Assessing Students' Critical Thinking: What We Are Learning from Institutional Use of the CAT Instrument

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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.

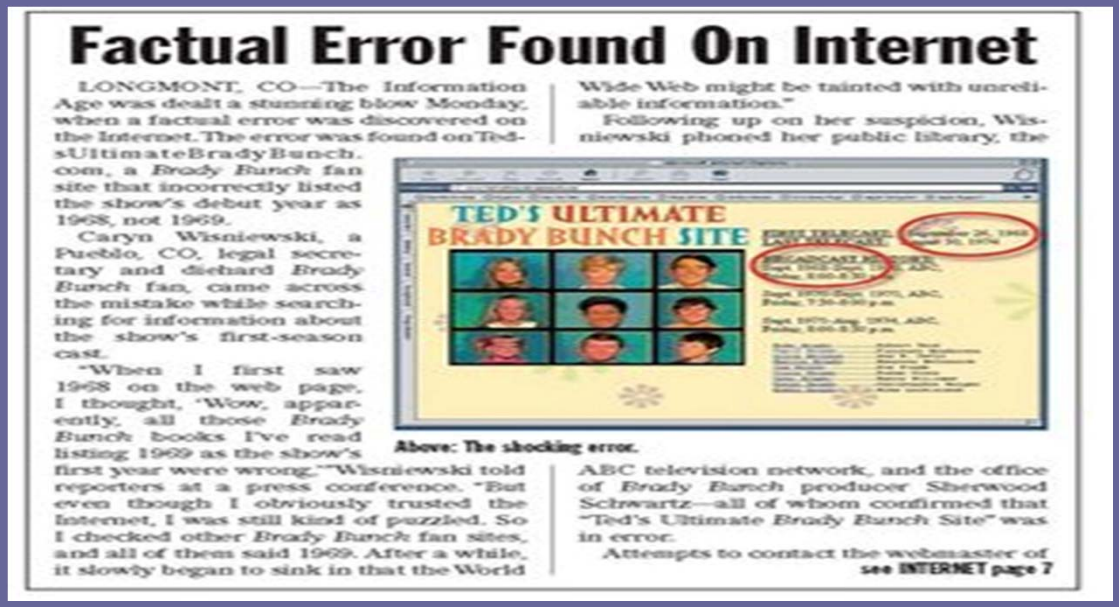
Derek Bok, 2005

President Emeritus of Harvard University

Link

Information and the Internet

75% of College Students use the Internet as Primary Method of Searching for Information



Factual Error Found On Internet

LONGMONT, CO—The Information Age was dealt a stunning blow Monday, when a factual error was discovered on the Internet. The error was found on TedsUltimateBradyBunch.com, a *Brady Bunch* fan site that incorrectly listed the show's debut year as 1968, not 1969.

Caryn Wisniewski, a Pueblo, CO, legal secretary and diehard *Brady Bunch* fan, came across the mistake while searching for information about the show's first-season cast.

"When I first saw 1968 on the web page, I thought, 'Wow, apparently, all those *Brady Bunch* books I've read listing 1969 as the show's first year were wrong.'" Wisniewski told reporters at a press conference. "But even though I obviously trusted the Internet, I was still kind of puzzled. So I checked other *Brady Bunch* fan sites, and all of them said 1969. After a while, it slowly began to sink in that the World Wide Web might be tainted with unreliable information."

Following up on her suspicion, Wisniewski phoned her public library, the

Above: The shocking error.

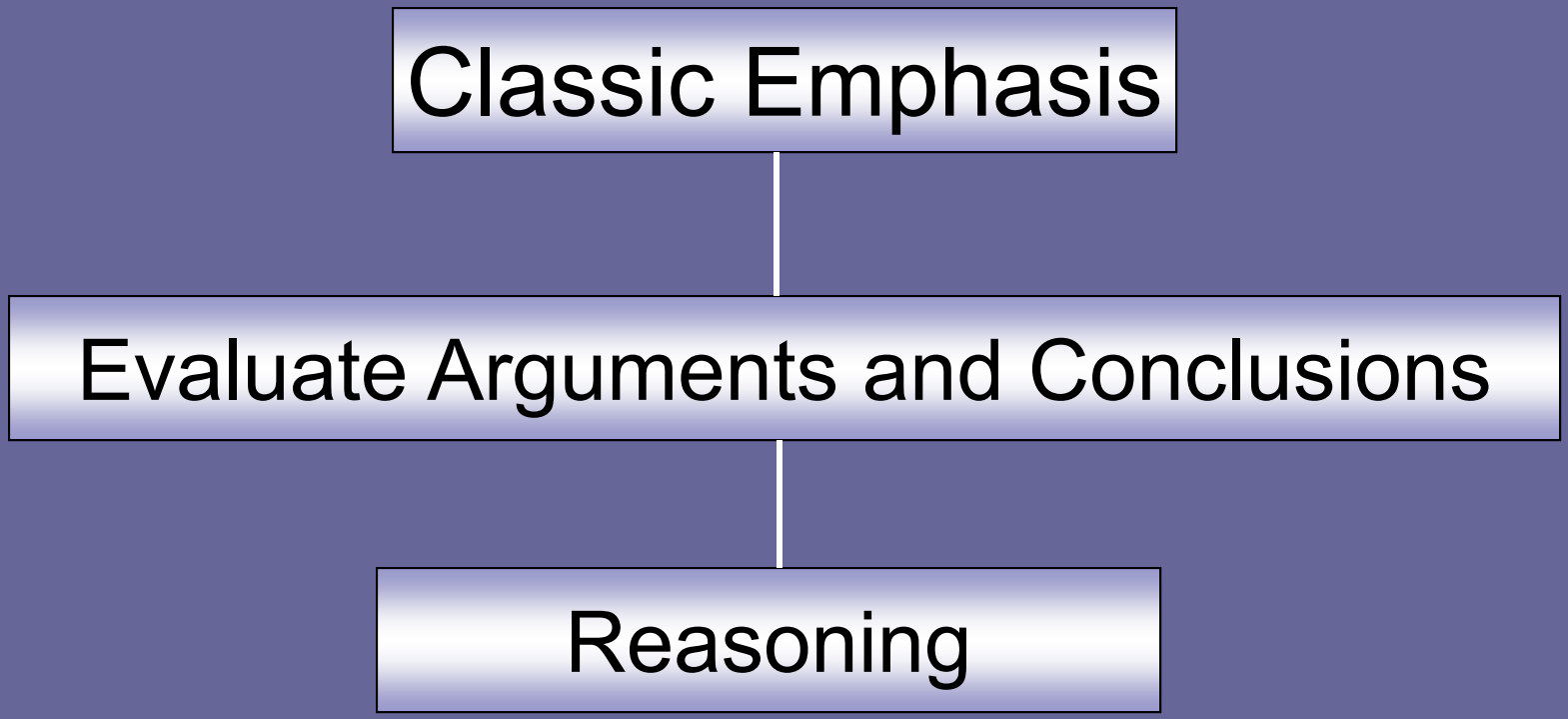
ABC television network, and the office of *Brady Bunch* producer Sherwood Schwartz—all of whom confirmed that "Ted's Ultimate *Brady Bunch* Site" was in error.

