What You Want to Know and What You Need to Know about Your Students' Learning

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How well do your students…

Integrate	Transfer	Analyze
(Re)Apply	Re-use	Synthesize

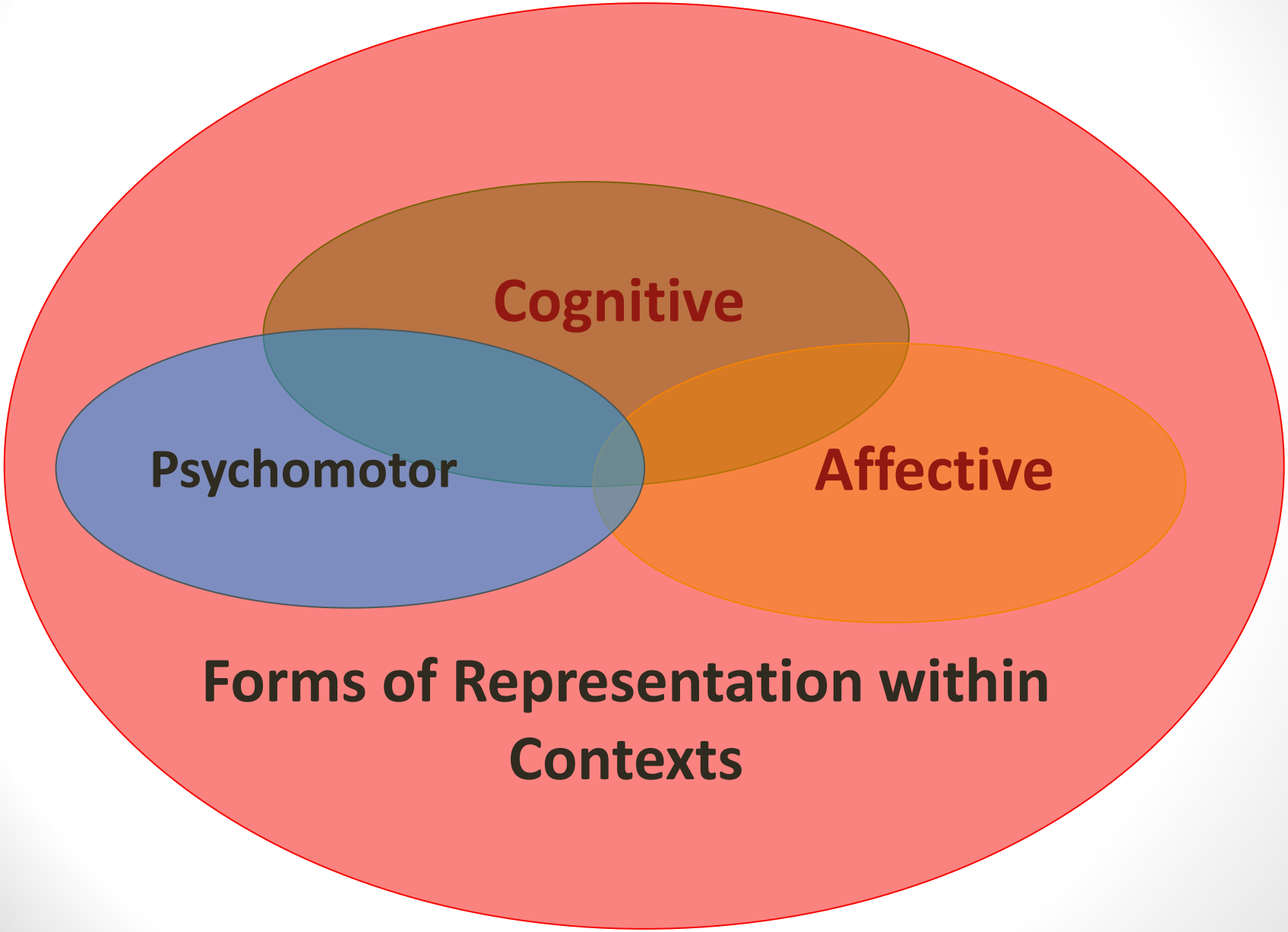
Restructure previous incorrect learning…

- Within a course or module or learning experience?
- Along the chronology of their studies and educational experiences?
- From one subject or topic or focus or context to another one such as from an exercise to a case study or internship?

