

How Can Classroom Assessment Inform Learning?

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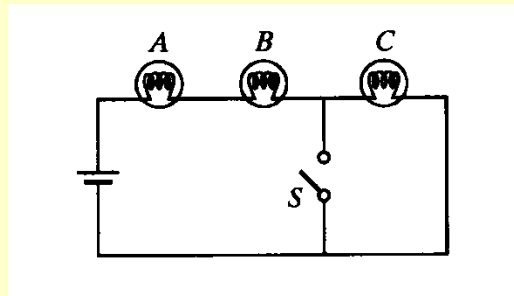
Overview

- **Negative effects on learning of low-level, multiple-choice tests**
- **Reforming the content of classroom assessments (Authentic assessment)**
- **Reforming the process of classroom assessment (Formative assessment)**
- **Curricular supports for teacher professional development**

Assessment tasks convey what's important to learn as well as providing an opportunity to check on students' understanding and evaluate achievement.

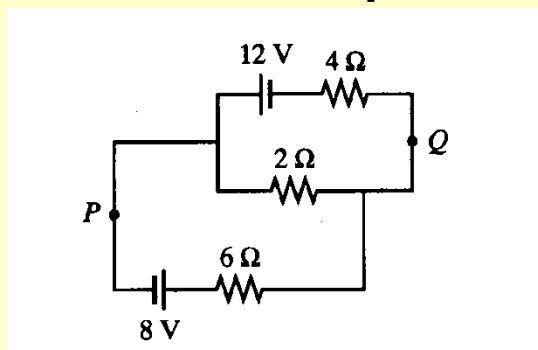
- **Poor readers thought that good readers could read fast without making mistakes; good readers thought that good readers could understand the story. (Borko & Eisenhart, 1986)**
- **Physics students tend to believe that physics knowledge is a collection of isolated facts and laws, and they tend to solve problems by manipulating formulas. (Hammer, 1994)**

1. A series circuit consists of three identical light bulbs connected to a battery as shown here. When the switch S is closed, do the following increase, decrease, or stay the same?



- The intensities of bulbs A and B
- The intensity of bulb C
- The current drawn from the battery
- The voltage drop across each bulb
- The power dissipated in the circuit

2. For the circuit shown, calculate (a) the current in the $2\text{-}\Omega$ resistor and (b) the potential difference between points P and Q.



Mazur (1997)

Figure 4
Trends in Percent Meeting Standard in Texas and Maryland:
Grade 8 Mathematics