Attempts to contact the webmaster of

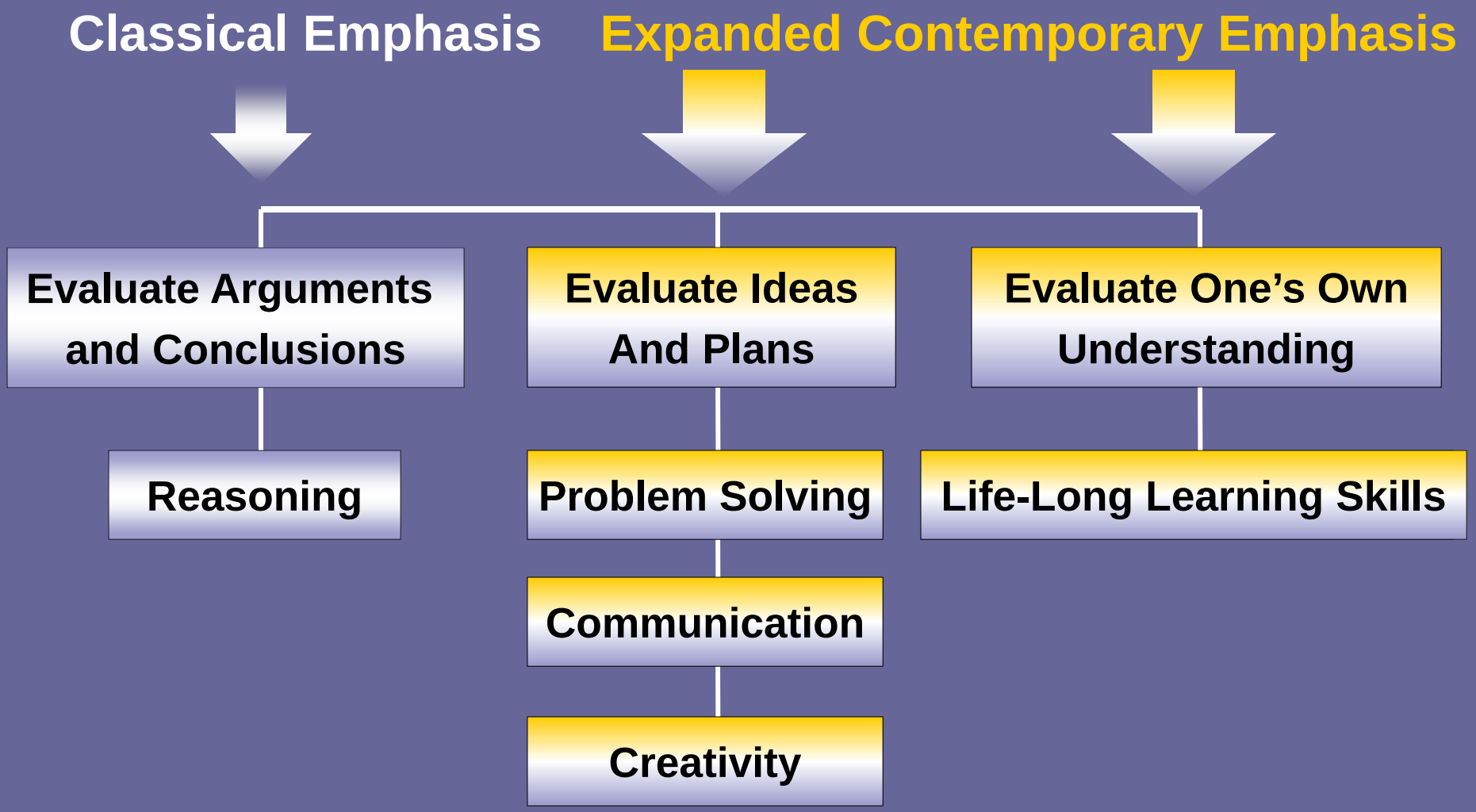
see INTERNET page 7

31% of Population Use the Internet as Primary Source of Healthcare Information

What is Critical Thinking?



What is Critical Thinking?



Bloom's Classic Taxonomy

Evaluation
Synthesis
Analysis
Application
Comprehension

Information (rote retention)

Critical Thinking

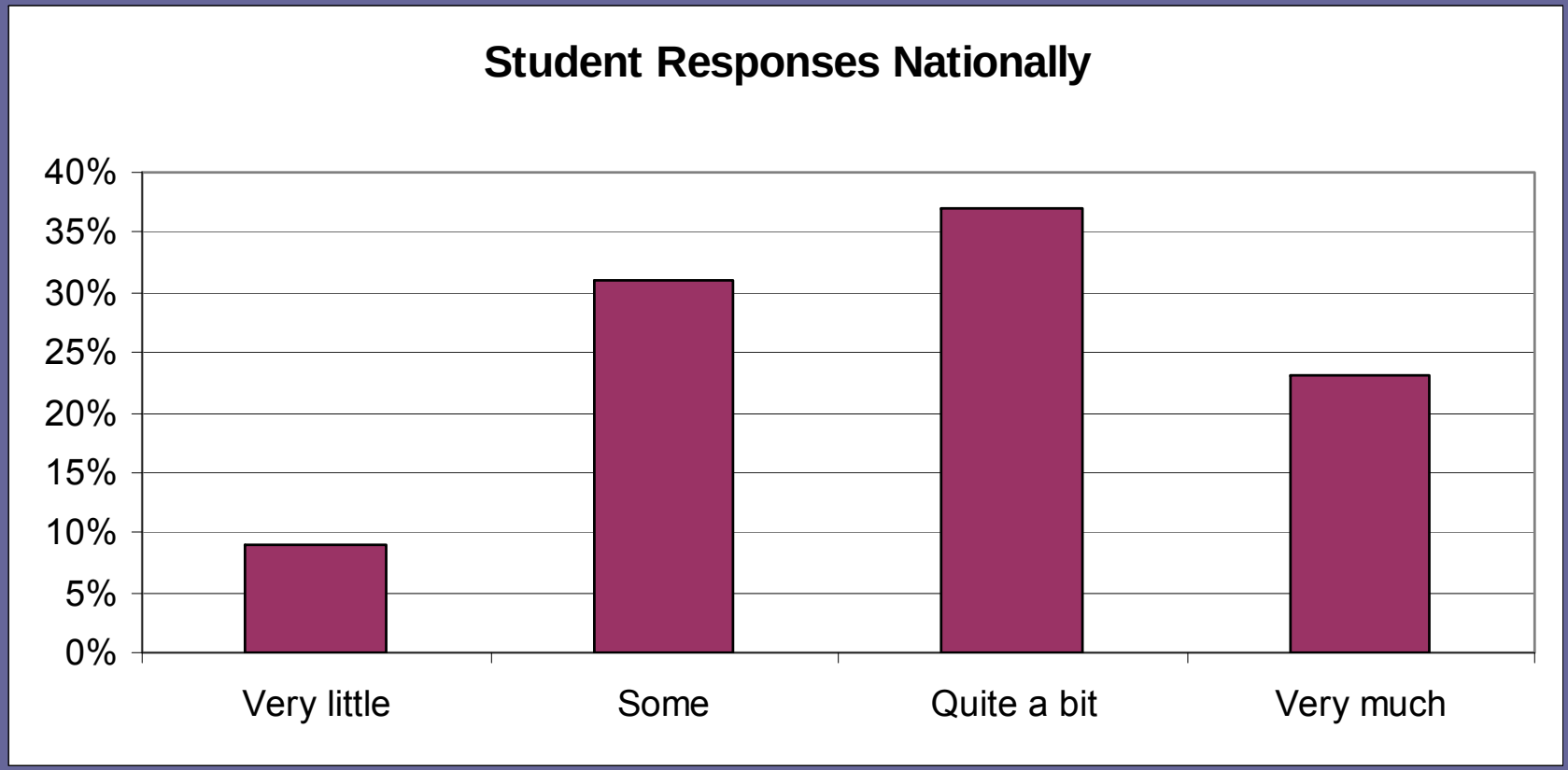
Agreement on what is not Critical Thinking

