



Engaging Faculty in Assessing Critical Thinking using the CAT Instrument

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Webinar Goals

- Provide an overview of the development of the CAT instrument and the skills it measures.
- Explore how the CAT can be used to encourage more effective practices within disciplines.
- Discuss potential ways to use the CAT for assessment.

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Importance of Critical Thinking

National polls indicate over 90% of the faculty in this country think critical thinking is the most important part of undergraduate education.

Derek Bok, 2005

President Emeritus of Harvard University

Importance of Critical Thinking

Explosion of Information

Internet

E=MC²

Email

Blogs

MySpace

Wikipedia

Facebook

Phone Apps

Augmented Reality

Magazines

Television

Books

Journals

Radio

The Changing Nature of Education

**Remembering
Information**

Finding Relevant Information

**Understanding & Evaluating
Information**

Using Information Effectively



What is Critical Thinking?

Classic Emphasis

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graph TD; A[Classic Emphasis] --- B[Evaluate Arguments and Conclusions]; B --- C[Reasoning];
```

Evaluate Arguments and Conclusions

Reasoning

What is Critical Thinking?

Classical Emphasis

Expanded Contemporary Emphasis



**Evaluate Arguments
and Conclusions**

**Evaluate Ideas
And Plans**

**Evaluate One's Own
Understanding**

Reasoning

Problem Solving

Life-Long Learning Skills

Communication

Creativity

Bloom's Classic Taxonomy

Evaluation

Synthesis

Analysis

Application

Comprehension

Information (rote retention)

Critical Thinking

Agreement on what is not Critical Thinking

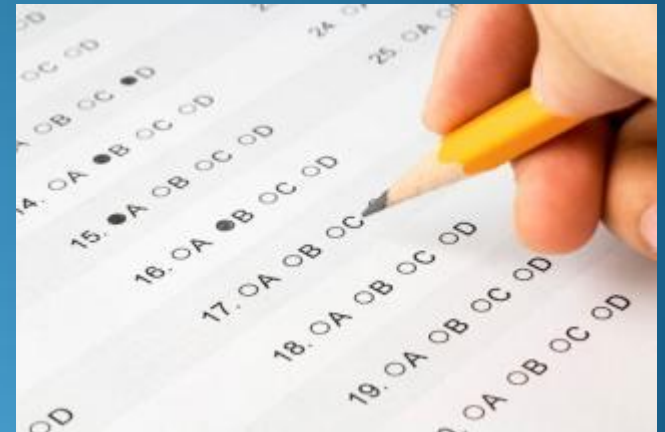
*NSSE Question

(2a) Memorizing facts, ideas, or methods from your courses and readings so you can repeat them in pretty much the same form.

Disconnect Between What is Considered Important and What We Assess

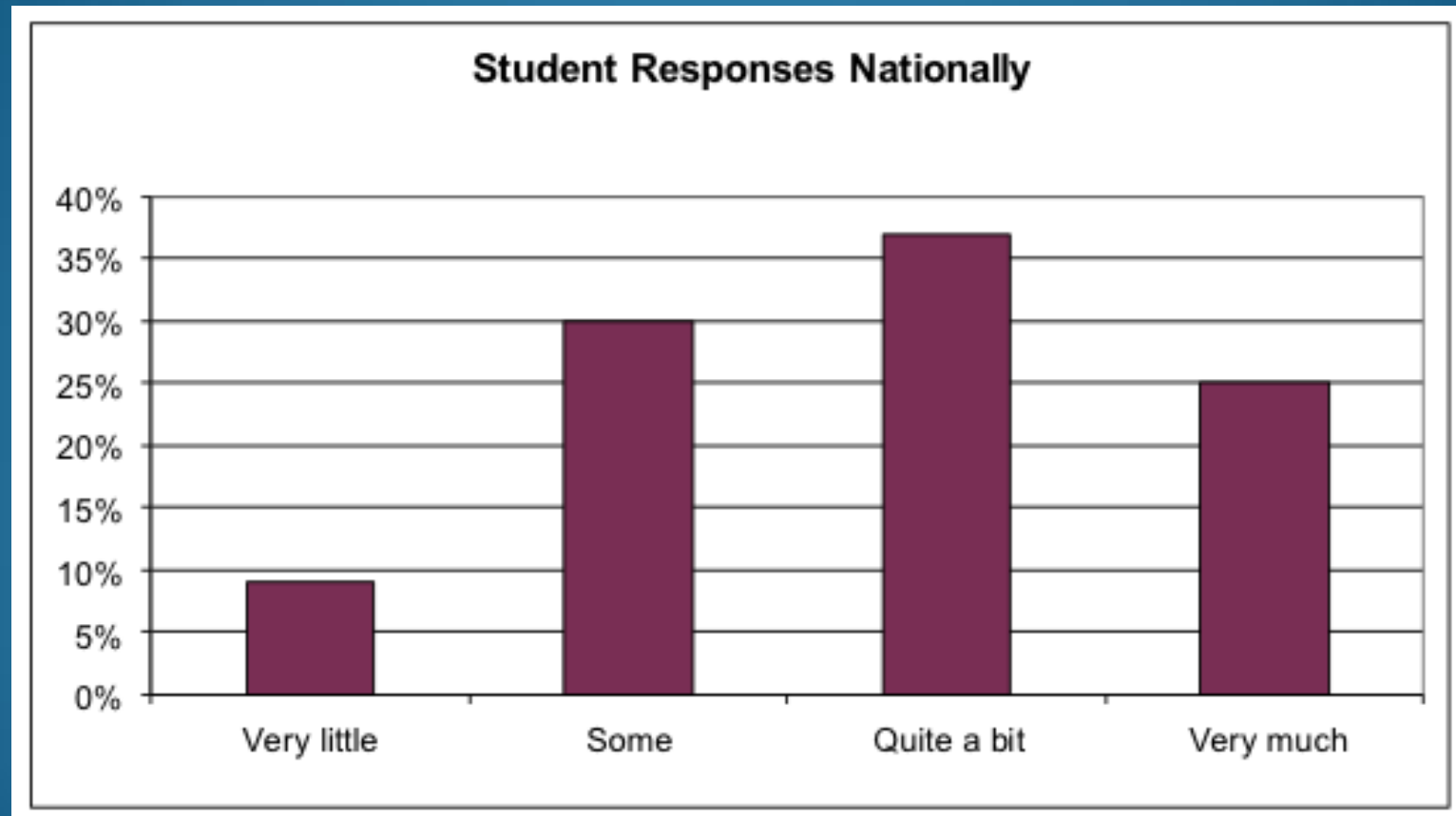


Critical Thinking



Factual Knowledge

NSSE: Coursework emphasizes: Memorizing facts, ideas, or methods from your courses and readings



Why Assess Critical Thinking?

Need to Measure Success for Accountability

Assessment Drives Improvement Efforts

How We Assess - Determines What Students Learn

History of CAT Development

Preliminary Work
At TTU
2000 - 2004



Collaborate With Other
Institutions To Refine CAT
2004 - 2007

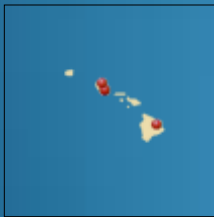


