Session 2
Handouts

Odd One Out

Which is the Odd One Out?	Why Is It The Odd One Out?
Formative Assessments Summative Assessments TVAAS Value-Added Scores Administrative Drop-In Evaluations	
Empirical Divergent Interpretive Probing Evaluative	

Learning Goal Inventory

CLE 3221.INQ.4: Apply qualitative and quantitative measures to analyze data and draw conclusions that are free of bias.

What do you think this learning goal is about?
List any facts, concepts, or ideas you are familiar with related to this learning goal:
List any terminology you know of that relates to this goal:
List any experiences you have had (in or outside of school) that may have helped you learn about the ideas in this learning goal:

sure students know that every idea is valued, not just the "right answer," so all students feel they have something to share in response to the question asked.

General Implementation Attributes

Ease of Use: High
Time Demand: Low
Cognitive Demand: Depends on the question

Modifications

You may choose to use random selection techniques such as cards with students' names on them or the *Popsicle Stick Questioning* FACT to select specific students you have a need to hear from. A modified version of *No-Hands Questioning*, combined with *Wait Time Variations*, is to have students put their hand up when they have an idea or comment to share. The teacher nods to the individual student when a hand goes up. The nod is the signal to then put his or her hand down. Once a significant number of hands have gone up, and then down, call on selected students.

Caveats

Avoid the use of recall questions, as they tend to result in more "I don't know" responses and provide little feedback on conceptual understanding.

Use With Other Disciplines

This FACT can also be used in mathematics, social studies, language arts, health, foreign languages, and performing arts.

My Notes

#38: ODD ONE OUT

Description

Odd One Out combines seemingly similar items and challenges students to choose which item in the group does not belong. Students are asked to justify their reason for selecting the item that does not fit with the others (Naylor et al., 2004).

How This FACT Promotes Student Learning

Odd One Out provides an opportunity for students to access scientific knowledge to analyze relationships between items in a group. By thinking about the similarities and differences, students are encouraged to use their reasoning skills in a challenging and engaging way. The FACT can be used to stimulate small-group discussion after students have had an opportunity to think through their own ideas. As students discuss their ideas in a group, they may modify their thinking or come up with ways to further test or research their ideas.

How This FACT Informs Instruction

Odd One Out can be used at the beginning of instruction to find out what students already know about a topic. It can also be used during the development of conceptual understanding to examine the reasoning students use in comparing and contrasting the items on the list. Teachers can use this FACT to examine how their students make connections among concepts and ideas. The information is helpful in considering instructional experiences that can challenge students' commonly held ideas. *Odd One Out* can also be used to assess how well students can transfer their learning to a new context if there is a possibility that they could be limited by the instructional context in which they learned about the ideas. Results from *Odd One Out* may indicate the need to design additional learning opportunities so that students can experience examples different from the ones used in their instructional materials.

Design and Administration

Select items that lend themselves to a grouping where one item justifiably does not fit with the others. Be sure to choose items and a relationship that is not immediately obvious in order to promote deeper thinking. Provide the list as a handout, overhead projection, or chart. Alert students to what the topic of the *Odd One Out* is before they examine the list of items. Make it clear to students that they should explore what they think rather than guess the answer they think you, the teacher, are expecting. Have students record their own thinking before discussing their ideas with a partner or in groups. Allow students enough time to discuss the various possibilities before homing in on "the odd one out." Figure 4.29 shows an example of an *Odd One Out* designed for middle school students studying the topic of properties of matter.

General Implementation Attributes

Ease of Use: High
Time Demand: Medium
Cognitive Demand: Medium/High

Figure 4.29 *Odd One Out* for Properties of Matter

Properties of Matter: In each set, circle the ***Odd One Out*** and describe why it does not fit with the others.