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

Video

***National Survey of Student Engagement , Indiana University**

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



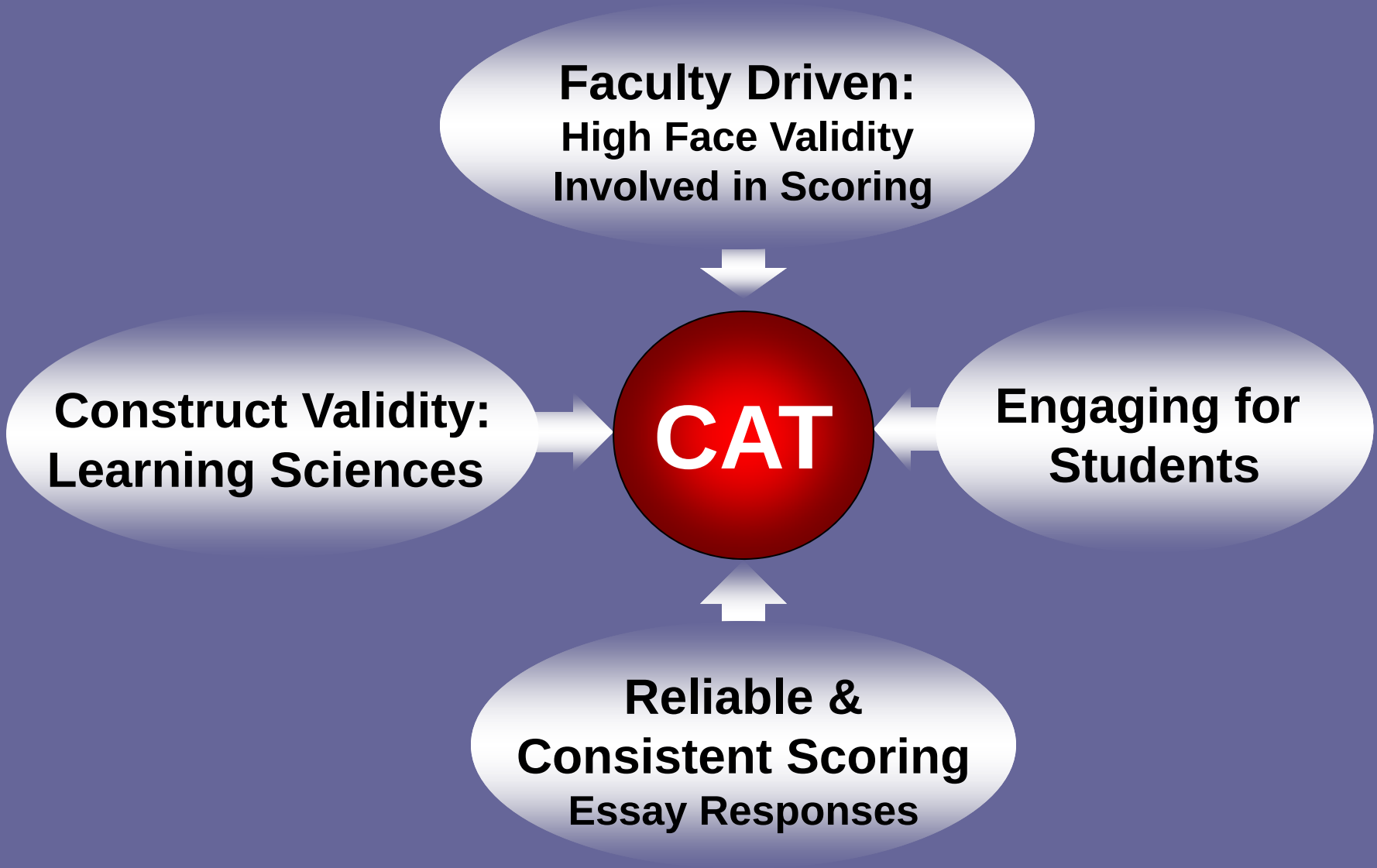
Why Assess Critical Thinking?