Develop Training Methods for
National Dissemination & Collect Norms
2007 - 2010

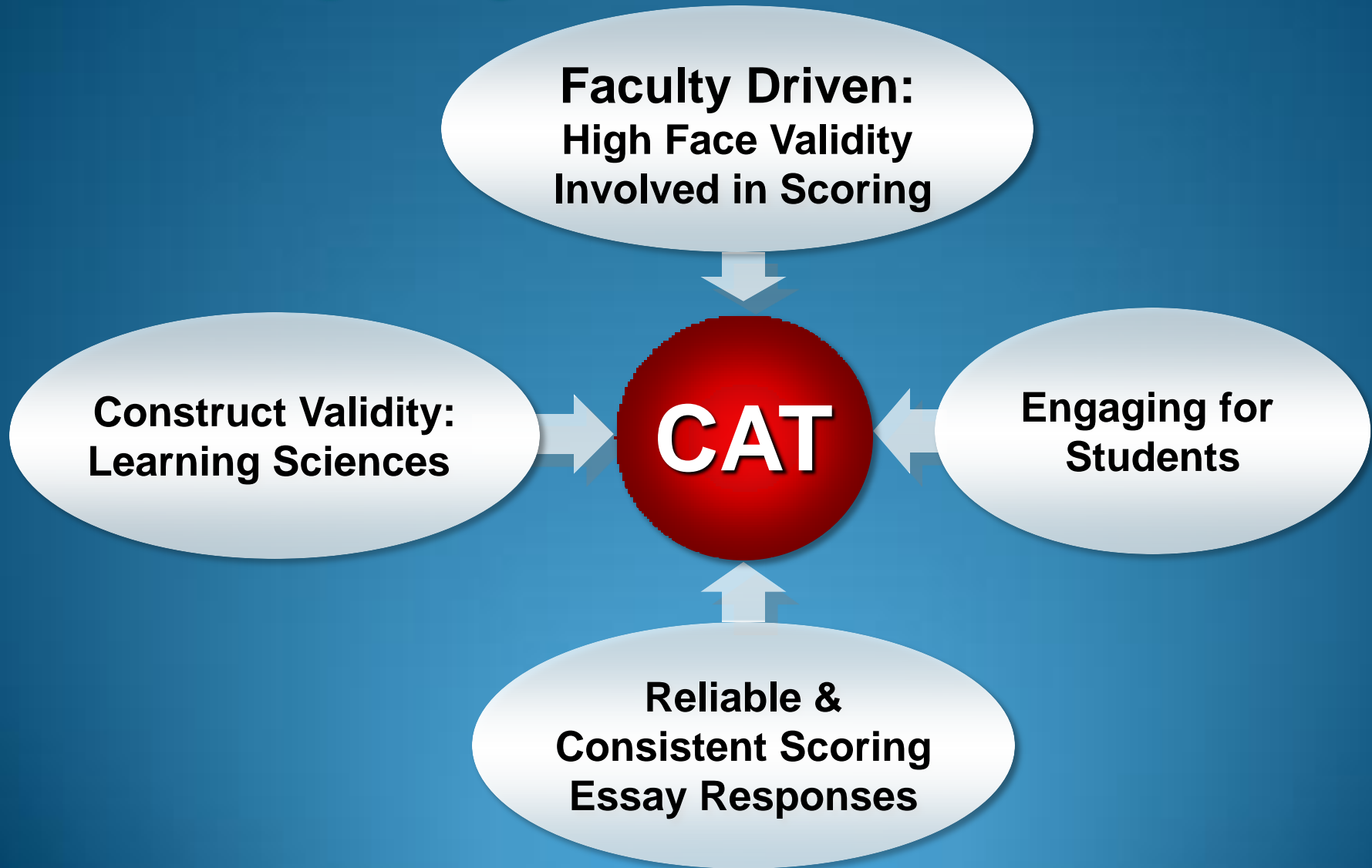


Expand National Dissemination
& Support Assessment in NSF Projects
2010 - 2014

Over 100 Institutions Collaborating



Designing the CAT Instrument



Skills Evaluated by CAT Instrument

Evaluating Information

- Separate factual information from inferences.
- Interpret numerical relationships in graphs.
- Understand the limitations of correlational data.
- Evaluate evidence and identify inappropriate conclusions

Creative Thinking

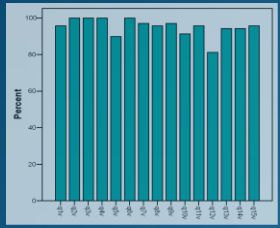
- Identify alternative interpretations for data or observations.
- Identify new information that might support or contradict a hypothesis.
- Explain how new information can change a problem.

Learning & Problem Solving

- Separate relevant from irrelevant information.
- Integrate information to solve problems.
- Learn & apply new information.
- Use mathematical skills to solve real-world problems.

Communication

- Communicate ideas effectively.



Validating the CAT

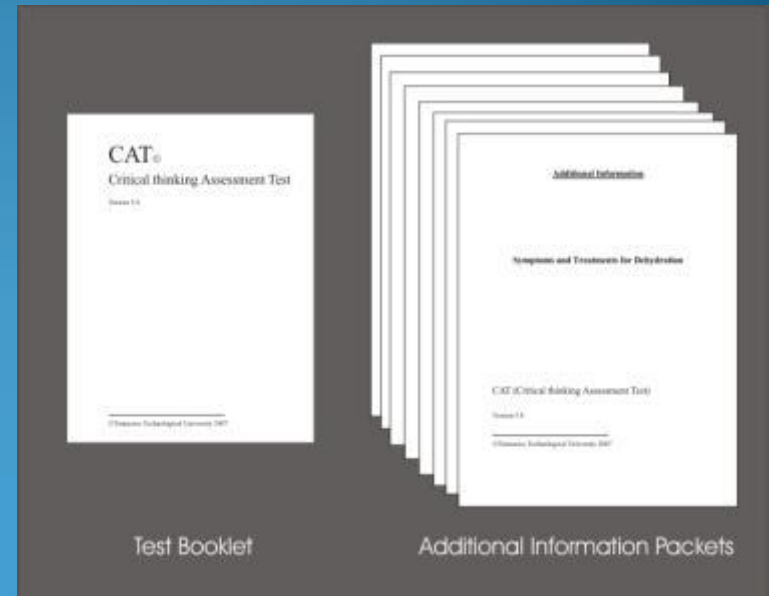
	ACT	SAT	Academic Profile	Grade Point Average
CAT	0.501*	0.516*	0.562*	0.295*

	CCTST (California Critical Thinking Skills Tests)	CAAP Critical Thinking Module