Which Is the Odd One?	Why It Is the Odd One Out
Weight Density Length Color	

Which Is the Odd One?	Why It Is the Odd One Out
Melting Point Density Solubility Mass	

Which Is the Odd One?	Why It Is the Odd One Out
Length Volume Temperature Mass	

Which Is the Odd One?	Why It Is the Odd One Out
Burn Float Stretch Dissolve	

SOURCE: Based on Odd One Out Strategy created by Naylor, S., Keogh, B., and Goldsworthy, A. (2004). *Active assessment—Thinking, learning and assessment in science.* London, England: David Fulton Publishers.

Modifications

With younger children or less fluent readers, consider using pictures with words. Use only one or two sets for younger students. Instead of "Odd One Out," use "Which of These Things Is Not Like the Other?"

Caveats

Make sure students are familiar with the words or objects listed before they are asked to examine the relationship between them.

Use With Other Disciplines

This FACT can also be used in mathematics, social studies, language arts, health, foreign languages, and performing arts.

Caveats

Be careful not to overuse this strategy as students quickly tire of it if it is used in the same way with every instructional unit. Be aware that the open-ended nature of this FACT is not as effective in pinpointing specific misconceptions, learning gaps, or conceptual difficulties as some of the other specific probing techniques.

Use With Other Disciplines

This FACT can also be used in mathematics, social studies, language arts, health, foreign languages, and performing arts.

My Notes

#33: LEARNING GOALS INVENTORY (LGI)

Description

An *LGI* is a set of questions that relate to an identified learning goal in a unit of instruction. Students are asked to "inventory" the extent to which they feel they have prior knowledge about the learning goal. They also describe the prior experiences they had to learn about it.

How This FACT Promotes Student Learning

The *LGI* activates student thinking about a topic of instruction that targets explicitly identified learning goals. It requires them to think about what they already know in relation to the learning goal statement as well as when and how they may have learned about it. It also helps make the target learning goals explicit to students. A key principle of learning is that students must know what the learning target is. Explicitly sharing learning goals with students raises their awareness of what their learning will be focused on.

How This FACT Informs Instruction

The *LGI* provides information to teachers on students' perceptions of their existing knowledge in relation to identified learning goals, including

state or national standards. It also provides information on when and how students may have had opportunities to learn the ideas related to the goal. This information is particularly helpful when students are coming from other schools or classes within a school where there is not a consistent curriculum. It provides an opportunity for teachers to see which goals may be "new" to students and which may provide an opportunity to revisit and build upon previous learning experiences.

Design and Administration

Identify the goals from the instructional unit and/or the state and/or national standards targeted in the unit of instruction. Create a question inventory on one goal such as the one shown in Figure 4.26 for a high school biology unit on cells that targets a learning goal from *Maine's Learning Results* (Maine Department of Education, 2007). Give time for students to fill it out. Post the goals on a chart throughout the instructional unit so students will know what the learning targets are. The *LGI* can be given back to students at the end of the instructional unit as a self-assessment and reflection on their learning, noting the difference between their ratings before and after the instructional unit.

Figure 4.26 *LGI* for a High School Biology Unit on Cells

Learning Goal: Describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interaction between cells and their environment, and the impact of cellular processes and changes on individuals (MLR 9-12/E3 Cells) (Maine Department of Education, 2007)

What do you think this learning goal is about?
List any facts, concepts, or ideas you are familiar with related to this learning goal:
List any terminology you know of that relates to this goal:
List any experiences you have had (in or outside of school) that may have helped you learn about the ideas in this learning goal:

General Implementation Attributes

Ease of Use: Medium
Time Demand: Medium
Cognitive Demand: Medium

Modifications

The *LGI* can be used in an oral discussion format with younger students or completed as a whole-class inventory.

Caveats

Learning goals that come from state and national standards are interpreted in a variety of ways by teachers. Consequently, expect the same variation in interpretation from students. How one student may interpret a learning goal may be very different from how another student interprets it.

Use With Other Disciplines

This FACT can also be used in mathematics, social studies, language arts, health, foreign languages, and performing arts.