Need to Measure Success for Accountability

Assessment Drives Improvement Efforts

How We Assess - Determines What Students Learn

Designing the CAT Instrument



History of CAT Development

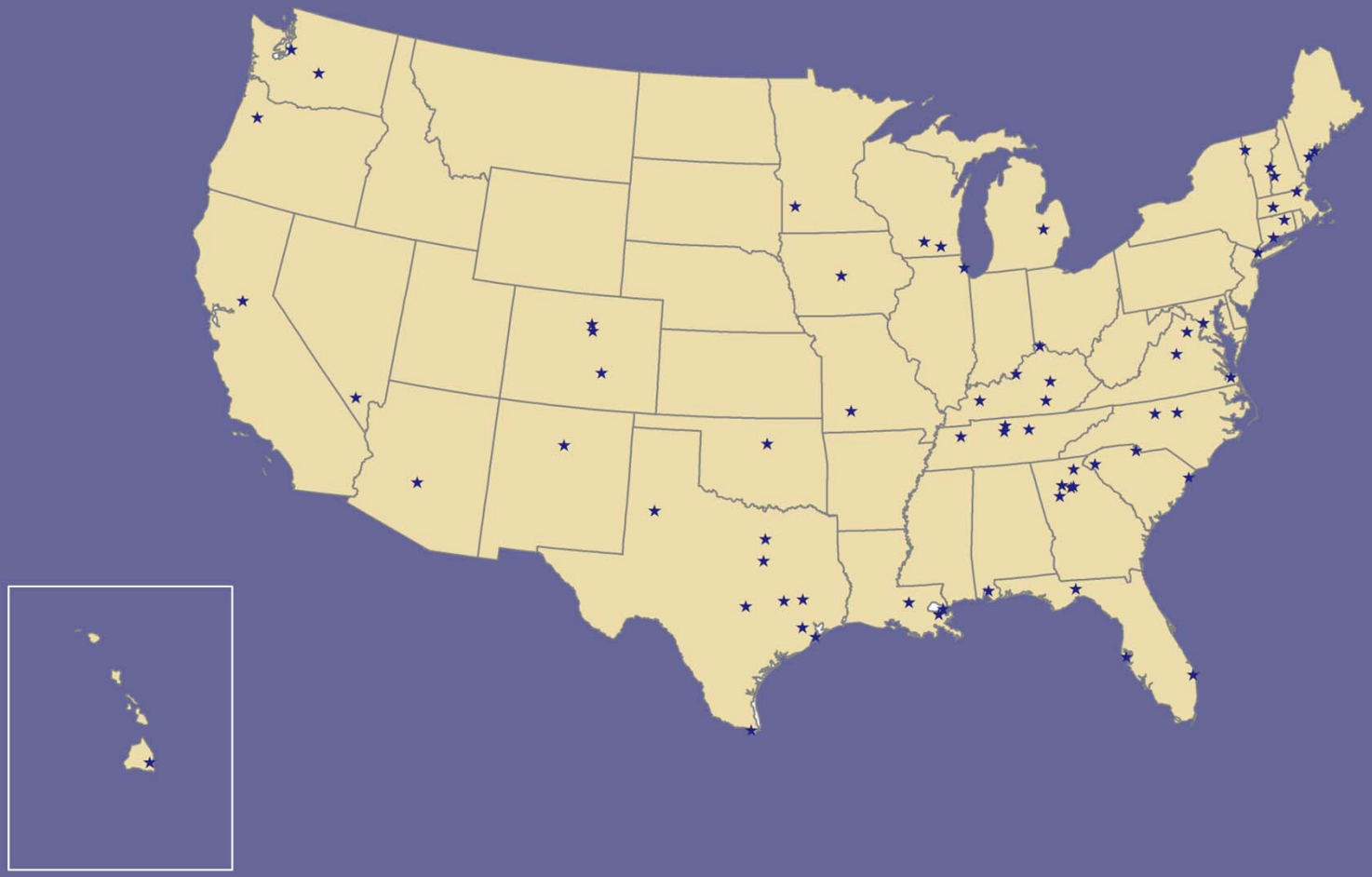
Preliminary Work At TTU 2000 - 2004

Collaborate With Other Institutions To Refine CAT
2004 - 2007

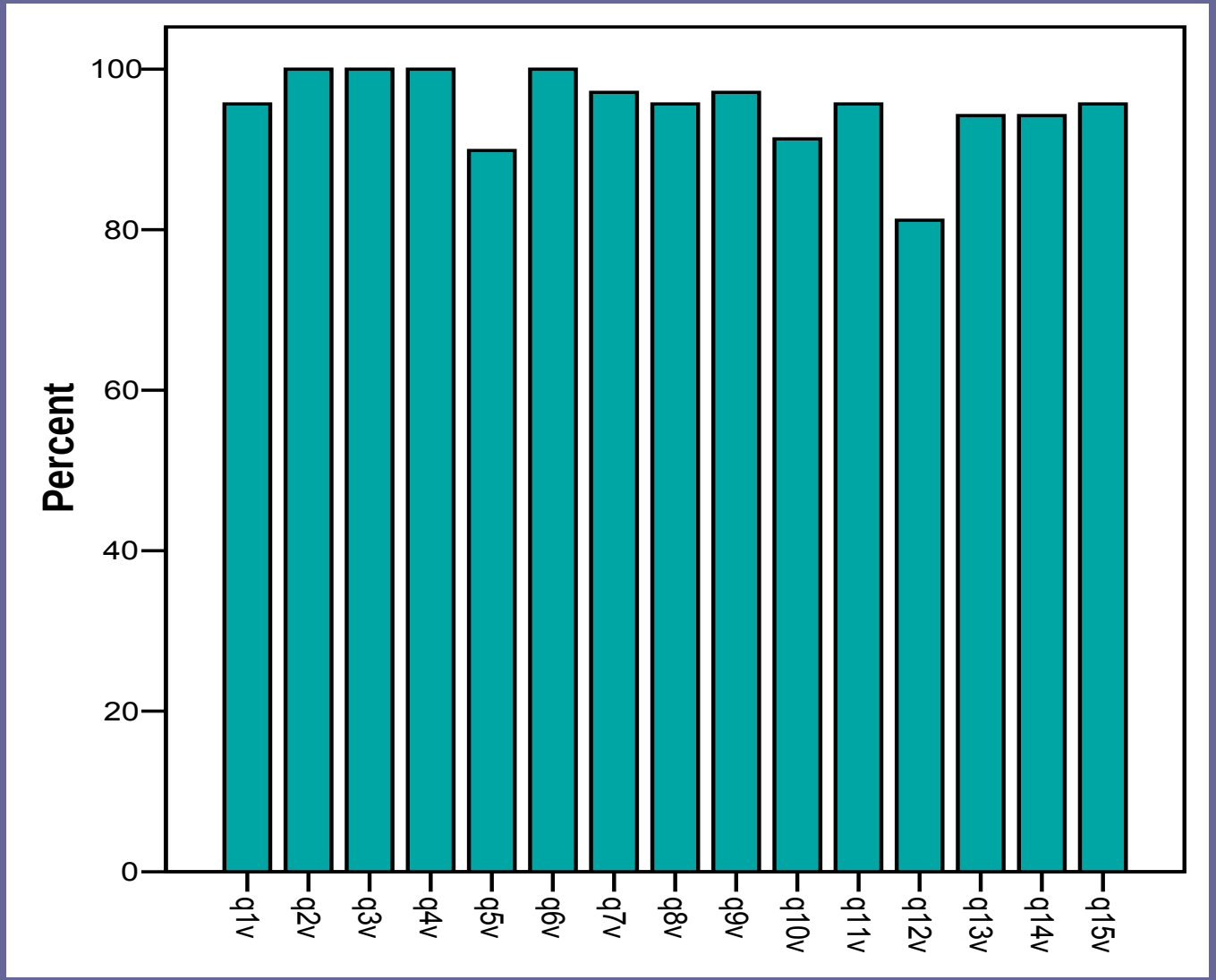
Develop Training Methods for National Dissemination & Collect Norms
2007 - 2010

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

Over 70 Institutions Collaborating



Faculty Evaluations of Question Validity



CAT Statistics

	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*

CAT Results with NSSE

(National Survey of Student Engagement)