CAT	0.645*	0.691*

- **High Face Validity – Faculty & Learning Sciences**
- **Moderate Correlations - General Acad-Performance**
- **Higher Correlations with Other CT Measures**
- **Correlations with Student Perceptions - NSSE**
- **Positive Transfer from High Impact Practices**

CAT Features

- One hour exam
- Mostly short answer essay
- Faculty scored in workshops
- Detailed scoring guide
- Sensitive to course effects
- Reliable
- Valid



Sample Disclosed Question

A scientist working at a government agency believes that an ingredient commonly used in bread causes criminal behavior. To support his theory the scientist notes the following evidence.

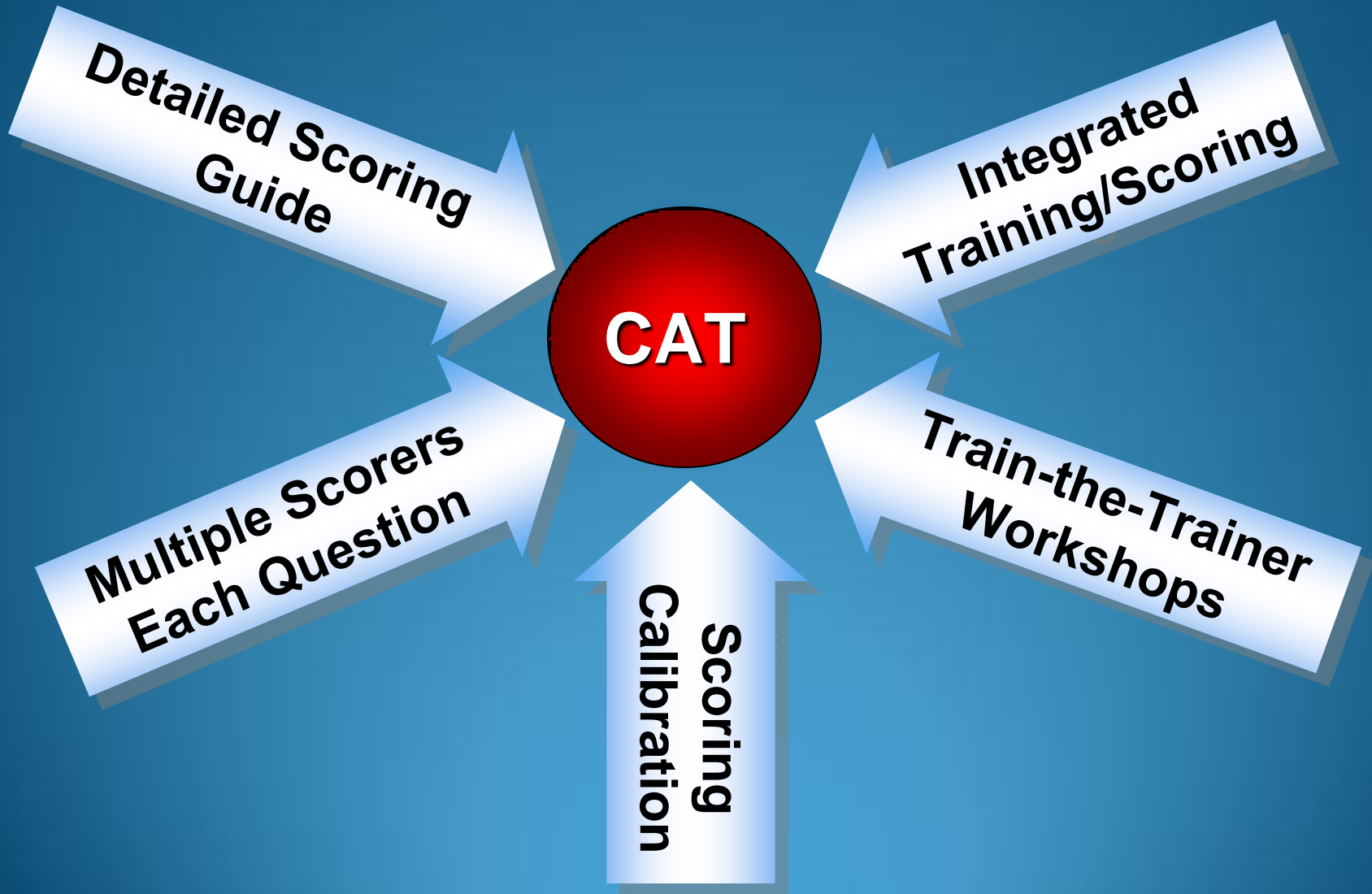
- 99.9% of the people who committed crimes consumed bread prior to committing crimes.
- Crime rates are extremely low in areas where bread is not consumed.

Do the data presented by the scientist strongly support their theory? Yes ____ No ____

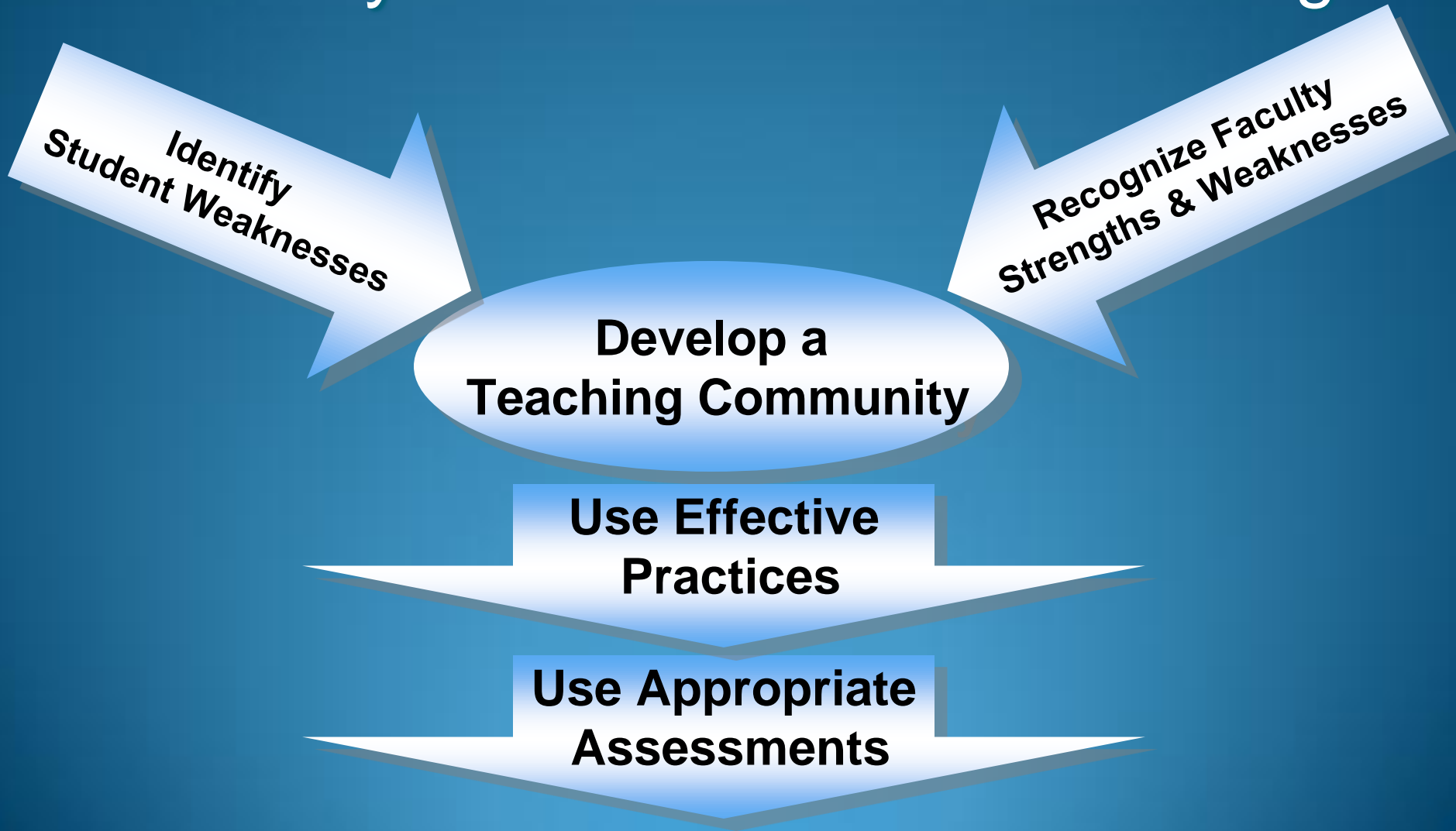
Are there other explanations for the data besides the scientist's theory? If so, describe.

What kind of additional information or evidence would support the scientist's theory?

Ensuring Reliability of Scoring



