To Test or Not to Test, That Is Not The Question!

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Overview of Today's Presentation

- Some key concerns about the current state of educational assessment
- A conceptual scheme for understanding educational assessment from ***"Knowing What Students Know"***
- What cognitive science and measurement science TOGETHER provide as a basis for major advances in assessment
- Implications for assessment design and use
- Final thoughts and exhortations for learning scientists

Concerns Often Expressed About Educational Assessment

- Misalignment of high-stakes accountability tests and local curricular and instructional practices
- Narrowing of instruction by teaching to tests with restricted performance outcomes.
- Assessments frequently fail to provide instructionally useful and/or policy relevant information, and the information they do provide is not timely.
- Classroom assessments, which have the potential to enhance instruction and learning, are not being used to their fullest capability.

No Child Left Behind

President George W. Bush

ESEA/NCLB Key Requirements

- Annual assessments of all students in Math and Reading for Grades 3-8, and once in grades 9-12, beginning no later than 2005/2006 academic year
  - Math and Reading annual assessments must be aligned with state academic content and achievement standards
- Annual assessment of students in science no less than once in each of grades 3-5, 6-9 and 10-12, beginning no later than 2007/2008 academic year
- Adequate Yearly Progress
  - 100% of students must meet or exceed a “proficient” level of academic achievement by the 2013-2014 academic year
  - Establish intermediate goals for uniform improvement over the 12 year period

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Knowing what Students Know

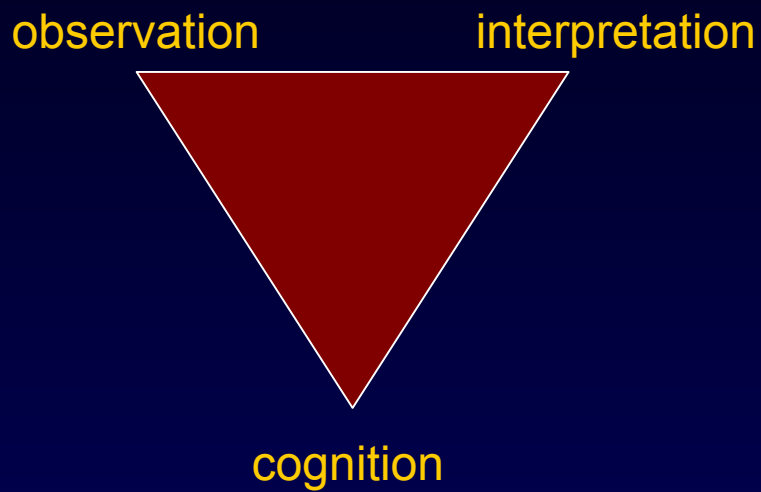
The Science and Design of Educational Assessment

Necessities & OpportunitiesTo Rethink Educational Assessment

- Advances in cognitive sciences illuminate important aspects of learning & understanding that should be major targets of assessment
- Advances in measurement and technology expand the capability to collect and interpret more complex forms of data and evidence
- Merger of the three holds promise for promoting a “new science and practice of educational assessment”

Assessment as a Process of Reasoning from Evidence
The Assessment Triangle

- cognition
  - model of how students represent knowledge & develop competence in the domain
- observations
  - tasks or situations that allow one to observe students' performance
- interpretation
  - method for making sense of the data



Must be coordinated!

Why Synchrony Is Needed

- Problem 1: Sophisticated statistical techniques used with restricted models of learning or restricted cognitive tasks will produce limited information about student competence.

- Problem 2: Assessments based on a complex and detailed understanding of how students learn will not yield all the information they otherwise might if the statistical tools available to interpret the data, or the data themselves, are not sufficient for the task.