Who—besides you….

- Promotes, challenges, validates, and builds on students' new or previous learning?
- Corrects continuing misunderstandings by providing feedback?
- Models a desired practice or behavior?

Integrated Learning….

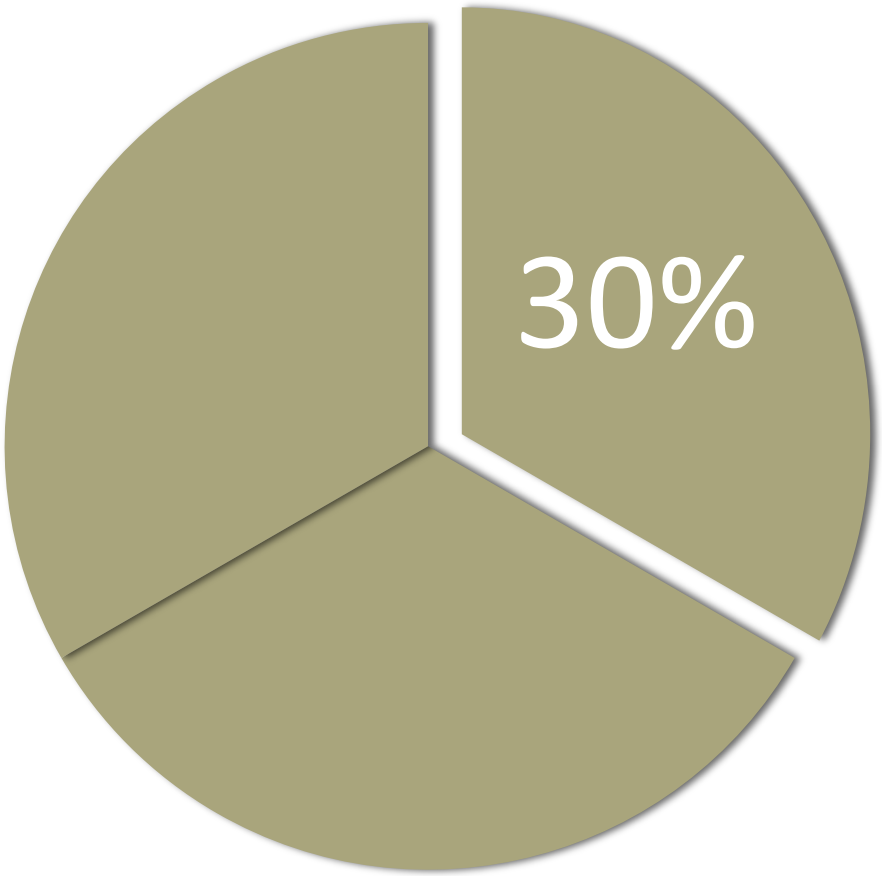


Foci

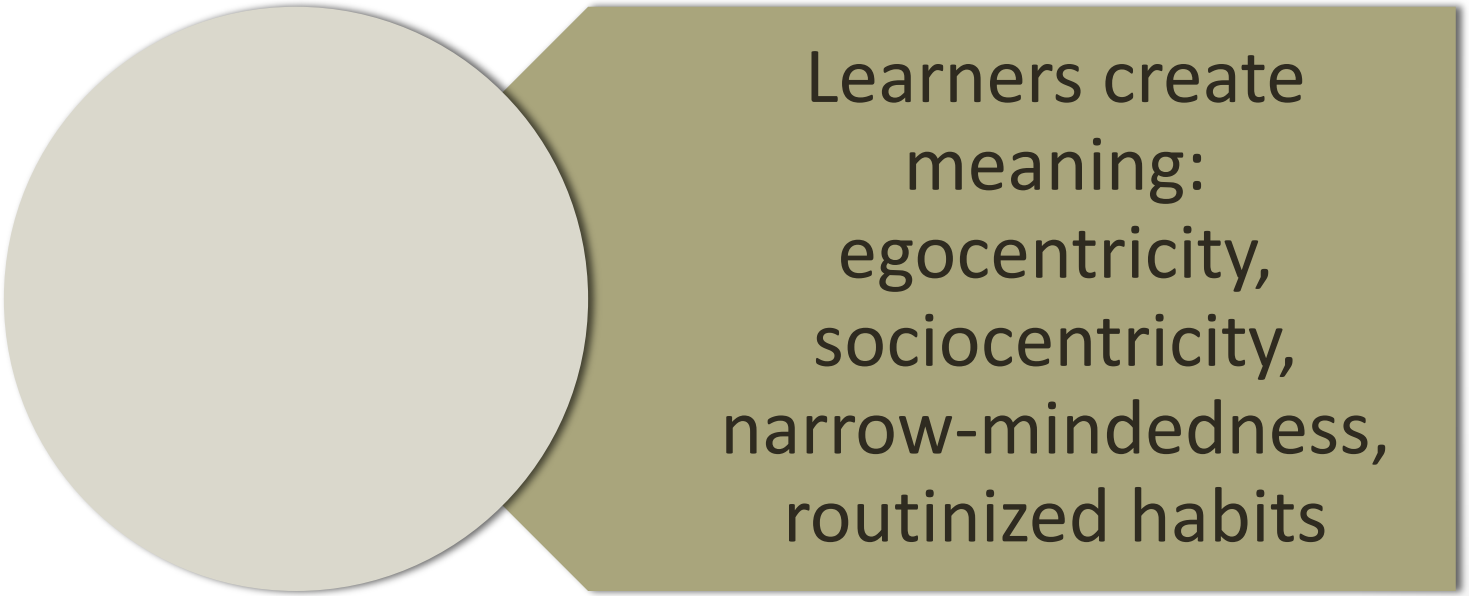
- Research on Learning That Informs Teaching, Learning, and