Professional Development: Faculty Involvement in CAT Scoring



Opportunities to Practice Skills in Varied Contexts

**Original Research
Service Learning
Real World Problem Solving
Case Studies**

Skills Evaluated in a Meaningful Way



CRITICAL THINKING ASSESSMENT TEST

[TTU HOME](#)[CRITICAL THINKING ASSESSMENT TEST](#)[SUCCESSFUL PROJECTS](#)

in depth

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SUCCESSFUL PROJECTS

Some Examples of Projects that have Improved CAT Scores

Under Construction

Clemson University

NSF TUES (CCLI) Project #0837540. Development of an Inquiry-Based Cell Biology Laboratory with Emphasis on Scientific Communication Skills. PI: Dr. Lesly Temesvari (LTEMESV@clemson.edu) or Dr. Terri Bruce (terri@clemson.edu).

This project involved the development of a new cell biology laboratory course that emphasized critical thinking, effective writing and communication, and ethical reasoning. The new course used an inquiry-based pedagogic strategy allowing students to design and perform experiments in the context of mini research projects. Students also gained experience in communicating their findings through poster/oral presentations and through the writing of manuscripts in standard journal format. As a part of the scientific inquiry and communication processes, students also engaged in the discussion of the ethics of scientific communication.

Duquesne University

NSF TUES (CCLI) Project #717685. A Model for Incorporating Application-Based Service Learning in the Undergraduate Science Curriculum. Dr. Nancy Trun (PI) trun@duq.edu, Dr. Lisa Ludvico & Dr. Becky Morrow (Co-PIs).

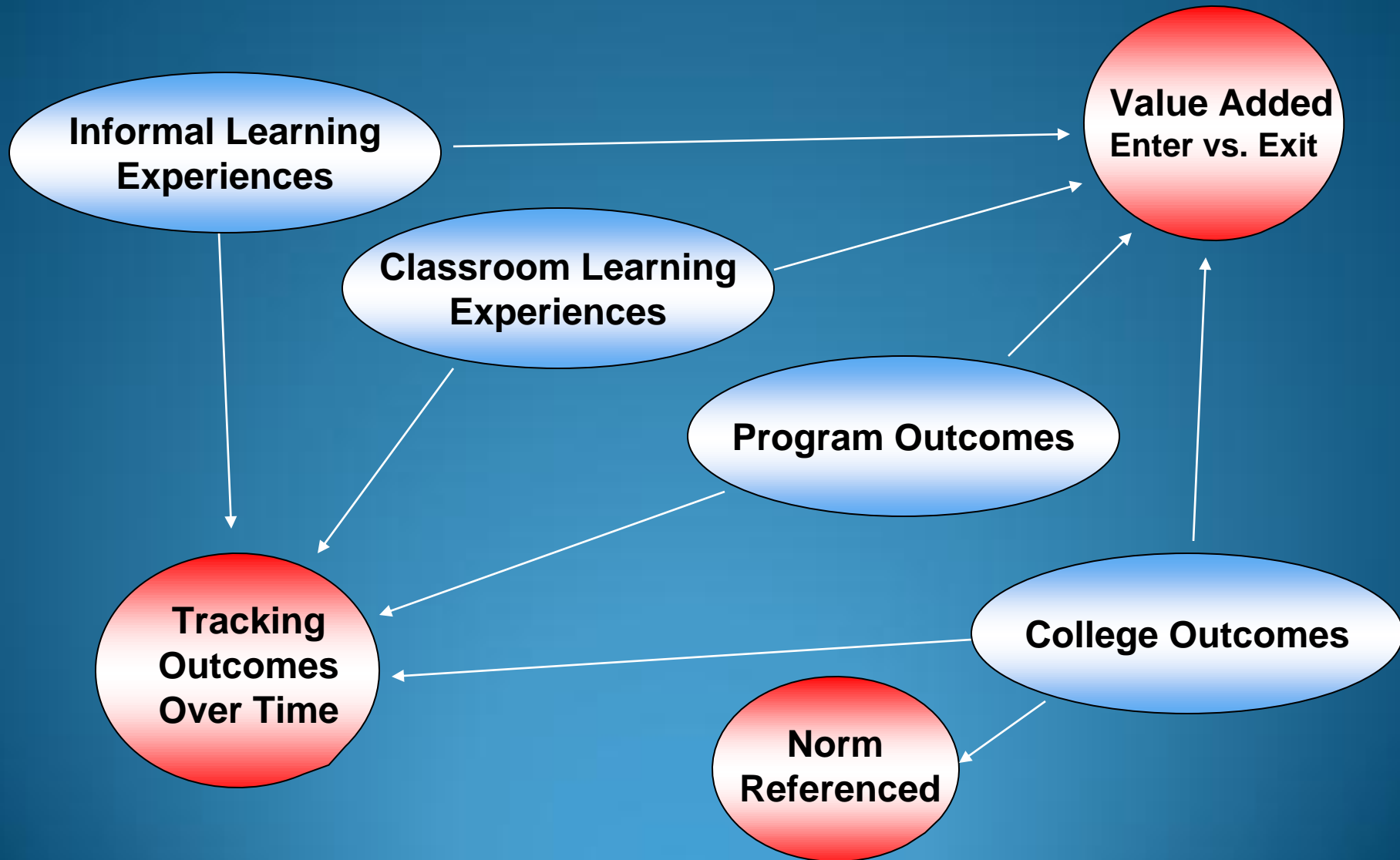
<http://www.scienceresearch.duq.edu/bio/biofac/ntrun/ABSL/index.html>

Application Based Service Learning (ABSL) is a pedagogy that we are developing to address the need for novel approaches to Science, Technology, Engineering and Math (STEM) education at the undergraduate level. ABSL combines traditional service learning with novel undergraduate research on a community problem. For the service-learning portion of the class, students spend a set number of hours throughout the semester in a specific community environment so that they learn about and understand the community problem. In class, the students conduct novel research, using the scientific method, on various parts of the community problem and investigate solutions to the problem.

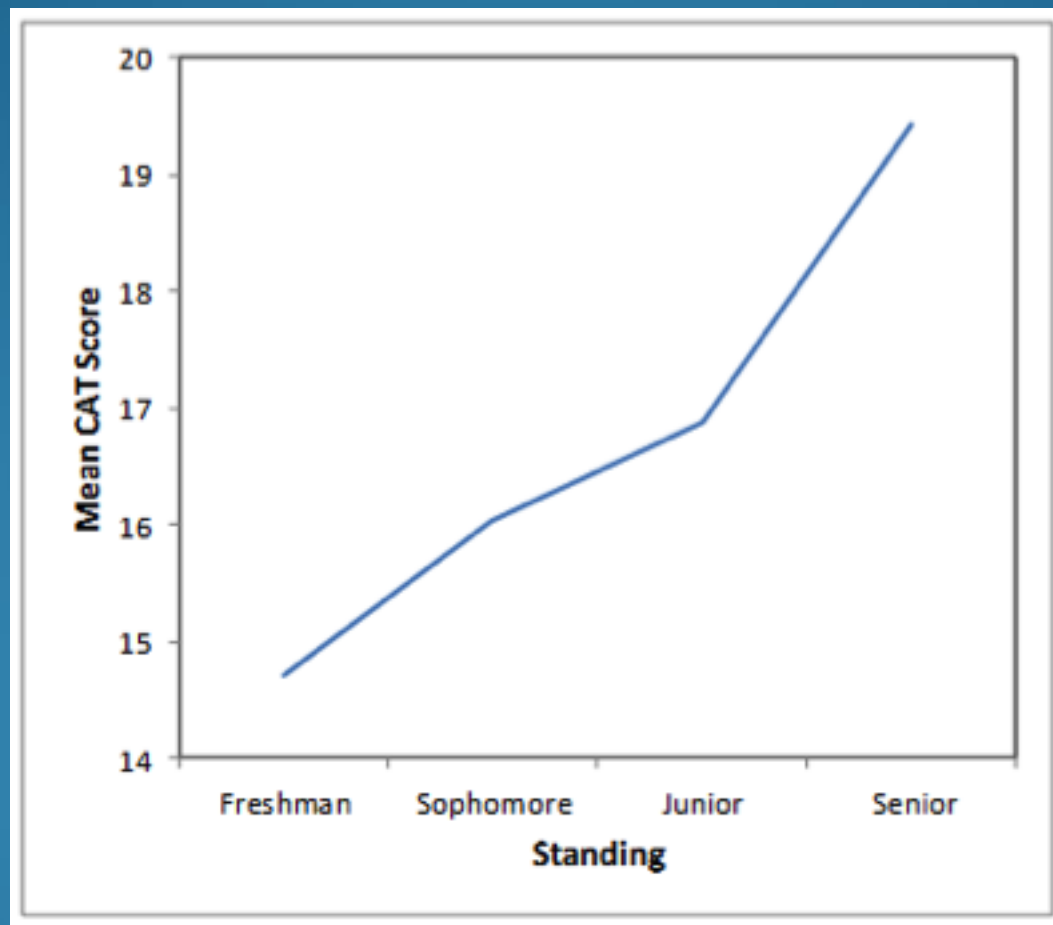
Purdue University

NSF TUES (CCLI) Project #0441884. A Model for Incorporating Research-Based