My Notes

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_____

_____

#34: LOOK BACK

Description

A *Look Back* is a recount of what students learned over a given instructional period of time. Students recount specific examples of things they know now that they didn't know before and describe how they learned them (B. Chagrasulis, personal communication, 2005).

How This FACT Promotes Student Learning

This FACT provides students with an opportunity to look back on and summarize their learning. Asking students "how they learned it" helps them think about their own learning and the different ways, as learners, they are able to integrate new scientific information.

Types of Questions

Empirical (Factual) or convergent thinking questions have only one correct answer, like "What did you have for breakfast this morning?" These types of questions are also known as closed questions. The answer is not always simple, however; it depends on how broad the question is. "Why does a curve ball curve?" is a factual question that can have a very complicated answer. Factual questions usually make the best inquiry-based projects, as long as they are answerable and have room for exploration. Specifically, factual questions tend to be lower thinking questions (knowledge level) while convergent questions may not be (comprehension, application, or analysis levels).

Questions Based Upon Facts from Text:

- Who is the current president of the United States?
- Did Germany participate in the First World War?
- Can AIDS be transmitted through kissing?

Questions That Encourage Convergent Thought:

- On reflecting over the entirety of the play Hamlet, what were the main reasons why Ophelia went mad? (This is not specifically stated in one direct statement in the text of Hamlet. Here the reader must make simple inferences as to why she committed suicide.)
- Is the universe expanding?
- What is the chemical formula for photosynthesis?
- Which breeds of livestock would be best adapted for South Texas?

Divergent Thinking Questions are open-ended (usually having no singularly correct answer), high-order (analysis, evaluation, or synthesis levels) which require students to think creatively. Pursuing students divergent questions and comments is one of the **central elements of inquiry teaching**. It not only engages students in classroom discussions, it allows them to think **independently**, **creatively**, and more **critically**.
It teaches them to **take ownership** of their own learning while also feeling a shared responsibility for the learning of the entire class.
A teacher can ask divergent questions to elicit many different answers.

- Imagine...
- Suppose...
- Predict...
- If..., then...
- How might...
- Can you create...
- What are some of the possible consequences...
- What if...

Divergent questions allow a number of students to respond to the same question, encouraging student participation.
Redirecting questions will also help to increase the number of students participating in a discussion, but teachers need to make a strong effort to call on all students equally (Jacobson et al.,1993).

Interpretive questions have more than one answer, but they still must be supported with evidence from the text. For example, depending on their interpretations, people can have different, equally valid answers to "Why did Ahab chase Moby Dick?" The answers are not wrong unless they have no relationship to the text at all, such as "Because aliens from outer space controlled him!" When exploring any type of text (video, fiction, nonfiction, a painting, poetry, etc.), it is important to ask interpretive questions that build on one another because students will have to refer back to the text. Interpretive questions are effective for starting class discussions, for stimulating oral and written language exercises and, sometimes, for leading to good inquiry-based learning projects.

Questions Requiring Interpretation of Text:

- Why are certain details more memorable?
- What other information might you need to pursue this topic?
- How does this reading/writing/discussion/group work build on our earlier discussion of the larger concept of X?

Probing or Clarifying Questions give students opportunities to process information by **justifying or explaining their responses**--dealing with the *why*,*how*, and the *based-upon what* aspects of a concept.

Probing promotes **reflective and critical thinking**. Because it requires teachers to think quickly in the moment, it can also be one of the most difficult questioning techniques (Jacobson et al.,1993). Used to gain more information from a student to help the teacher better understand a student's ideas.

Questions of Clarification

- What do you mean by...?
- Is your basic point _____ or _____ ?
- Summarize in your own words what I just said.

Questions that Probe Assumptions

- What are you assuming by that?
- What could we assume instead?
- All of your reasoning is dependent on the fact that _____. Why have you based your reasoning on _____ rather than _____ ?