a Collaboratively Designed Chronological Approach to Assessing Student Learning

- A Problem-based Approach to Assess Students' Enduring Learning

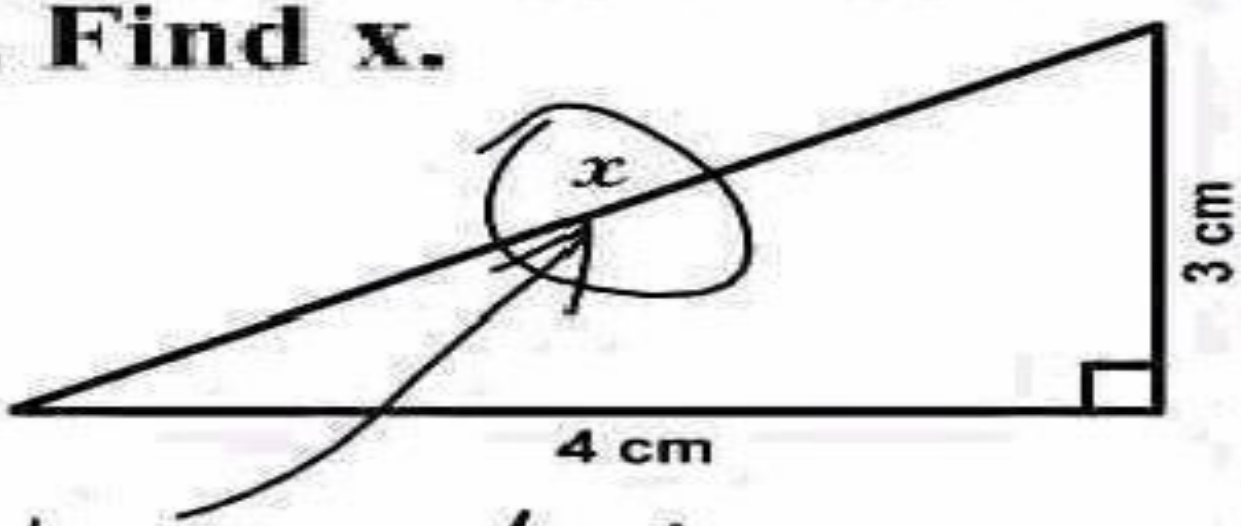
Percent Students Forget When They Log off or Leave Your Learning Experience



Students' Meaning-Making



3. Find x.



Here it is

What did Mahatma Gandhi and Genghis Khan Have in Common?