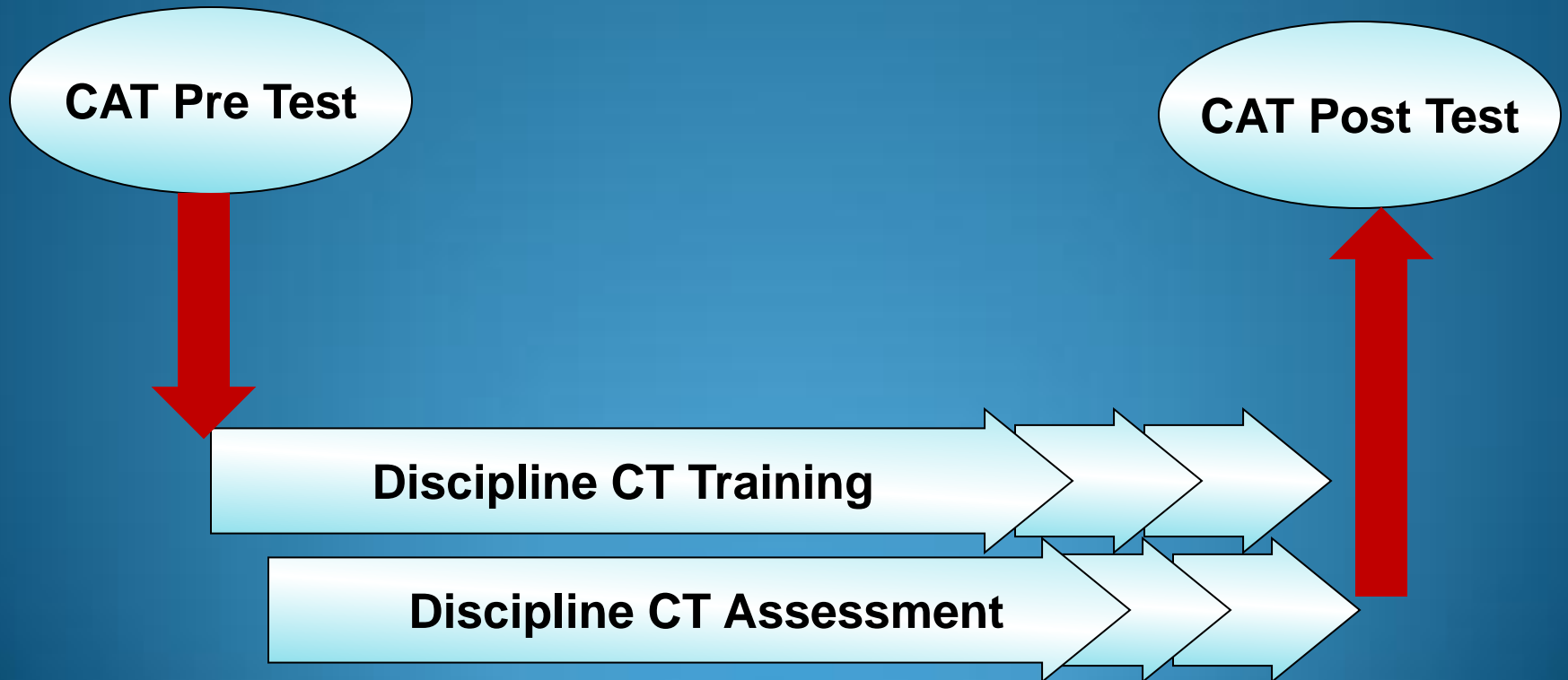
Assessment Uses of CAT



CAT Instrument Sensitive to Class Standing & Individual Courses



Using the CAT to Assess Transfer from Discipline Specific CT Training



CAT Means Comparison Report
Sample Institution: Date 2010 (N=25)

Evaluate and Interpret Info	Problem Solving	Creative Thinking	Effective Comm.	Skill Assessed by CAT Question	Institution			
					Pre Mean	Post Mean	Probability of difference ^a	Effect Size ^b
X				Q1 Summarize the pattern of results in a graph without making inappropriate inferences.	.48	.52		
X			X	Q2 Evaluate how strongly correlational-type data supports a hypothesis.	.39	.45		
		X	X	Q3 Provide alternative explanations for a pattern of results that has many possible causes.	.79	1.37	*	+ .58
	X	X	X	Q4 Identify additional information needed to evaluate a hypothesis.	.81	1.46	**	+ .78
X				Q5 Evaluate whether spurious information strongly supports a hypothesis.	.58	.55		
		X	X	Q6 Provide alternative explanations for spurious associations.	.91	1.30	*	+ .46
	X	X	X	Q7 Identify additional information needed to evaluate a hypothesis.	.58	1.00	**	+ .68
X				Q8 Determine whether an invited inference is supported by specific information.	.45	.55		