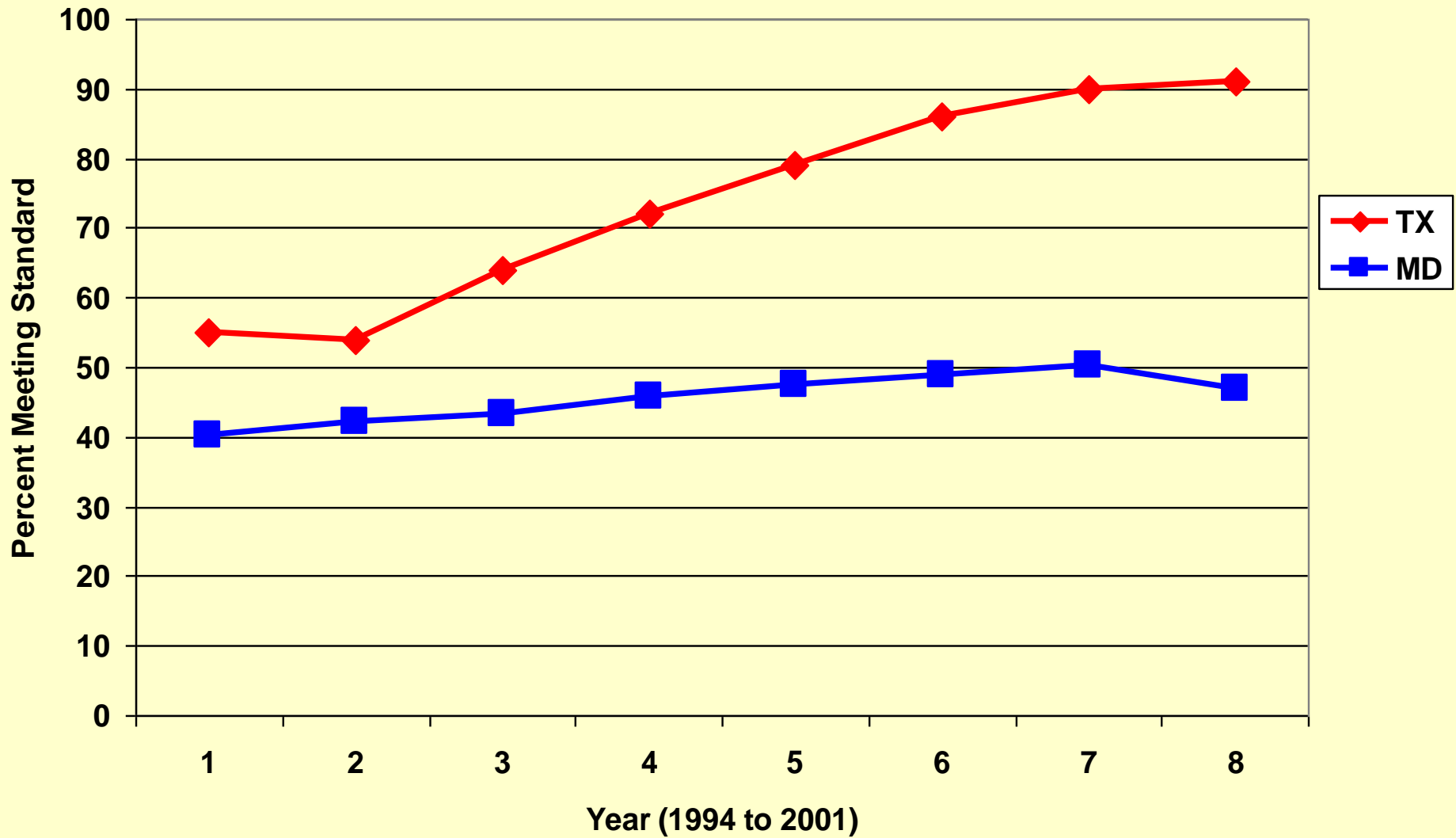


Figure 5
Trends in Percentage of Students Proficient or Above on State NAEP
Grade 8 Mathematics for Maryland and Texas (1990 through 2000)

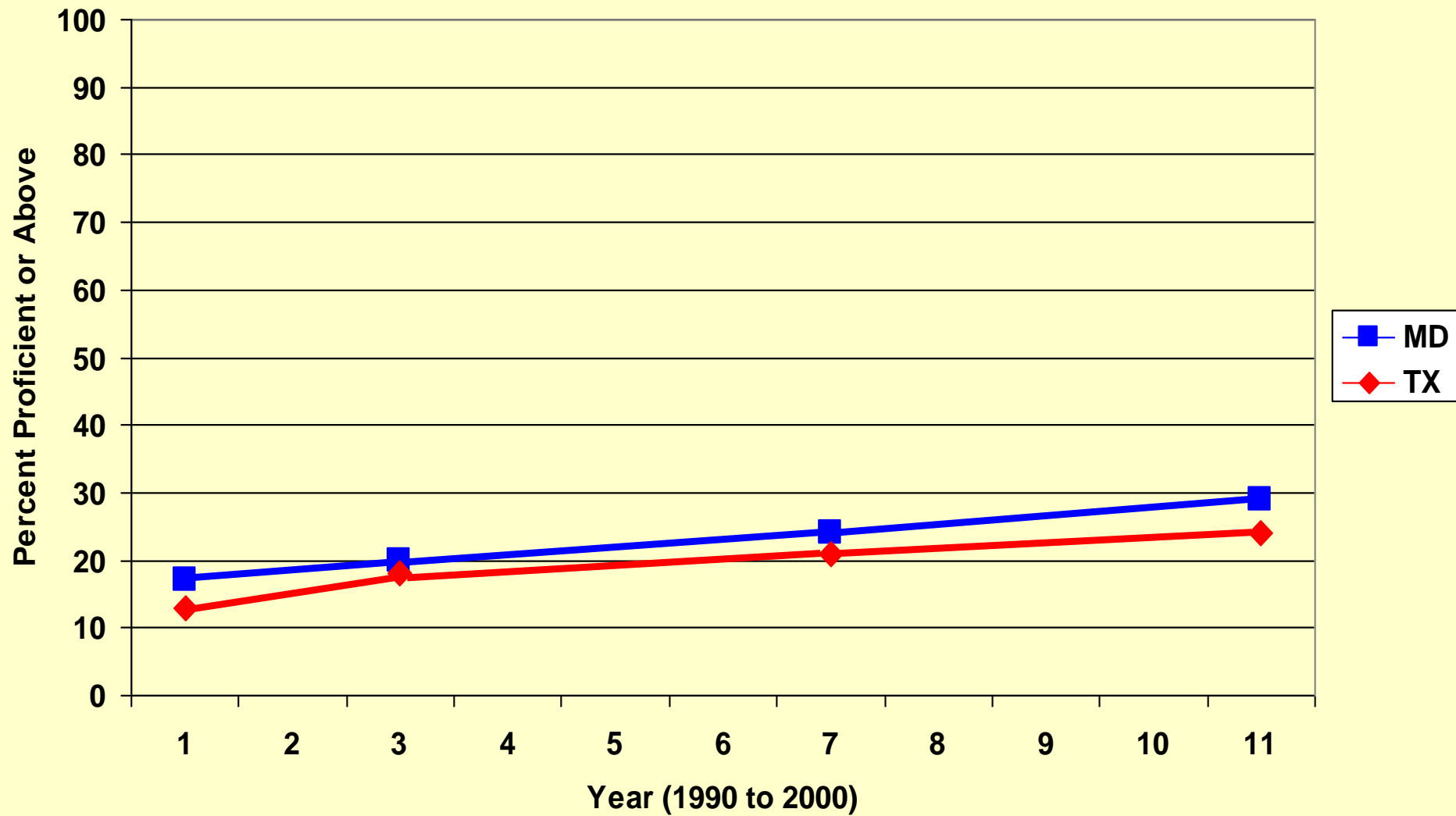


Figure 3 - Mean Percent Correct on a Standardized-Test Item and Alternative-Test Item in a High-Stakes District (B) and Equating Sample (E).