Questions that Probe Implications and Consequences:

- What are you implying by that?
- When you say _____ are you implying _____ ?
- But if that happened, what else would also happen as a result?
- What would cause that to happen?

Questions that Probe Reason and Evidence:

- Why do you say that?
- What led you in that belief?
- How does this apply to this case?
- What provides good evidence for that?

Evaluative questions ask for some kind of opinion, belief or point of view, so they have no wrong answers. Nonetheless, the answers do depend on prior knowledge and experience, so they are good ways to lead discussions (e.g., "What would be a good place to take the kids on a field trip?") and explore books or other artistic works (e.g., "Do you agree with Ahab's views on whales?"). They rarely make for good inquiry-based projects because they are internally focused, but they can be a great way to connect with and elicit interaction from young or shy students (e.g., "Who's your favorite Pokemon?")

Questions about Viewpoints or Perspectives:

- What would someone who disagrees say about that?
- What is an alternative?
- What would be the opposite side of this argument?

Cueing Questions cue the answer or response after no response to an initial question has been given. For example, the initial question was "How many legs do crayfish, lobsters, and shrimp have?" After no response, the cueing question is, "The class to which those animals belong is class Decapoda. Does that give you a clue about the number of legs they have?"

Genuine Questions

Following are some examples of questions for individuals or small groups that can be adapted to any topic or problem by filling in the blanks. The purpose of these questions is to elicit student thinking. They can be used as the basis for oral or written discussion.

What do you think?

How would you explain ___ to a student who doesn't understand?

Could you explain ___ in another way?

How can you be sure that ___?

Can you explain your reasoning?

Can you draw a picture or build a model to illustrate ___?

How do you feel about ___?

Is there anything you don't understand about ___?

What are your conjectures about what will happen?

What else would you like to know?

What do you plan to do next?

What is the most important idea or fact you learned while working on ___ and why do you feel that way?

What were you first thoughts about____?

What was/is the most challenging/easiest part of ___ for you?

What do you understand now that you didn't understand abefore?

What caused you to have a breakthrough in your understanding of___?

How else do you think you could solve the problem?

How would you describe this problem in your own words?

What didn't work?

Are there any relationships in this problem that will always be present in similar problems?

What is ____?

What's your idea?

What were your thought processes while you worked on ___?

What do you wonder about regarding ____?

Where did you get "stuck" and what helped you get "unstuck"? What are your observations about?

#41: PASS THE QUESTION

Description

Pass the Question provides an opportunity for students to collaborate in activating their own ideas and examining other students' thinking. Students begin by working together in pairs to respond to a question, partially finishing a response. When the time is up, they exchange their written, partially completed response with another pair to finish—modifying, adding to, or changing it as the pair deems necessary.

How This FACT Promotes Student Learning

The interactive nature of the pair discussion provides an opportunity for students to think about what they know and come to a consensus of thinking with their partner. After the partially finished written response is passed to a new pair of students, the new pair must examine the thinking of their peers and decide whether they agree with their thinking. If so, the pair continues the response by completing what was already started by the other pair. If their ideas differ, they may modify or change the response the other pair started and complete it for them. Pairs then get together to give feedback to each other on why they did or did not change the responses as well as feedback on how well they felt the other pair's thinking helped them pick up where the original pair's response left off.

How This FACT Informs Instruction

As teachers listen carefully to students exchange ideas in response to the question posed, they gather evidence on the nature and depth of students' understanding. The information may surface disagreements students have about the content, furthering the need to design additional opportunities that will address the concept in question. The student responses can also be collected and examined to see the range of students' thinking about the question, indicating the need for differentiation with certain groups of students.