Unusual names

People learn differently and may hold onto folk or naive knowledge, incorrect concepts, misunderstandings, false information

Johanna works in an office. Her computer is a stand-alone system. What is a stand-alone computer system?

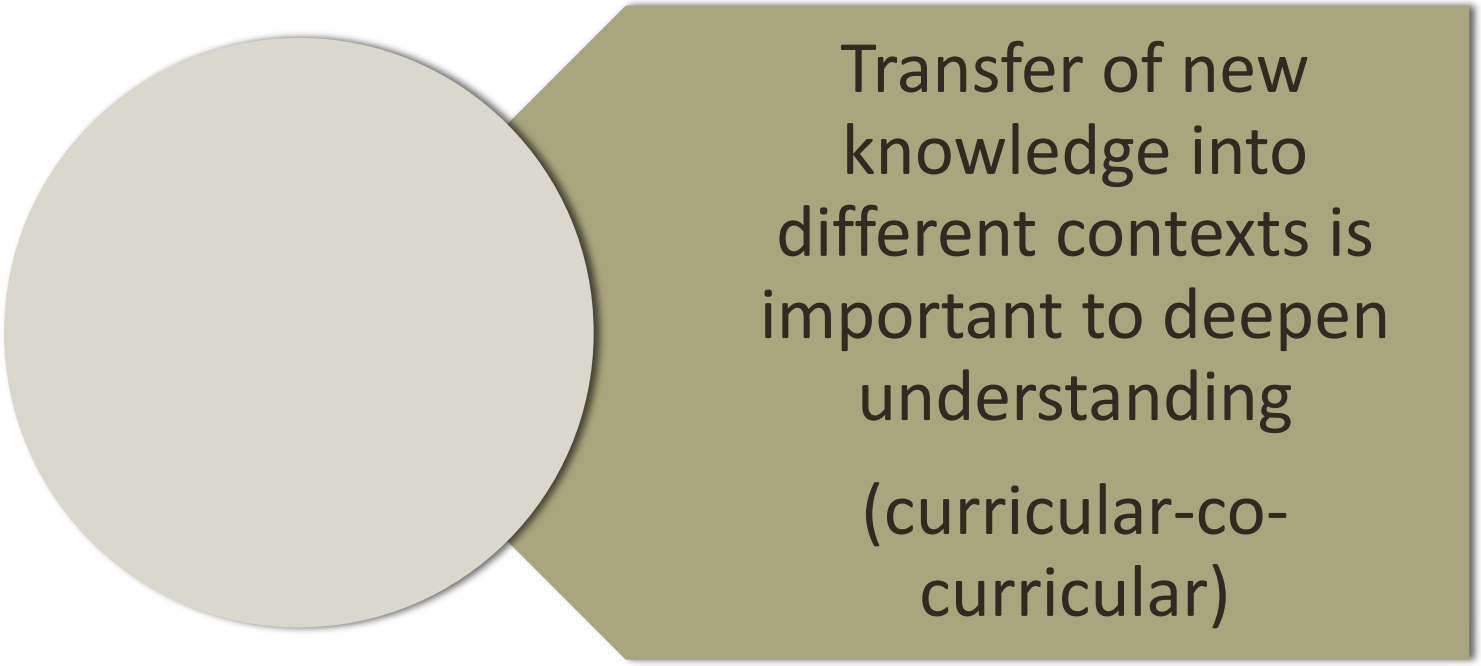
It doesn't come with a chair.

Deep learning occurs over time—transference

Learning Progressions: knowledge-based, web-like interrelated actions or behaviors or ways of thinking, transitioning, self-monitoring. May not be developed successfully in linear progression--thus necessitate formative assessment along the trajectory of learning. Movements towards increased understanding (Hess, 2008).