Standardized Test

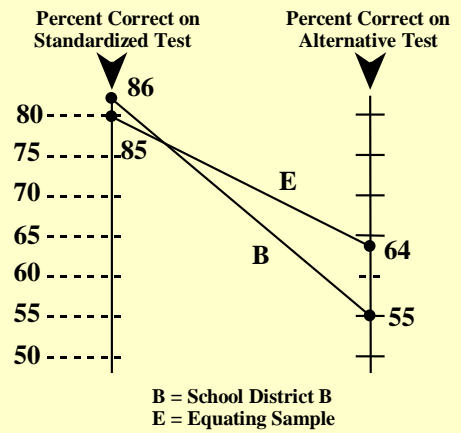
- 4
x3
- A. 9
 - B. 12
 - C. 15
 - D. 18

Alternative Test

Which number sentence goes with

X	X	X	X
X	X	X	X
X	X	X	X

- A. $3 \times 4 =$
- B. $3 + 4 =$
- C. $3 \times 12 =$



From: Flexer, R.J. (1991). Comparisons of student mathematics performance on standardized and alternative measures in high-stakes contexts. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL, April, 1991.



To be effective in furthering student learning, classroom assessment must be exemplary in two fundamentally important ways.

- **First, its form and content must fully represent important thinking and competencies in each of the disciplines. (authentic assessment)**
- **Second, assessment processes and purposes must support learning and a learning orientation. (formative assessment)**

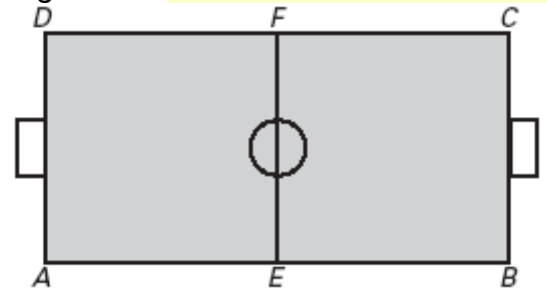
Conceptually Rich Problems

By selecting critical tasks that embody known misconceptions, teachers can help students test their thinking and see how and why various ideas might need to change (Bell & Purdy, 1985) (*How People Learn*).

- If an image is projected through a lens and shows up upside down on a screen, what happens if you cover half the lens?
- With a battery, light bulb, and wire, how can you make the light bulb light?
- How does a tree get so big from a tiny seed? (Most children think it eats food from the soil.)

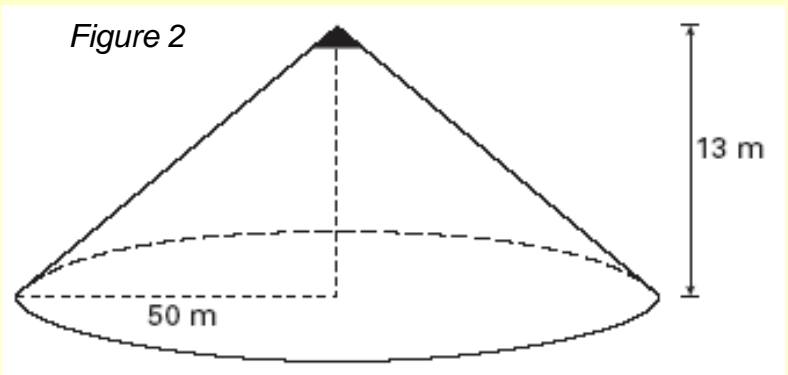
A campground has a large lawn with a soccer field that measures 100×50 meters (Figure 1). The park manager decides to keep the field open at night.

Figure 1



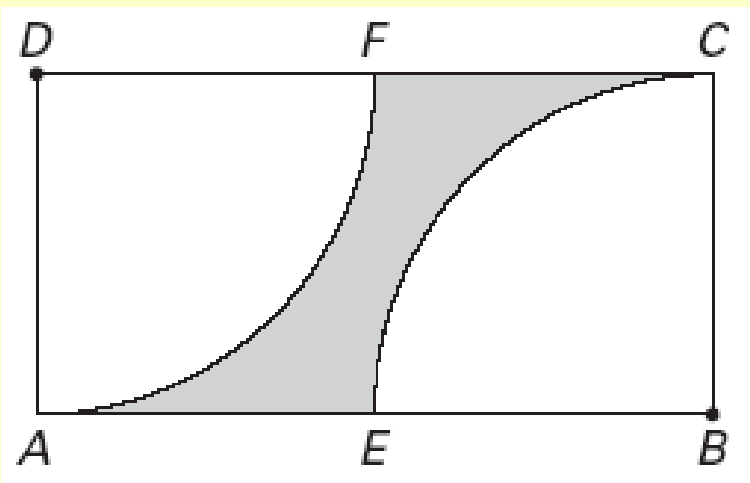
Therefore, a decision needs to be made about where to place some light posts. Standard lamp posts are 13 meters high and light a circular region with a radius of 50 meters (see Figure 2).