Multiple R = .490

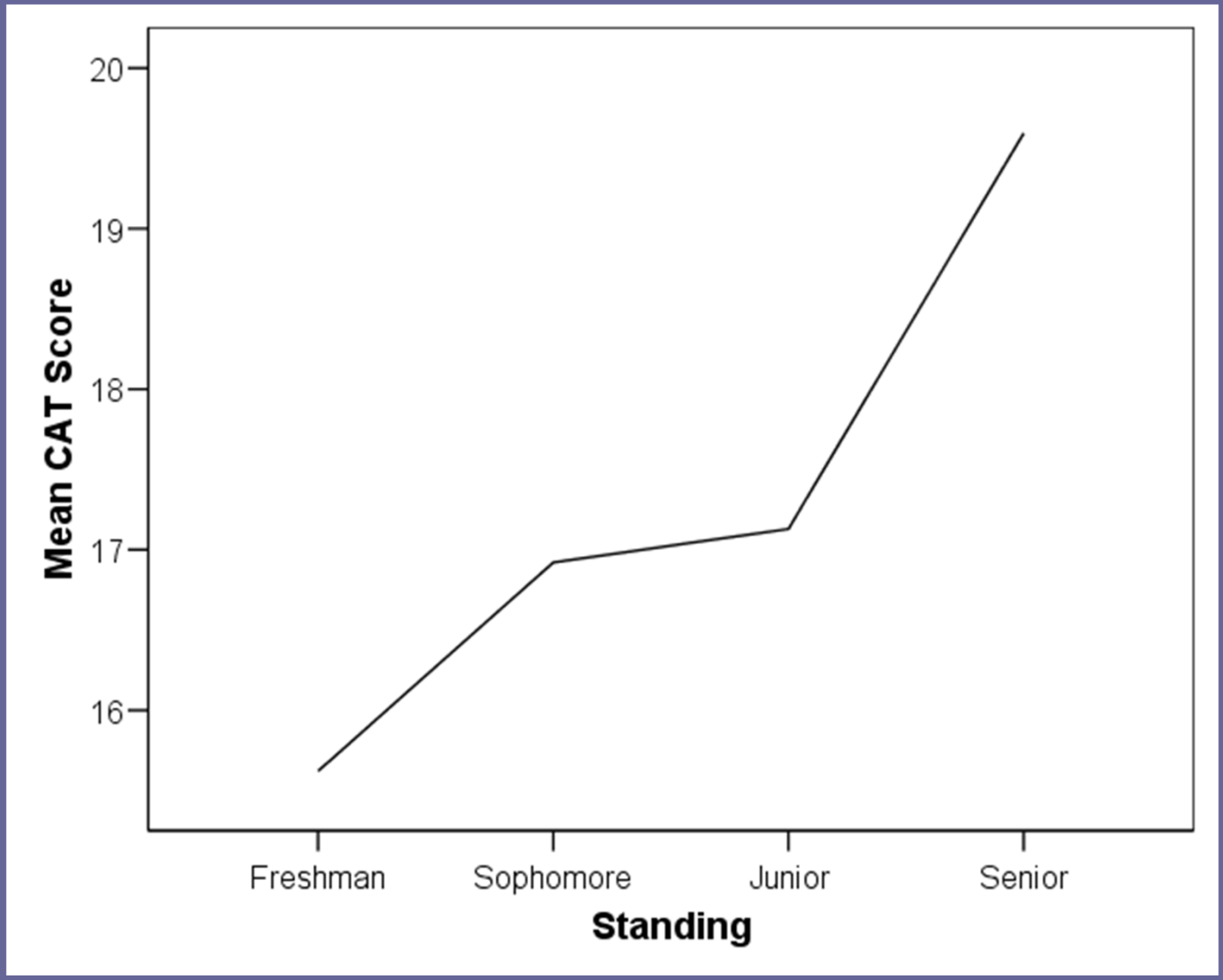
(explains 24% of variability in CAT)

NSSE Question	Beta Coefficient
(2a) Memorizing facts, ideas, or methods from your courses and readings so you can repeat them in pretty much the same form. *(negative relationship)*	-.341 **
(3b) Number of books read on your own (not assigned) for personal enjoyment or academic enrichment.	.277 **
(11e) Thinking critically and analytically & (11m) Solving complex real-world problems	.244 **
(7h) Culminating Senior Experience (thesis, capstone course, project, comprehensive exam, etc.)	.231 *