Design and Administration

Develop a question that will elicit a rich explanatory response based on students' prior knowledge or experience. Questions can also be a new application of the concepts students have been learning about in their instructional unit. Arrange students in pairs. Write the question on a chart, on the board, or state orally. Give pairs two to three minutes to collaboratively begin drafting a response to the given question. Make sure students know they need to develop enough of a response so that another pair can

follow their thinking but not so much that it doesn't leave room for the other pair to complete it. After two to three minutes have passed, pairs swap their partially completed answer with another pair. The pairs then continue to pick up from where the other pair left off. Encourage pupils to cross off parts they don't agree with and modify or exchange the crossed-off part with their own ideas. They may continue adding their own ideas to enhance, extend, and complete the response. When both pairs are finished, they share the completed responses with each other, defending their reasons for any changes they made and providing feedback on each others' thinking. They also examine whether their ideas converged or diverged. The teacher may ask pairs to share some examples, providing feedback from the teacher and the rest of the class on the response to the question.

General Implementation Attributes

Ease of Use: Medium
Time Demand: Medium
Cognitive Demand: High

Modifications

This FACT can also be used with individuals. An individual student starts the response and then exchanges with another student for completion and sharing. It can also be a written exchange between two different classes studying the same topic.

Caveats

Make sure time is provided to debrief the class about the question and engage students in a discussion about the ideas. Include how a scientist or someone who knows the content well would respond to the question. Without this opportunity to compare their responses to the scientific ideas, some students may be left accepting misconceptions or inaccurate statements that were made by their peers.

Use With Other Disciplines

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Use With Other Disciplines

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My Notes

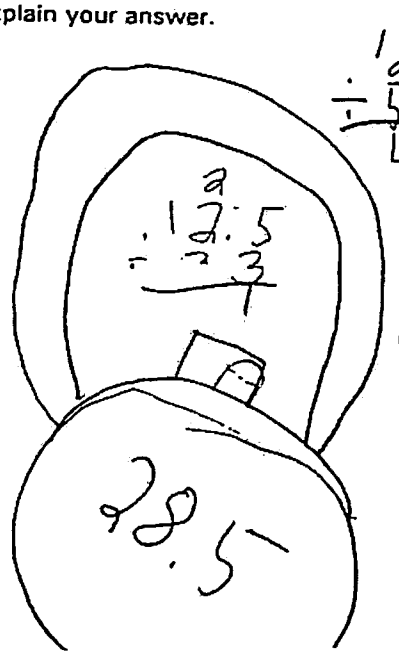
Features of ineffective feedback	Examples of ineffective feedback	Examples of Effective Feedback	Features of effective feedback
Identification of problem only.	Discussion too brief	The introduction and discussion are too brief. You have been provided with a long list of references that would provide you with more information. Reading makes writing of introductions and discussion much easier and also helps with more in depth results interpretation.	Suggestions for closing the gap added to identification of problem.
Too general. It does not specify why the intro is 'OK'	Short, but OK	You need to discuss whether the findings in this experiment support or reject your hypothesis and why. Did this experiment support the current ideas in the area?	Specific directions assist student in both understanding where their performance fell short as well as how to improve in the future
Again, not specific enough to lead the student to identify exactly what the problem is and how to correct it.	Check the literature, what did others do?	Begin your discussion with a brief summary of your results. Then you need to discuss your results and state what they mean using the work done from other authors.	
Vague and potentially confusing	Which?	Please indicate in the text which treatment is relevant to include here.	Specific and directed
Too vague. Is the title missing, inadequate or wrong? If the student does not understand what the problem is, they cannot avoid it in future.	Title?	Your graph should be written as a sentence i.e. three heat-treated seed germinated representing 20% of the total of 15 seeds in this group.	Providing a reworded sentence for the student indicates clearly what is expected.
	Full title needed	This title needs to be more descriptive and include the date and the type of treatment	Specific and detailed.
As above	Cumulative total?	You need to plot the results so that they are a cumulative total of the number of seeds which germinated.	

Table 1: Tutor comments on first year Biology assignment at University of Western Sydney (adapted from Ross & Tronson, 2005).