Figure 2



1. The diagram below (Figure 3) shows the lighting of the field when lights are placed at points D and B. What is the area of the soccer field that is **NOT lit** when these two light posts are used. Show your work.

Figure 3

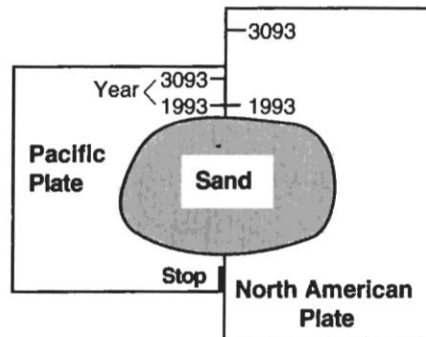


Dutch examination item by the courtesy of the Freudenthal Institute.

Part B

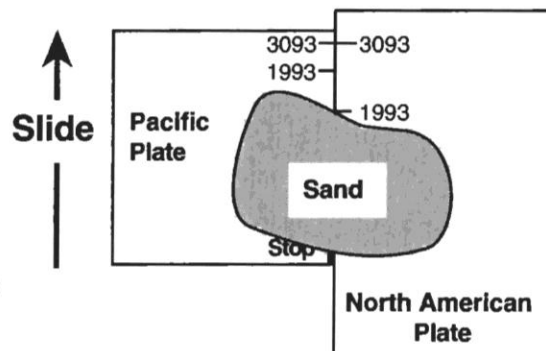
- Follow the directions below.

Your plate model should look like this.



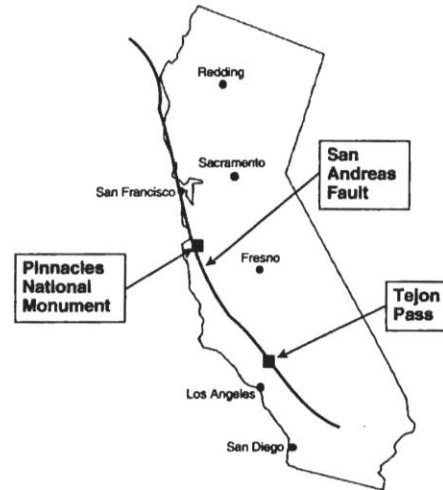
- Without disturbing the sand from Part A, line up the lines labeled "1993" on both plates. Your model should look like the drawing above.
- Slowly slide the paper marked "Pacific Plate" until the lines marked "3093" are lined up.

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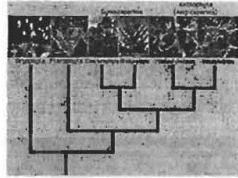
COMPONENT 4

4. Look at the map below. The land formations in the **Pinnacles National Monument** and the land formations at **Tejon Pass** were once located next to each other. Now they are separated by over 150 miles.



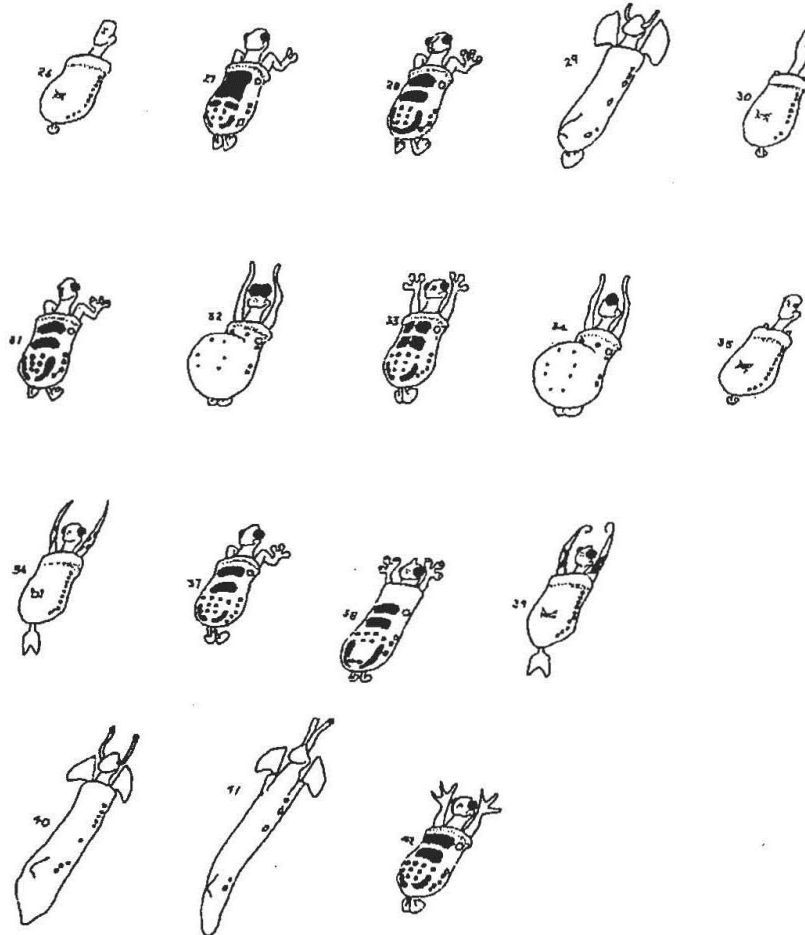
Explain how the Pinnacles National Monument and Tejon Pass were separated from each other.