* Significant at .01 level

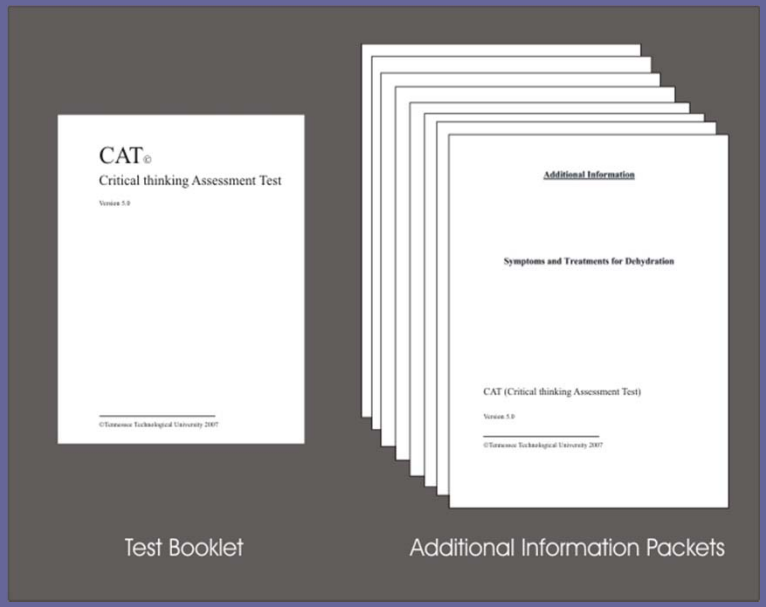
** Significant at .001 level

CAT Instrument Sensitive to Class Standing & Individual Courses



CAT features

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



Cost

$5 Test, $200 Year Participation Fee

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____

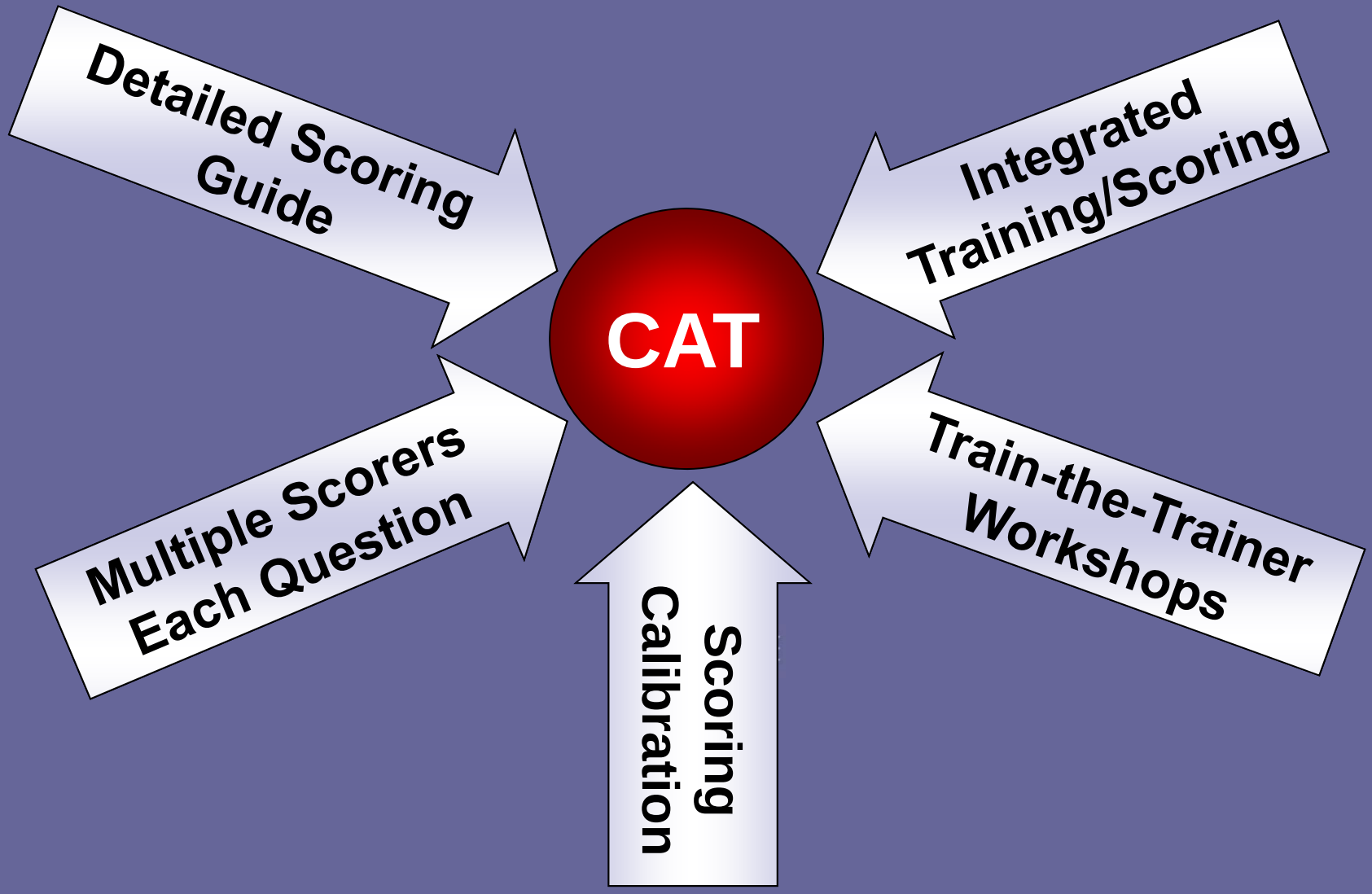
Are there other explanations for the data besides the scientist's theory? If so, describe.

_____

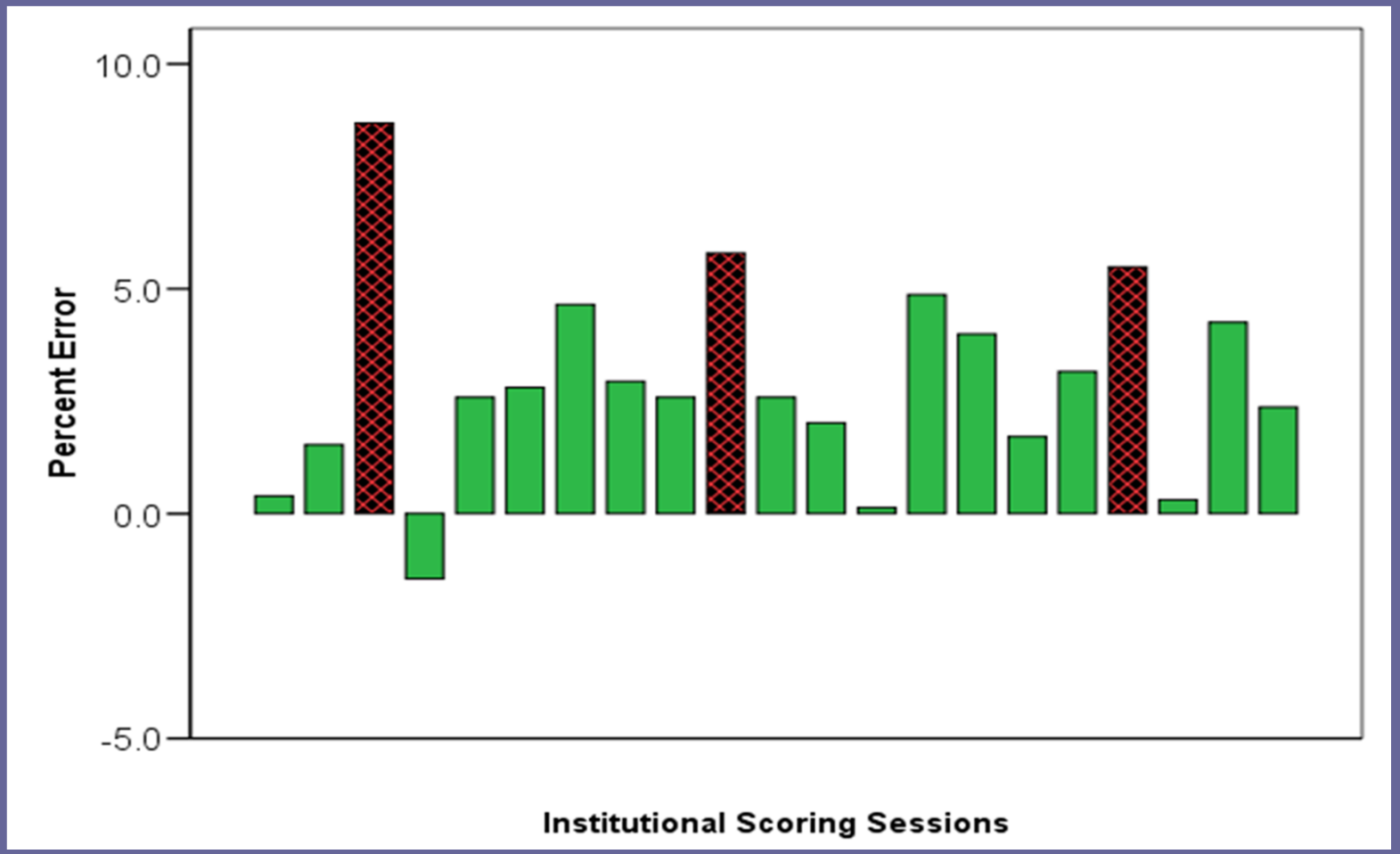
What kind of additional information or evidence would support the scientist's theory?