Two Important Themes

- What is constant: the principles underlying any assessment activity
  - how we conceive each of the 3 elements of the "assessment triangle" and their interplay are critical -- none of the 3 can be taken for granted

- What is variable: purpose and context of assessment use
  - situations should not be treated exactly the same and one size does not fit all needs

Scientific Foundations of Assessment

- Advances in the Sciences of Thinking and Learning -- the cognition vertex
  - informs us about what observations are sensible to make

- Contributions of Measurement and Statistical Modeling -- the interpretation vertex
  - Informs us about how to make sense of the observations we have made

Advances in Sciences of Thinking & Learning

- The most critical implications for assessment are derived from study of the nature of competence and the development of expertise in specific curriculum domains.
  - Knowledge organization
  - Characteristics of expertise
  - Metacognition
  - Multiple paths to competence
  - Preconceptions and mental models
  - Situated knowledge and expertise

Some Summary Points

- Contemporary knowledge from the cognitive sciences strongly implies that assessment practices need to move beyond discrete bits and pieces of knowledge to encompass the more complex aspects of student achievement
- Instructional programs and assessment practices based on cognitive theory exist for areas of the curriculum
- Further work is needed
  - translate research findings for practical use
  - develop models of learning for all areas of curriculum

Advances in Measurement: Beyond Models of General Proficiency

- Three general sets of measurement issues that can be accommodated by various models
  - continua vs classes
  - single vs multiple attributes
  - status vs change
- Possible to describe a progression of models and methods of increasing complexity

Summary Points

- Many new methods are available but they have yet to be made useable and understandable -- technology can help
- Need to explore fit between particular statistical models and varying descriptions of competence and learning
- Collaboration needed among educators, psychometricians, and cognitive scientists

Assessment Design & Use

Three “big issues” to consider in translating the scientific foundations into “engineering design” realities:

- Principles to guide the process of assessment design and development
- Multiple uses of assessment -- practices connected to contexts and purposes
- Feasibility -- possibilities for applying technology to critical design and implementation challenges

Assessment Design Principles

- Assessment design should always be based upon a **model of student learning** and a clear sense of the **inferences about student competence** that are desired for the **particular context of use**.

- The model of student learning suggests the most important aspects of achievement that one would want to make inferences about and provides clues about the types of tasks that will elicit evidence to support those inferences.

Some Selected Examples of the Use of Student Models

- Development of number sense (Case & Griffin);
- Subtraction bugs (Brown & Burton);
- ACT-R theory and domain models (Anderson, Koedinger, Corbett et al.);
- Facets in physics (Minstrell & Hunt);
- Middle School Math through Applications (Greeno et al.);
- Australia's developmental progress maps (ACER)

Assessment Practice

- Report envisions *systems* of assessments that cut across contexts and that are:
  - comprehensive
  - coherent
  - continuous
- We need to shift the emphasis in the direction of the classroom where learning occurs
  - Example -- BEAR assessment system
  - Example -- Minstrell's Facets-based system
  - Example -- Anderson & Corbett's Tutors

Opportunities Afforded by Technology

Computer and telecommunications technologies provide powerful new tools necessary to meet many of the design and implementation challenges implied by merging cognitive models and measurement methods:

- going beyond conventional practices for item presentation
- implementing a range of task designs and item formats
- tapping a broader repertoire of cognitive skills and knowledge
- recording and scoring complex aspects of behavior
- embedding assessments in learning environments

Technology & Assessment Futures

- Rich sources of information about student learning can be continuously available across wide segments of the curriculum and for individual learners over extended time periods.

- Issue is how to design for this possibility and explore the options it provides for effectively using assessment information to meet the multiple purposes of current assessments and, most importantly, to aid in student learning.

Final Thoughts & Exhortations

- *KWSK* offers a vision for educational assessment as a facilitator of high levels of student achievement -- assessment as integral to learning
- Vision represents a departure from the context of current assessment use
- Current scientific knowledge can yield many enhancements in assessment design & use
- Further research in the learning sciences as well as changes in policy and practice are necessary to move the field of educational assessment forward
- Either we become part of the game or the types of learning that matter to us will be driven from the curriculum in the onslaught of accountability tests!

Coming soon in the U.S. are More Tests
But will they help children learn?