Science Assessment Activity # 7: *Carmaliticus*



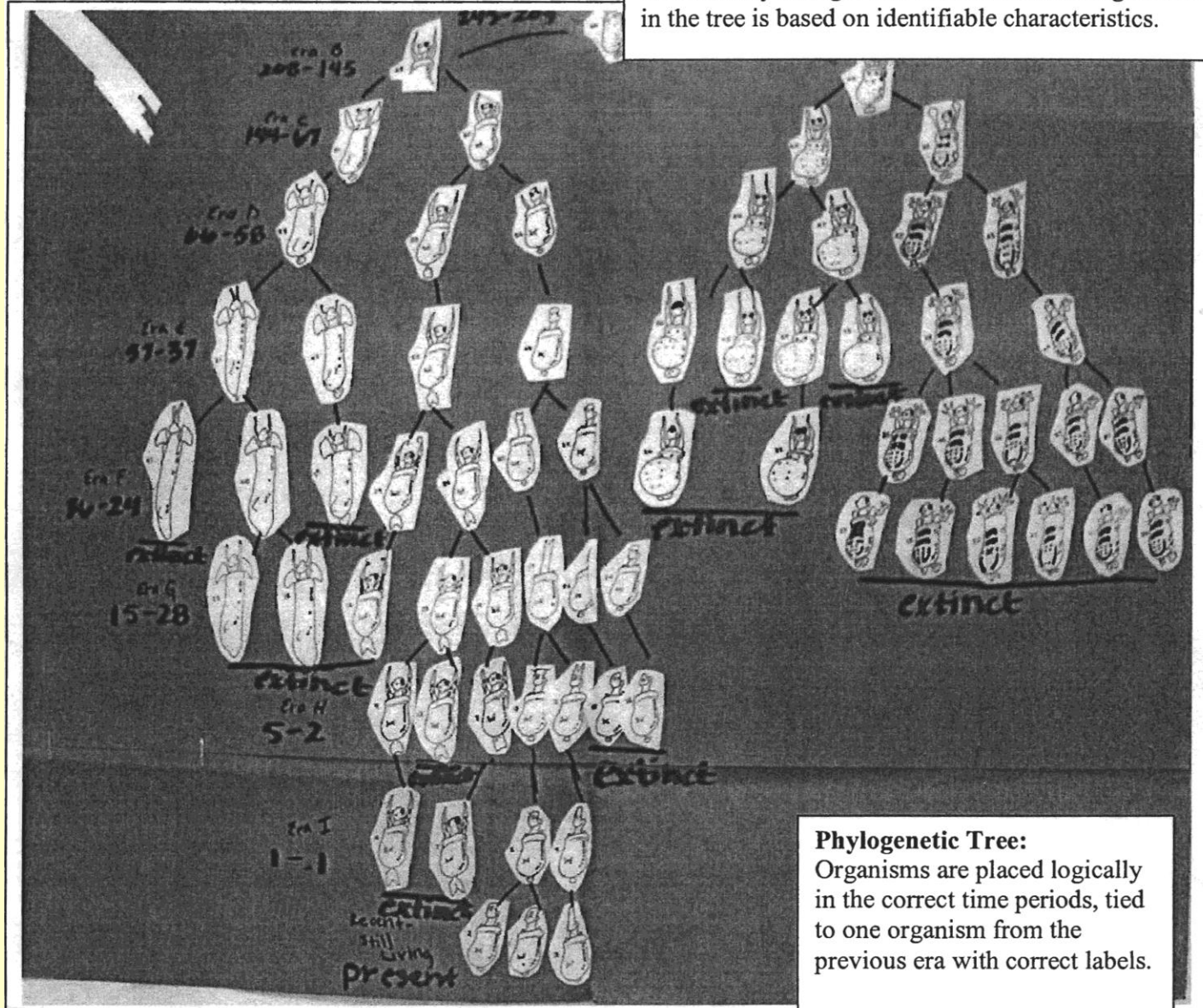
Description:

In this activity, students are provided with 66 imaginary organisms that are to be organized into a phylogenetic tree. Students provide evidence for the development of the tree using the characteristics of the organisms and then compare their trees to another classmate's tree.



Basic Concepts:

The phylogenetic tree indicates an understanding of evolutionary change. The classification of organisms in the tree is based on identifiable characteristics.



Phylogenetic Tree:
Organisms are placed logically in the correct time periods, tied to one organism from the previous era with correct labels.