Meta-cognitive processes are a significant means of reinforcing learning (thinking about one's thinking)

Learning involves creating relationships between short-term and long-term memory


Transfer of new knowledge into different contexts is important to deepen understanding
(curricular-co-curricular)

NRC, 2002

Threshold Concepts: pathways central to the mastery of a subject or discipline that change the way students view a subject or discipline, prompting students to bring together various aspects of a subject that they heretofore did not view as related (Land, Meyer, Smith, 2010).

Practice in various contexts creates expertise or enduring learning

- Surface Learning (inert)
- Deep Learning(activated)

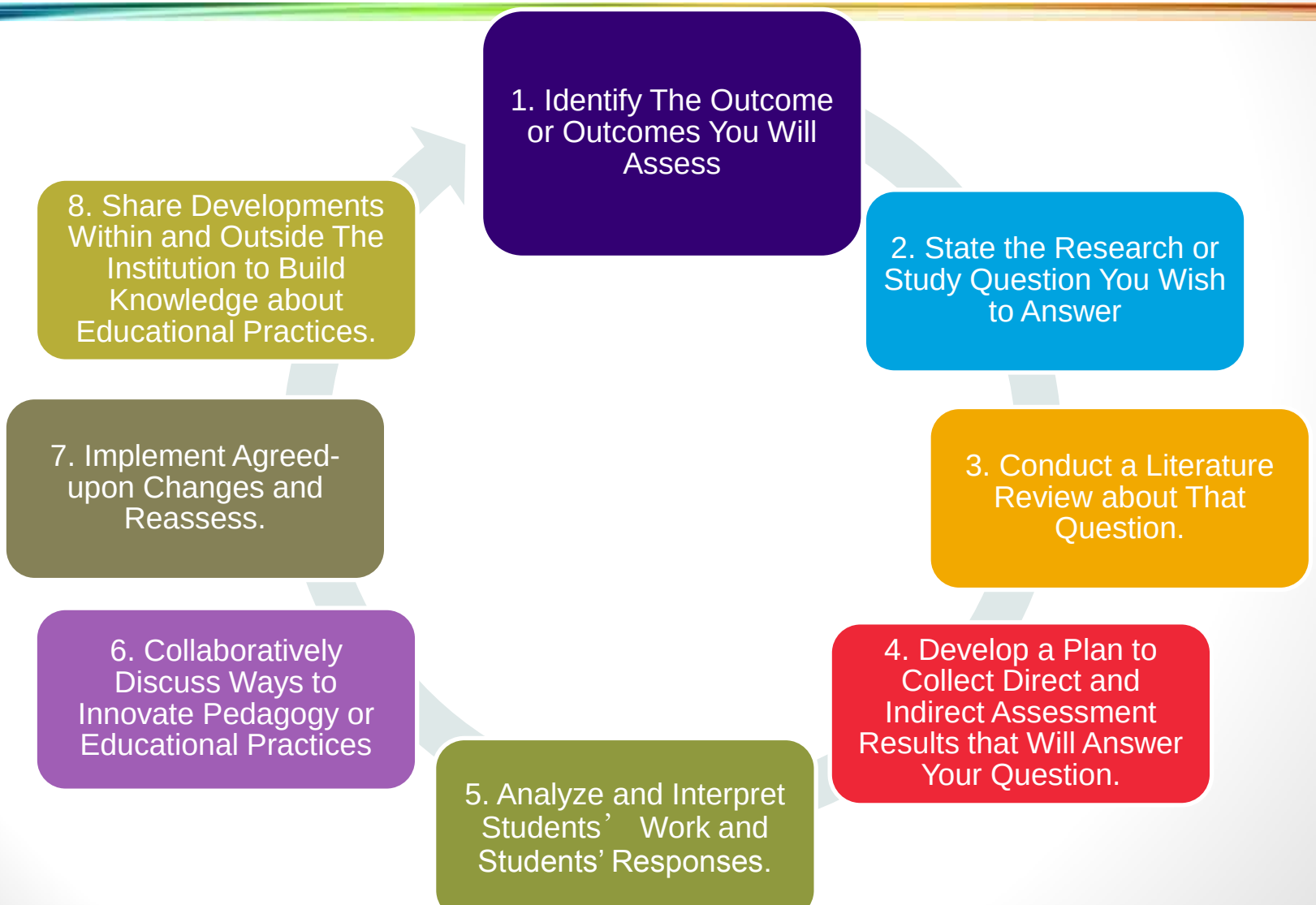
Questions that Underlie Assessment

1. What do you expect your students to demonstrate, represent, or produce by the end of their program of study--stated in your learning outcome statements?

2. At what collaboratively agreed upon levels do you expect your students to demonstrate those outcomes?

3. What chronological barriers or difficulties do students encounter as they learn--from the moment they matriculate?
4. How and when will you identify and address those barriers so that "more" students achieve your expected exit-level achievement?

