria for evaluating and discussing the assessment:

1. Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?

2. Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?

3. Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?

4. Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?

5. Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?

6. Problems—Were there any issues or problems with the assessment? How could the task be improved?

Instructions for Looking at Student Work

Read the information provided about the assessment and the context in which it was given. Look through the student work and see if you can group them into high, medium and low performance on the task. Then look at the student responses in greater detail according to the criteria listed below.

Assessment #8: Chemical Reactions and Atoms
Grade Level – 4th
GEMS Activities – *Chemical Reactions, Of Cabbages and Chemistry*

Context: The assessment was given after these two units were taught. The concept of atoms was inserted and emphasized as an important aspect of these lessons.

Some criteria for evaluating and discussing the assessment:

1. Prompt stated clearly—Did it seem like the students understood the assessment task and knew what to do?

2. Appropriate for Grade Level—Does the concept or skill seem like something students should be able to understand or do at this grade level?

3. Important to Assess—Is the concept or skill central to understanding or doing the science addressed in the unit they have been experiencing?

4. Elicits Understanding—Do the student responses provide information about their understanding? Can you identify any patterns in the range of student responses? Are there different aspects of understanding that are expressed in groups of responses?

5. Informs Instruction—Is there information in the student responses that informs the teacher about how the lesson went and possibly how to improve it?

6. Problems—Were there any issues or problems with the assessment? How could the task be improved?

Examples of Assessment Strategies:

Effective assessments are indistinguishable from good teaching and serve as learning activities for students.

Accessing Prior Knowledge—Sharing ideas with a partner can be a safe, low anxiety place to tell what you know. Sharing what a partner said is also low stress because it's someone else's words. Informs curriculum planning, reveals misconceptions, allows for measuring growth of student knowledge.
Example: Conduct a Thought Swap. Tell your partner everything you know (or wonder) about... and listen to them tell you what they know.

***Science Journal Writing**—Allows students to use communication skills to relate knowledge about science and what they've discovered and helps them make sense of their investigations. Provides insights into students' thinking and thought processes. Good writers are not necessarily good "test" takers.
Example: Describe an investigation or experiment that you did: questions asked, planning for the investigation, data collection, results and/or conclusions.

***Letter Writing—**Can allow students to articulate steps in doing an activity, an experiment, or solving a problem. Students can raise issues and describe reasoning. Letters and persuasive writing have been central to the communication process of math and science.
Example: Write a letter to a forensic scientist explaining your technique for taking fingerprints.

***Advertisements**—Using scientific results to convince others, and other types of persuasive writing, are authentic to science. Incorporates societal aspect of doing science. Requires stating clear expectations for students.
Example: Create an advertisement comparing products after doing consumer-testing experiments.

***Reflection Prompts**—Using open-ended questions with many possible solutions can provide insights into students' thinking and thought processes. Reflection may help students recognize processes of investigation and critical thinking. Requires observation and analysis of experiment, then organization of thoughts, to be clear to others. Can emphasize applying knowledge to new situations.
Example: Compare two chromatography tests and try to explain why they have different patterns.

Game Playing—Can be very engaging, and often involves peer teaching. Analogous to "game" of science, i.e., quest for solutions, teams, rules.
Example: Guess My Rule game. Sort objects by their properties or attributes and have partner guess the rule used to group them.

* ***Strategies that involve a written product***

***Model Making**—Can allow for different modalities of expression, Includes application of knowledge, creating a simplified representation of the world, illustrating how things work or might work. Modeling is a process used in science to both explain and predict phenomena.
Example: Create a paper animal with protective defenses and describe how the defenses work.

***Explorations**—Can be student-directed, and follow the learning cycle. Often begin with open-ended challenge and rich environment for exploration and can lead to new discoveries and interesting questions.
Example: Students asked to explore a cup of sand and describe/explain/draw how it behaves like a liquid and a solid.

***Experiments**—Experiments always include comparisons, controlling variables, measurable outcome. Opportunity for students to design comparison situations, conduct controlled experiments, and analyze their outcomes to draw conclusions.
Example: Observe a heat-producing chemical reaction in a baggie. Design an experiment to determine where the heat came from.

***Investigations**—Begin with a question followed by conducting the investigation, often designed by the student. Many types of resources can be used, previous student experimentation, research, observations, collecting data, etc. Can be more project-oriented, and students can produce reports, tailored to individual's interests.
Example: "What do you want to find out about bubbles?" Create an investigation to answer your question.

Conventions, Conferences, Debates—Students with different perspectives share their views, report and evaluate scientific findings. Ability to clearly communicate ideas, evaluate them with respect to larger field of knowledge, and convince others is essential in science. Allows students to deal with real world issues.
Example: Hold a town meeting at the end of a unit about *Acid Rain*.

Applications—Fit well with this phase of the learning cycle. By applying what they know to new situations, students use problem solving skills, and understanding of concepts to show what they've learned.
Example: Students use cabbage juice to test acidity of new or unknown substances.

Teacher Observations—Can consist of anecdotal reporting, behavior checklists, notes about students' comments, and other informal observations made by the teacher. Provides an opportunity to assess group behavior, and observe individual contributions and attitudes during science instruction.
Example: Teacher keeps a tally of productive questions students ask during a discussion about an investigation.

* ***Strategies that involve a written product***