		X	X	Q9 Provide relevant alternative interpretations for a specific set of results.	.70	1.12	*	+ .55
X	X			Q10 Separate relevant from irrelevant information when solving a real-world problem.	3.39	3.15		
X	X		X	Q11 Use and apply relevant information to evaluate a problem.	1.15	1.21		
	X			Q12 Use basic mathematical skills to help solve a real-world problem.	.79	.82		
X	X			Q13 Identify suitable solutions for a real-world problem using relevant information.	.88	.87		
X	X		X	Q14 Identify and explain the best solution for a real-world problem using relevant information.	1.30	1.34		
	X	X	X	Q15 Explain how changes in a real-world problem situation might affect the solution.	.30	.82	**	+ .68
CAT Total Score					13.51	16.33	***	+ .55

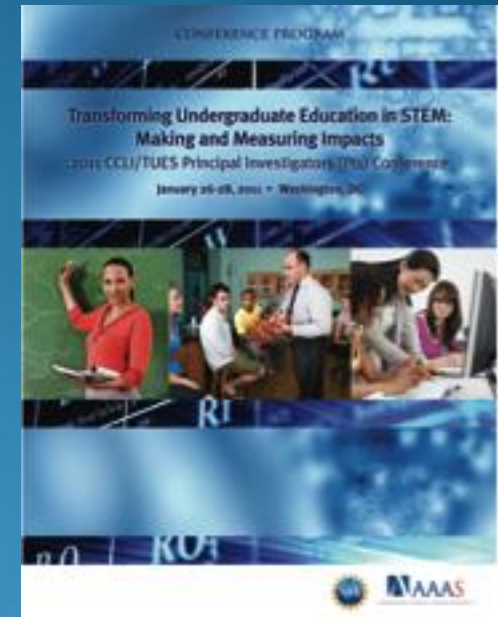
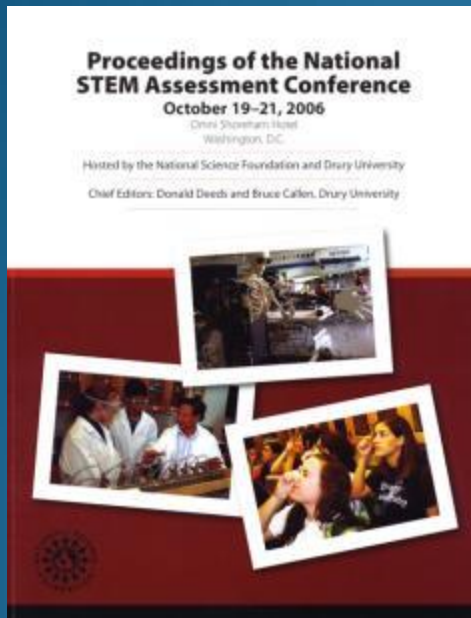
^a * p<.05 **p<.01 ***p<.001 (2-tailed)

^b Mean difference divided by pooled group standard deviation.
 (0.1 - 0.3 = small effect; 0.3 - 0.5 = moderate effect; >0.5 = large effect)

The map of skills covered by each question above is a suggested theoretical guide for interpreting results.

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www.CriticalThinkingTest.org



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