A Problem-based Assessment Framework



The Seeds of Research or Study Questions

Informal observations around the water cooler

Results of previous assessment along the chronology of learning or at the end of students' studies

Use of a Taxonomy of Weaknesses, Errors, or Fuzzy Thinking

Research or Study Questions

- Collaboratively developed
- Open-ended
- Coupled with learning outcome statements
- Developed at the beginning of the assessment planning process

Some Examples of Research/Study Questions

What kinds of erroneous ideas, concepts, or misunderstandings predictably interfere with students' abilities to learn or may account for difficulties they encounter later on?

What unsuccessful approaches do students take to solve representative disciplinary or interdisciplinary problems? Counter that with learning about how successful students solve problems.

What conceptual or computational obstacles inhibit students from shifting from one form of reasoning to another form, such as from arithmetic reasoning to algebraic reasoning?

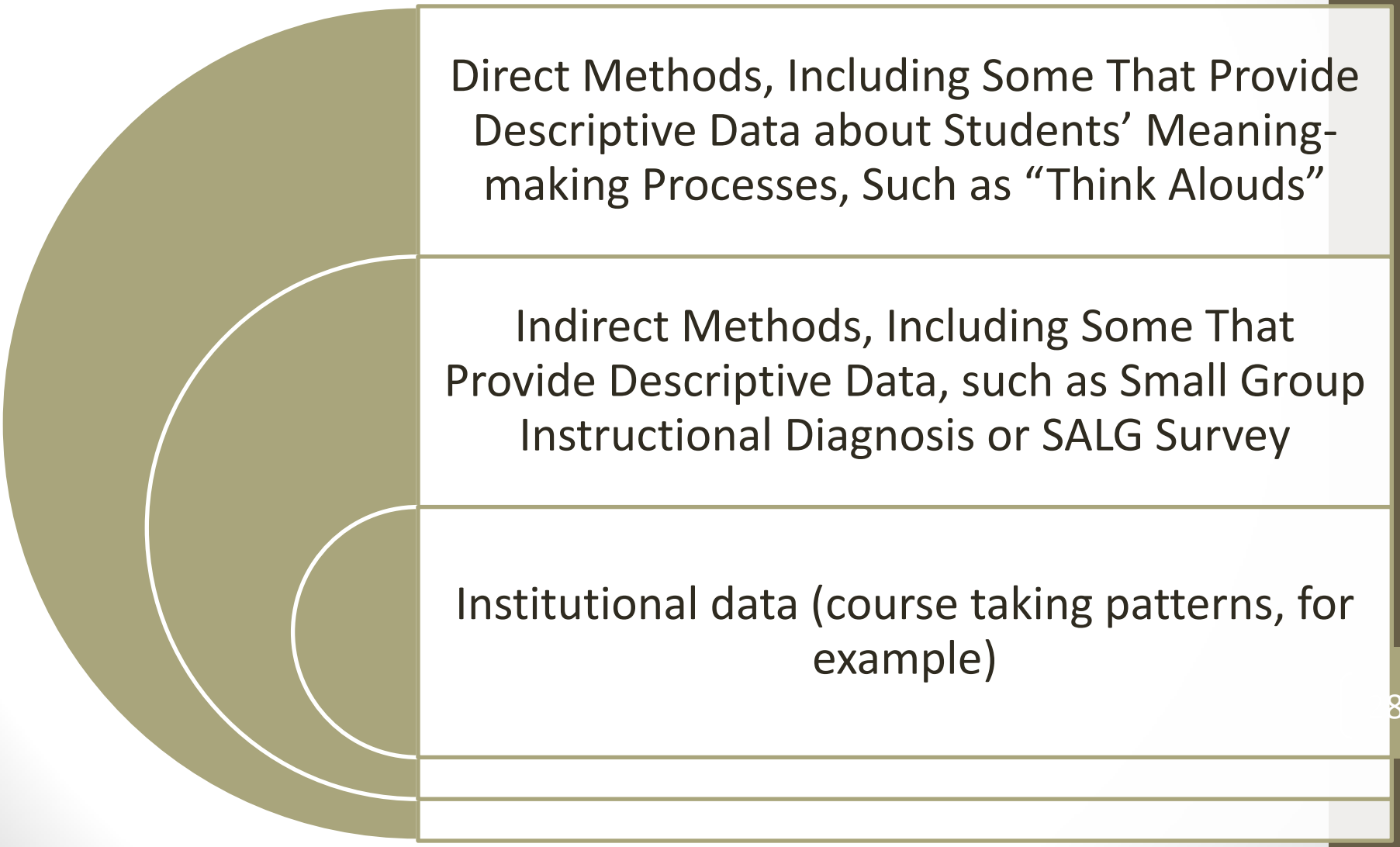
What kinds of cognitive difficulties do students experience across the curriculum and co-curriculum as they are increasingly asked to build layers of complexity?