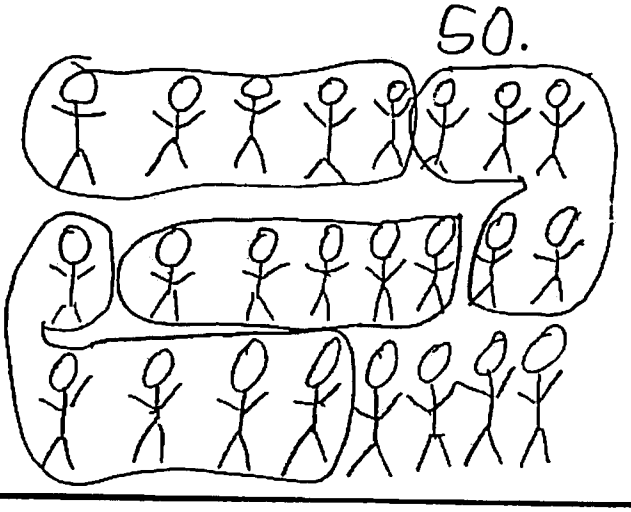
Sample 7

14. A group of 8 people are all going camping for three days and need to carry their own water. They read in a guide book that 12.5 liters are needed for a party of 5 people for 1 day. Based on the guide book, what is the minimum amount of water the 8 people should carry all together?

Explain your answer.



Sample 8



A3.1,H1

ratory Network Program—*Alternative Assessment Toolkit*
ity 3.1—*Camping Trip*
or: Judy Arter, NWREL

Permission for use in training given by
Lewiston School District (Idaho)

Twenty Purposes for Using Formative Assessment in the Classroom

- Activate thinking and engage students in learning
- Makes students' ideas explicit to themselves and the teacher
- Challenge students' existing ideas and encourage intellectual curiosity
- Encourage continuous reflection on teaching and learning
- Help student consider alternative viewpoints
- Provide a stimulus for discussion and argumentation/debate
- Help students recognize when they have learned or not learned something
- Encourage students to ask better questions and provide thoughtful responses
- Provide starting points for student exploration of ideas
- Aid formal concept development and transfer
- Determine if students can apply ideas to new situations
- Differentiate instruction for individuals or groups of students
- Promote the use of academic language in learning
- Evaluate the effectiveness of a lesson
- Help students develop self-assessment and peer assessments skills
- Give and use feedback (student to student, teacher to student, and student to teacher)
- Encourage social construction of ideas
- Inform immediate or later adjustments to instruction
- Encourage and include participation of all learners
- Increase comfort in making one's own ideas public

Source: http://www.lawrence.k12.ky.us/LCILT/Materials/Formative Assessment to Improve LearningLCDILT.ppt

Which Assessment Method Should You Use?

Using the following matrix to guide your decision on which assessment method to use based upon the learning goal you select.

Target to Be Assessed	*Assessment Method*			
	Selected Response	**Essay**	**Performance Assessment**	**Personal Communication**
Knowledge Mastery	Multiple choice, true/false, matching, and fill-in can sample mastery of elements of knowledge.	Essay exercises can tap understanding of relationships among elements of knowledge.	Not a good choice for this target--three other options preferred.	Can ask questions, evaluate answers, and infer mastery, but a time-consuming option.
Reasoning Proficiency	Can assess application of some patterns of reasoning.	Written descriptions of complex problem solutions can provide a window into reasoning proficiency.	Can watch students solve some problems or examine some products and infer about reasoning proficiency.	Can ask student to "think aloud" or can ask follow-up questions to probe reasoning.
Skills	Can assess mastery of the knowledge prerequisites to skillful performance, but cannot rely on these to tap the skill itself.		Can observe and evaluate skills as they are being performed.	Strong match when skill is oral communication proficiency; also can assess mastery of knowledge prerequisite to skillful performance.
Ability to Create Products	Can assess mastery of the knowledge prerequisite to the ability to create quality products, but cannot use these to assess the quality of products themselves.		Can assess: 1. Proficiency in carrying out steps in product development. 2. Attributes of the product itself.	Can probe procedural knowledge and knowledge of attributes of quality products, but not product quality.
Dispositions	Selected response questionnaire items can tap student feelings.	Open-ended questionnaire items can probe dispositions.	Can infer dispositions from behavior and products.	Can talk with students about their feelings.