_____

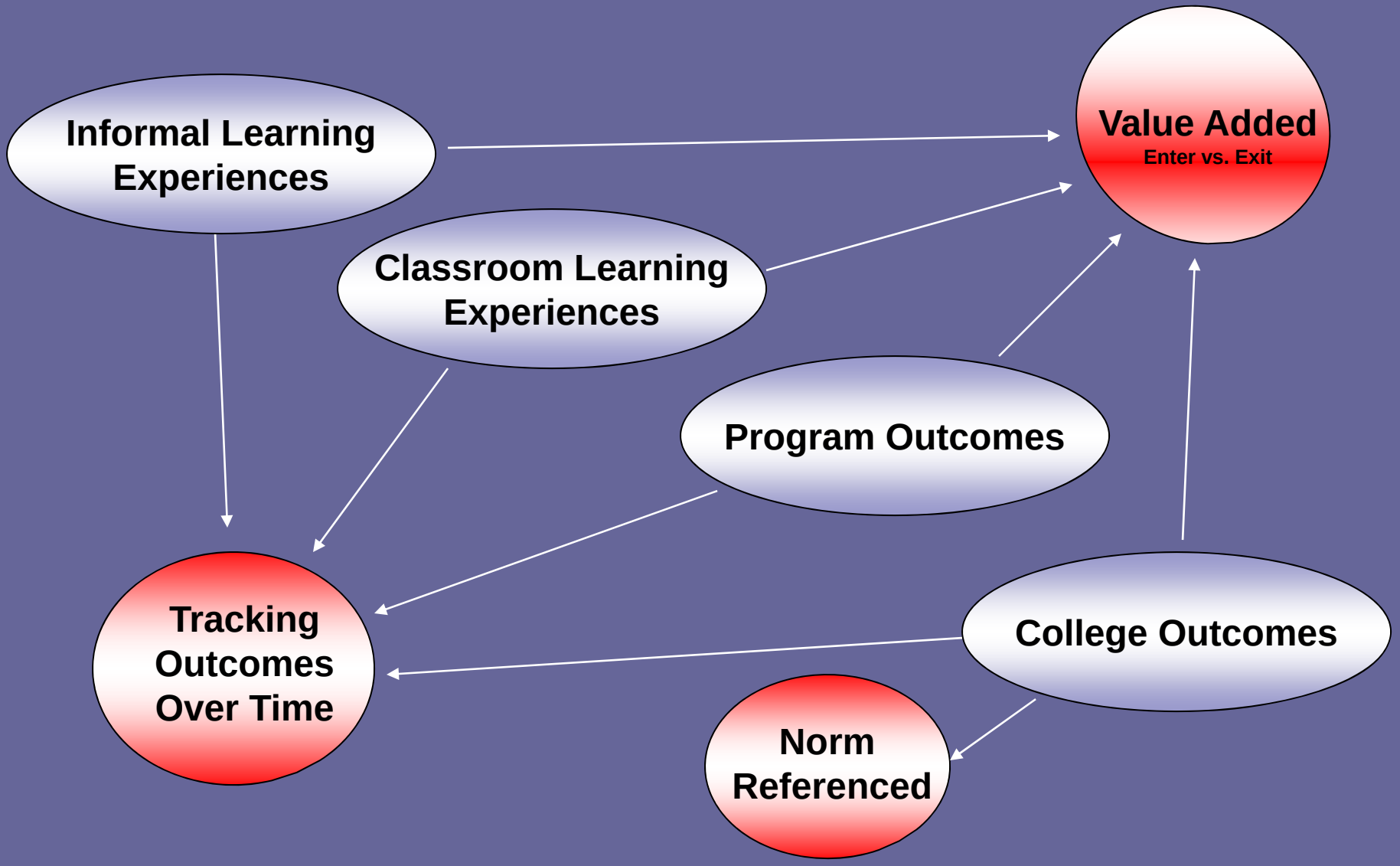
Ensuring Reliability of Scoring



Scoring Accuracy:
Other Institutions – TTU rescore



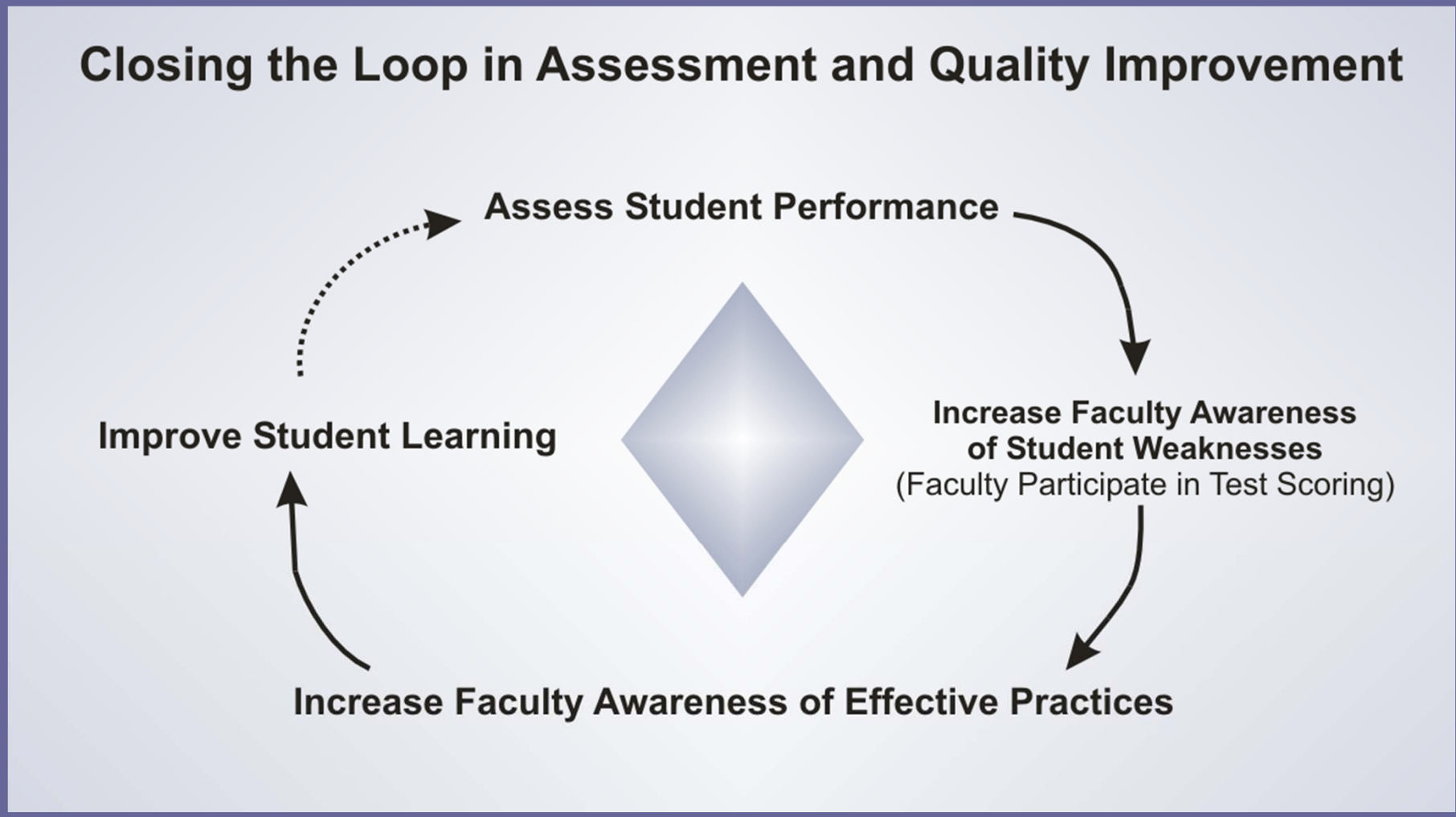
Assessment Uses of CAT



Effective Practices Are A Moving Target

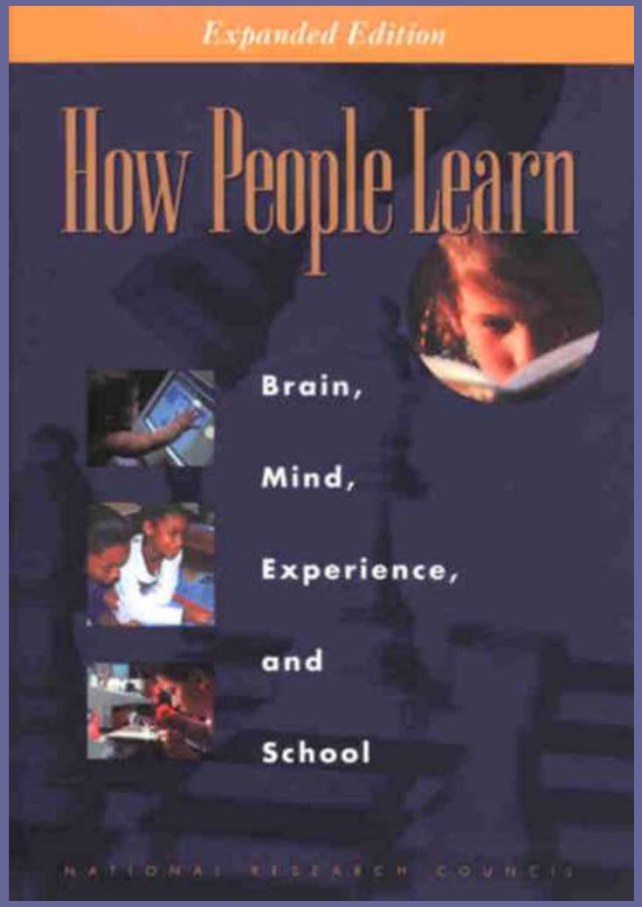
Video

Closing the Loop in Assessment and Quality Improvement



Professional Development: Faculty Involvement in CAT Scoring

Effective Practices



Student Centered

Knowledge Centered

Assessment Centered