Why or how do students misinterpret or misunderstand in your field--even when you think you are crystal clear in your demonstration or explanation?

How well do stand-alone skills-based courses, such as mathematics or writing courses, prepare students to integrate or apply those skills into disciplinary or professional courses or experiential learning situations?

What habits, sets of assumptions, or ways of reasoning travel with students across the curriculum and co-curriculum that may account for their less than desirable performance as they progress in their studies?

Identification or Design of Assessment Methods That Provide Evidence of Product and Process



Some Direct Methods to Assess Students' Learning Processes

- Think Alouds: Pasadena City College, "How Jay Got His Groove Back and Made Math Meaningful"(Cho and Davis)

- Word edit bubbles

- Observations in flipped classrooms or in 360-degree teaching environment

- Students' deconstruction of a problem or issue (PLEs in eportfolios can reveal this—tagging, for example)

- Use of reported results from adaptive or intelligent technology—learning analytics

- Focus on *hearing about* or ***seeing*** the processes and approaches of successful and not so successful students: Learning Dashboards

Some Direct Assessment Methods To Assess Students' Performance

- Critical incidents
- Scenarios—such as online simulations
- Conceptual mind mapping
- Questions, problems, prompts

- Problem with solution: Any other solutions?
- Chronological use of case studies
- Chronological use of muddy problems
- Online gaming such as Aqua Republica

Some Indirect Methods that Probe Students' Learning Experiences and Processes

- SALG (salgsite.org): Student Assessment of Their Learning Gains
- Small Group Instructional Diagnosis
- Interviews with students about their learning experiences-- about how those experiences did or did not foster desired learning, about the challenges they faced and continue to face.

Chronologically Collecting and Assessing Eviden of Student Learning

Baseline—at the beginning--to learn about what students know or how they reason when they enter a program

Formative—along the way--to ascertain students' progress or development against agreed upon expectations.