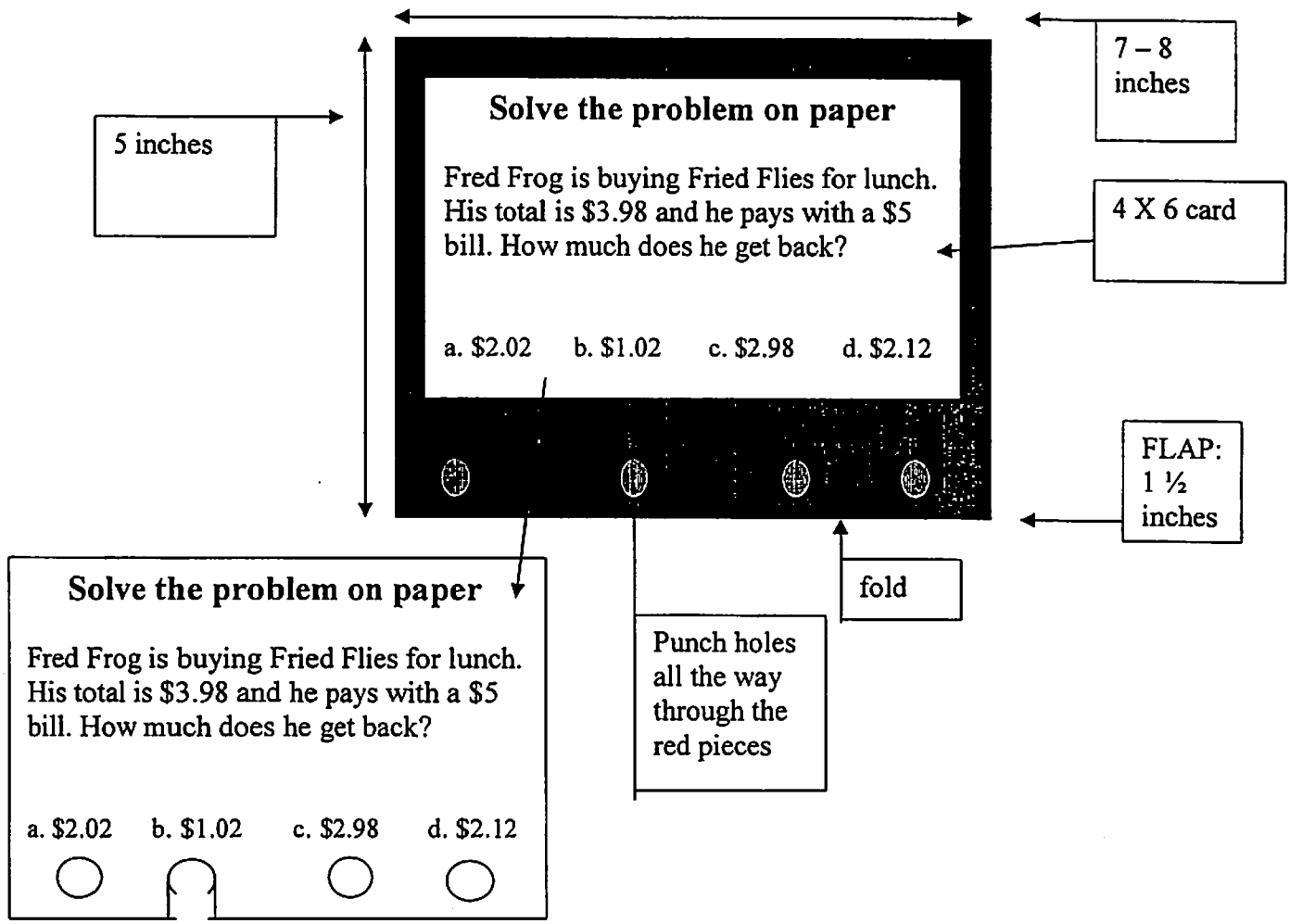
Source: Richard J. Stiggings, *Student-Centered Classroom Assessment.* 2nd ed. Upper Saddle River, New Jersey: Prentice-Hall, Inc., 1997.