- ✓ **Note that good assessment tasks are interchangeable with good instructional tasks.
(The exact same task should not be used for both purposes, however.)**
- ✓ **We also have evidence that “teaching to” problem types like these improves learning.**

Expanded Edition

How People Learn



Brain,



Mind,

Experience,



and

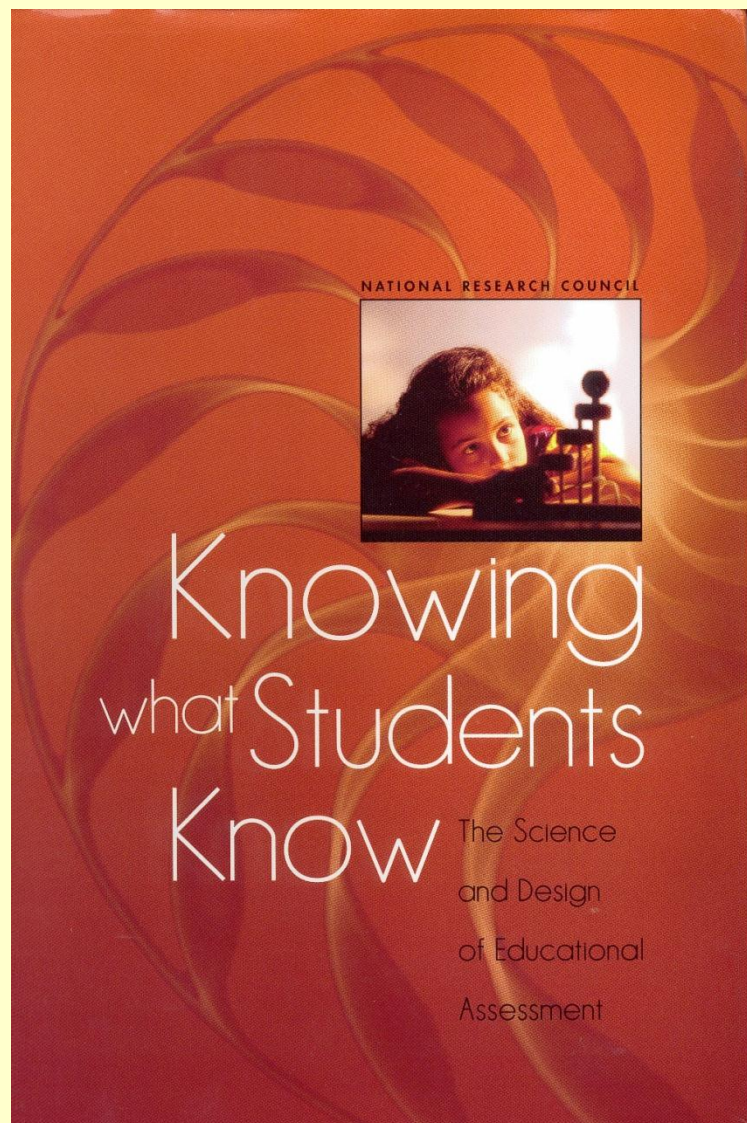
School

NATIONAL RESEARCH COUNCIL

The knowledge base for classroom assessment is closely tied to contemporary theories of learning -- about how knowledge is organized in the mind and about how participation in communities of practice shapes understanding.

How People Learn

Bransford, Brown, & Cocking,
1999, NRC



Knowing What Students Know

***Pellegrino, Chudowsky, & Glaser
NRC, 2001***

Cognitive science findings on key aspects of learning processes can be translated into targeted features of formative assessment:

- ***Accessing prior knowledge***
- ***Strategic use of feedback***
- ***Teaching and assessing for transfer***
- ***Meta-cognitive benefits of self-assessment***



These theories not only bring *coherence* to elements of formative assessment practice, they *explain* why formative assessment works *when* it works.

- **Kluger and DeNisi's meta-analysis cautions that in *one-third* of studies feedback worsens performance (based on person rather than task evaluation).**
- **Research on intrinsic motivation, e.g., Deci & Ryan (2000) shows negative effects of extrinsic rewards. Children can learn to be extrinsically motivated.**



As Processes, Good Formative Assessment Practices

- Elicit prior knowledge, both prerequisite and background knowledge, and develop classroom routines to help students become aware of knowledge use.
- Provide feedback that enables students to see how to improve performance over time.
- Develop classroom expectations that call for application and generalization, rather than repetitive practice.
- Use self-assessment as a means to support internalization of criteria and personal ownership of the learning process.

Research on Teacher Learning & Teacher Professional Development

- ***As with all novices, teachers learning about formative assessment are likely to attend to surface features.***
- ***Without conceptual support, teachers may adapt FA to fit traditional practices, e.g., making self assessment about grading, and miss its core features.***
- ***e.g., 1/3 of feedback studies show negative effects (Kluger & DeNisi meta-analysis)***
- ***In Assessment for Learning, teachers are treated as learners, trying to make sense of a new theory (Black, Harrison, Lee, Marshall, & William, 2003).***





Putnam & Borko (2000). *Research on Teacher Learning and Teacher Professional Development*

We know that teachers are most likely to make and sustain fundamental changes in instructional practice if given

- **time,**
- **conceptual and strategic support,**
- **and opportunities to tryout new practices in the context of their own teaching.**



Beyond Learning Theory and Formative Assessment Principles...

Teachers need better access to materials that model teaching for understanding.