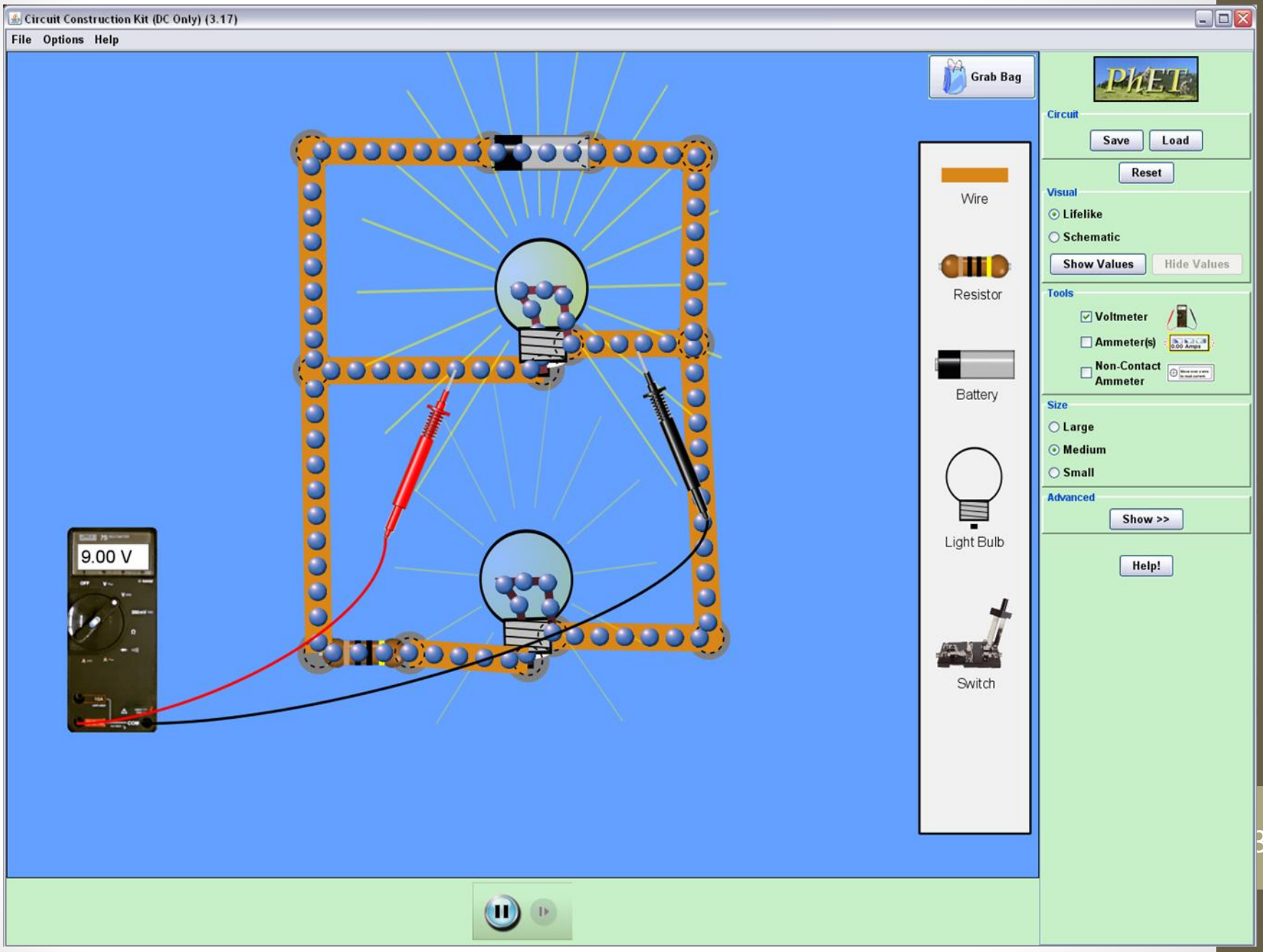
Summative—at the end--to ascertain students' levels of achievement against agreed upon expectations.

What's The Problem in Physics?

Through the use of concept inventories, it is well documented that entry-level physics majors hold onto incorrect understanding of physics concepts—even ones that have been historically proven to be incorrect.

Despite all attempts to correct these incorrect concepts, such as incorporating more labs into early courses, students continue to draw on their incorrect understanding years after their early coursework often accounting for their weak performance as they progress in their studies or resulting in their dropping out of the major.

How to restructure incorrect understanding of physics concepts became the work of physics faculty at the University of Colorado (PhET project).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Help!

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