Punch Cards

Immediate Feedback

Construction Directions

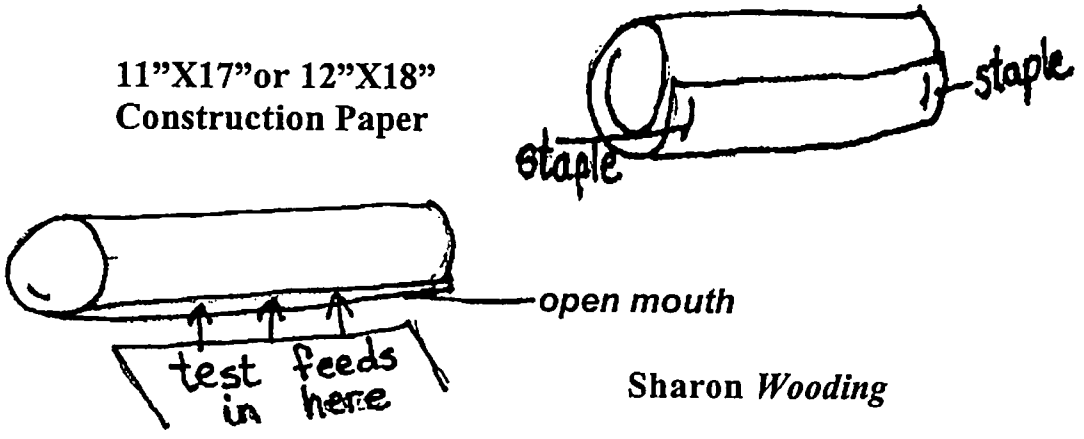
1. Cut 1 construction paper or cardstock rectangle 7 to 8 inches X 6 ½ inches.
2. Fold up 1 ½ inches on one end of the rectangle so that the new rectangle is 7" or 8" X 5".
3. Punch holes through the flap and backing. Staple both ends of the flap.
4. Insert a 4 x 6 card.
5. Write a problem on the card.
6. Write the answers above the holes.
7. Punch all 4 holes through the card.
8. Cut a slot through the hole on the CARD for the correct answer.
9. Make 4 more problem cards following steps 1-8 and place them in the holder.
10. Students will solve the problems. Place a pencil point into the hole of the selected answer. Pull on the card. If they have selected the correct answer, the card will slip out of the



Source: http://secondaryinstruction.com/InstructionalSupport/ImmediateFeedback/punchcards.doc

Test Tubes to Prevent Cheating

Test tubes take much of the worry about cheating out of test-giving time. No more carrels or barriers to set up. Test tubes are easy to make. They can be decorated by the individual student and kept for just them - or generically made and randomly handed out at the testing time. They can be made from construction paper and replaced when needed, or laminated to last for years. Are you read}? Take any 11"x17" or 12"x18" sheet of paper and roll it length-wise until it is approximately a 2"-3" diameter tube (which would make it 11" or 12" long!). Staple both ends of the tube. The open "mouth" of the tube would lie flat on the desk, open to the student. The test would then feed into the mouth of the tube as the questions were answered. If the test is double-sided, remove it through the side of the tube and repeat the process for the second side. The test can then be turned in still in the tube, or separated as the teacher wishes. This is simple, easy, and stress relieving.



Sharon *Wooding*

Source: http://www.teacherspayteachers.com/Product/Test-Tubes