- **Extended instructional activities**
- **Formative assessment tasks**
- **Typical misconceptions**
- **Scoring rubrics**
- **Strategies for eliciting student thinking**
- **Parallel summative assessments**

Marion & Shepard, 2010

Curricular Supports for Innovative Assessments

- **Replacement Units** are alternate instructional materials – *usually specially designed to exemplify more challenging and conceptually rich learning goals* – that can be used “in place of” more traditional textbook chapters.
- Typically, Replacement Units include daily lesson plans, but the best examples, Marilyn Burns, Pacesetter (now SpringBoard) also have built-in assessments, both formative and summative.
- Just as developers of RUs can *think through* activities and instructional supports to deepen understanding, expert developers can *think through* and do the field testing to identify best questions and successful instructional responses.
- **Summative assessment tasks could be planned-for extensions of unit assignments.**

Integration of Technology, Curriculum, and Professional Development

Roschelle, et al. *AERJ* (2010)

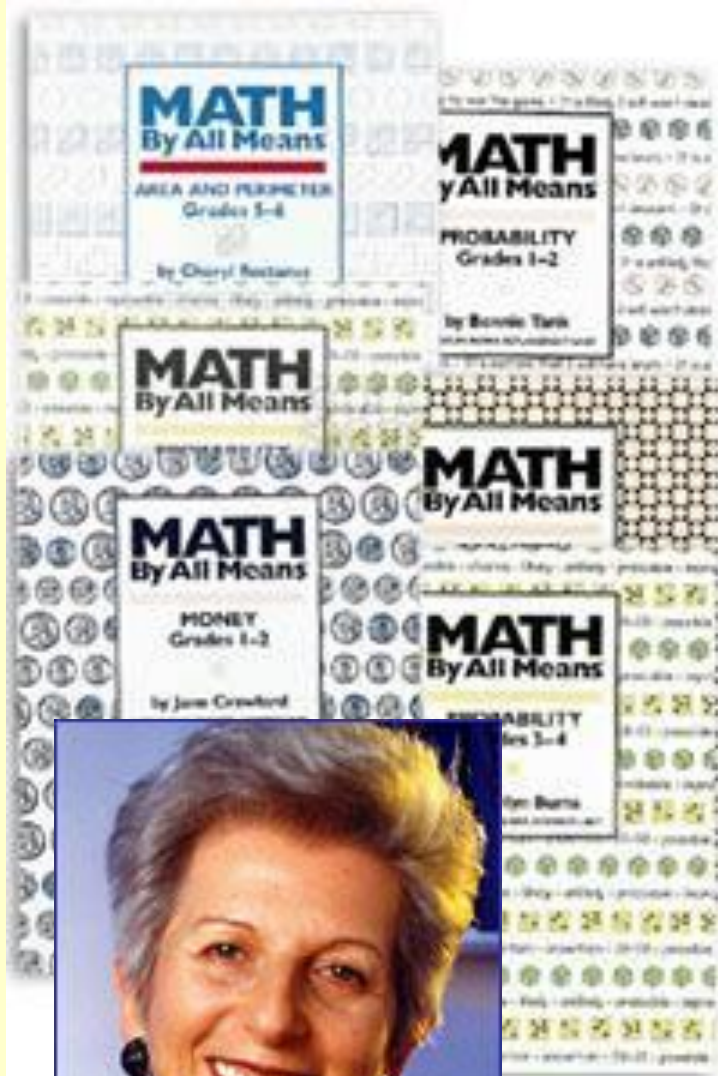
Getting beyond the “boutique critique” of small-scale, researcher-supported interventions

Scaling-up: 100s/schools, 1000s/students, train the trainers

- Replacement unit strategy focuses intervention on instruction (Cohen, Raudenbush, & Ball, 2003).
- Replacement units allow the integration of technology, curriculum, and teacher learning.
- Replacement units are large enough to allow real change; Also short and contained enough to limit the perceived risks for teachers and schools.



Replacement units provided explicit curricular content and pedagogical guidance and tight connections to standards. **Effect sizes: .63, .50, .56**

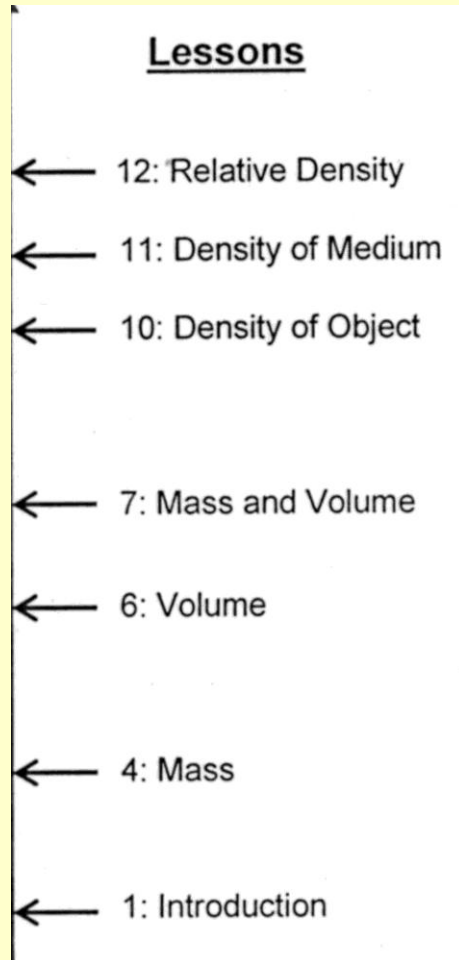


My first experience with Replacement Units: A Tribute to Marilyn Burns

Using Assessment to Improve Learning,
Shepard (1995), *Ed Leadership*

- ❖ Teachers in one school were annoyed that researchers had seemingly withheld advice to use Marilyn Burns' *Math By All Means* units.
- ❖ “Look this makes it easier, she’s already thought through the process – the lessons, the activities, the assessments. So we can focus on what the kids are doing and whether it makes sense to them.”

More sophisticated understanding of buoyancy

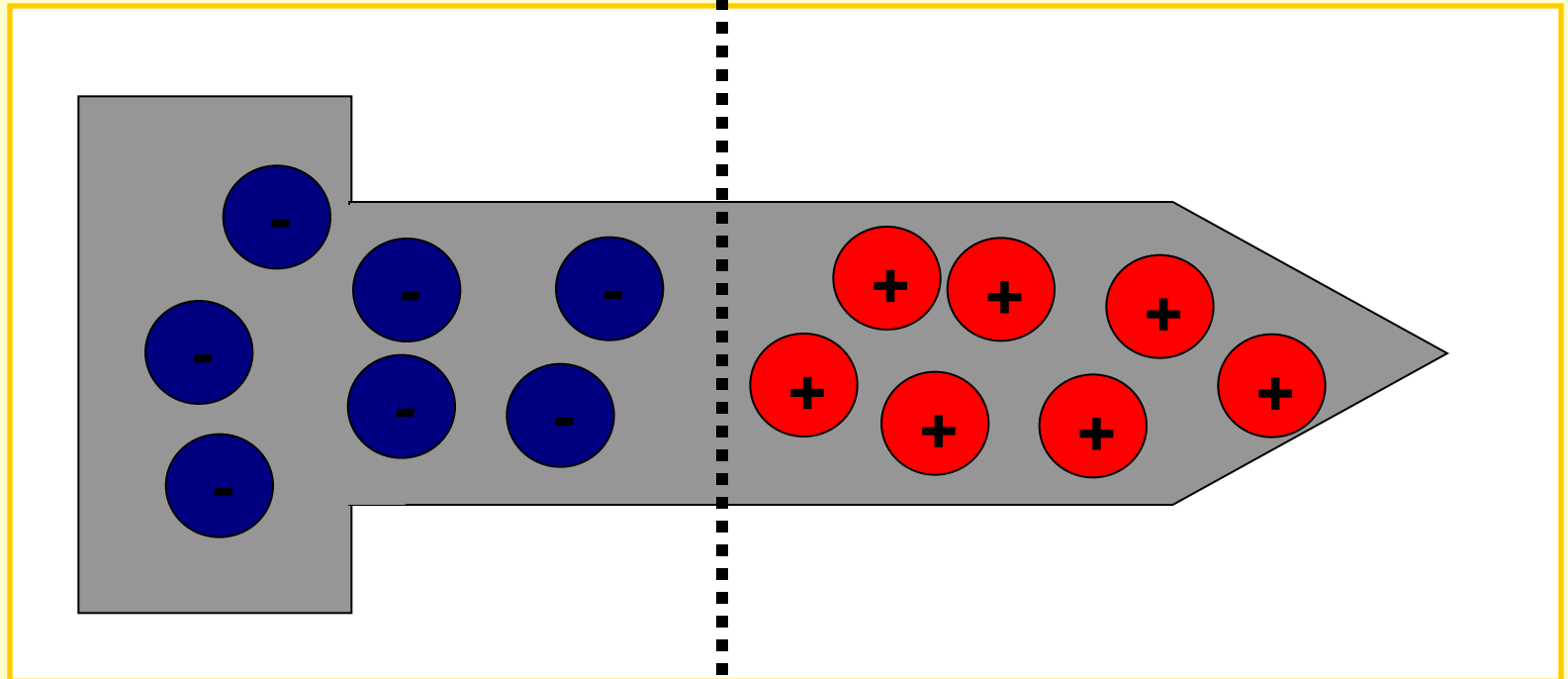


Less sophisticated understanding of buoyancy

- Coherence between classroom and external tests requires a shared understanding of the construct at the level of the progress dimension and at the level of specific assessment tasks and scoring guides. (Wilson & Draney, 2004)
- How learning typically unfolds helps teachers know “what next” and how to “back-up” (though we must also be aware of natural variations and departures from the typical pattern).
- **When embedded in units of instruction Learning Progressions can target typical misconceptions.**

An example of a typical misconception and challenge question:

What happens if you cut the nail in half?



Otero, Jalovec, & HerManyHorses. (2008).

Replacement Units

- RUs may be an effective strategy, short of developing entire curricula that would allow coherent development of all the key pieces – lesson plans, classroom formative tasks, unit-specific summative assessments and representative tasks to be used in large-scale assessments.
- R&D could specifically address generalization and transfer to large-scale tests rather than relying on “teaching to” exactly parallel items.
- And RUs are an effective means to support teachers learning to teach in new ways.