Community Centered

General Implications

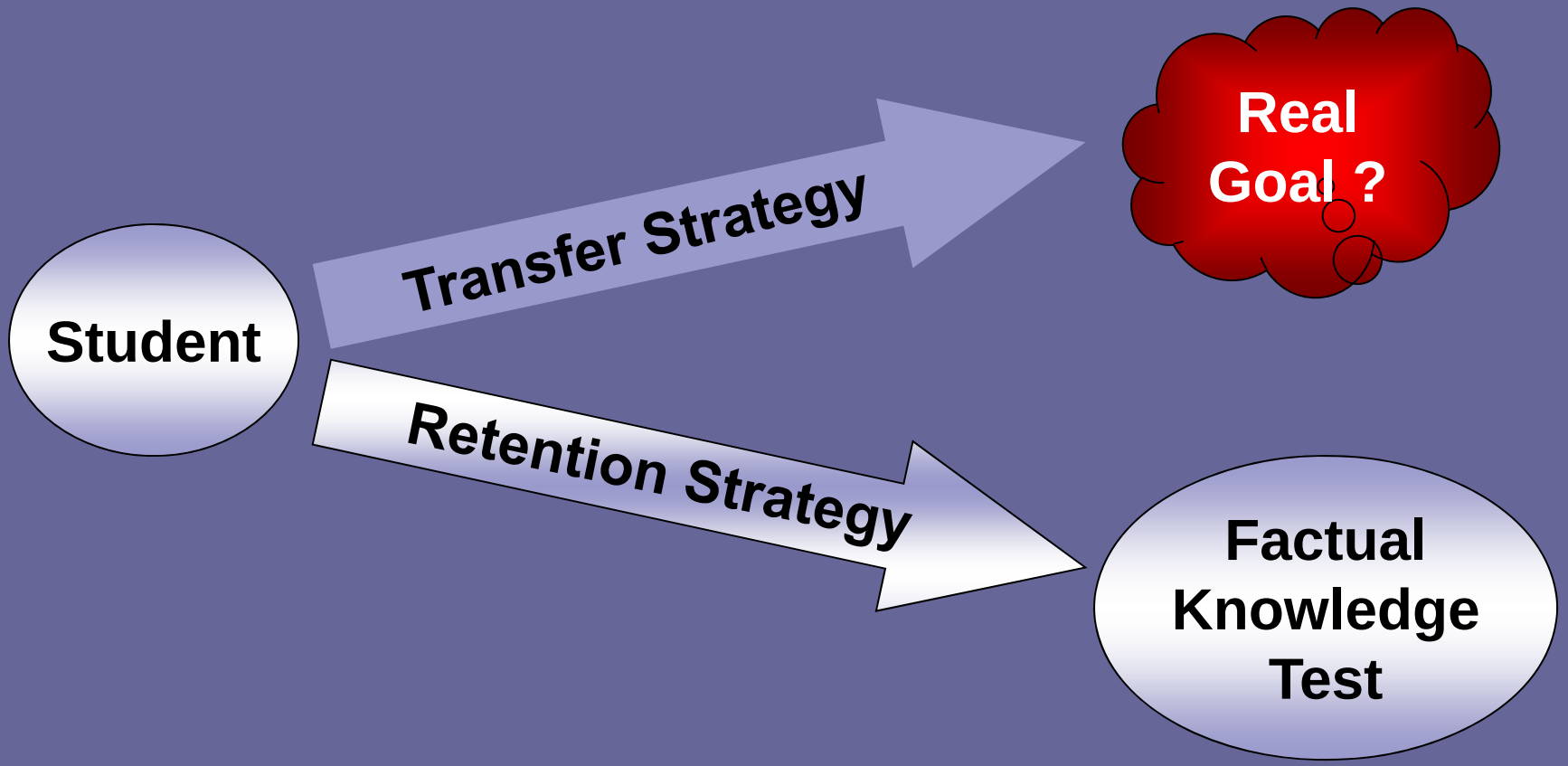
Learning for Rote Retention ≠ Problem Solving/Transfer

Prior Knowledge can Impede or Facilitate Learning

Transfer is Difficult – Requires Active Learning in Varied Contexts with Reflection

Assessments Measure Certain Types of Learning but also Establish Expectations

Relationship Between Assessment & Learning Strategy Selection



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.

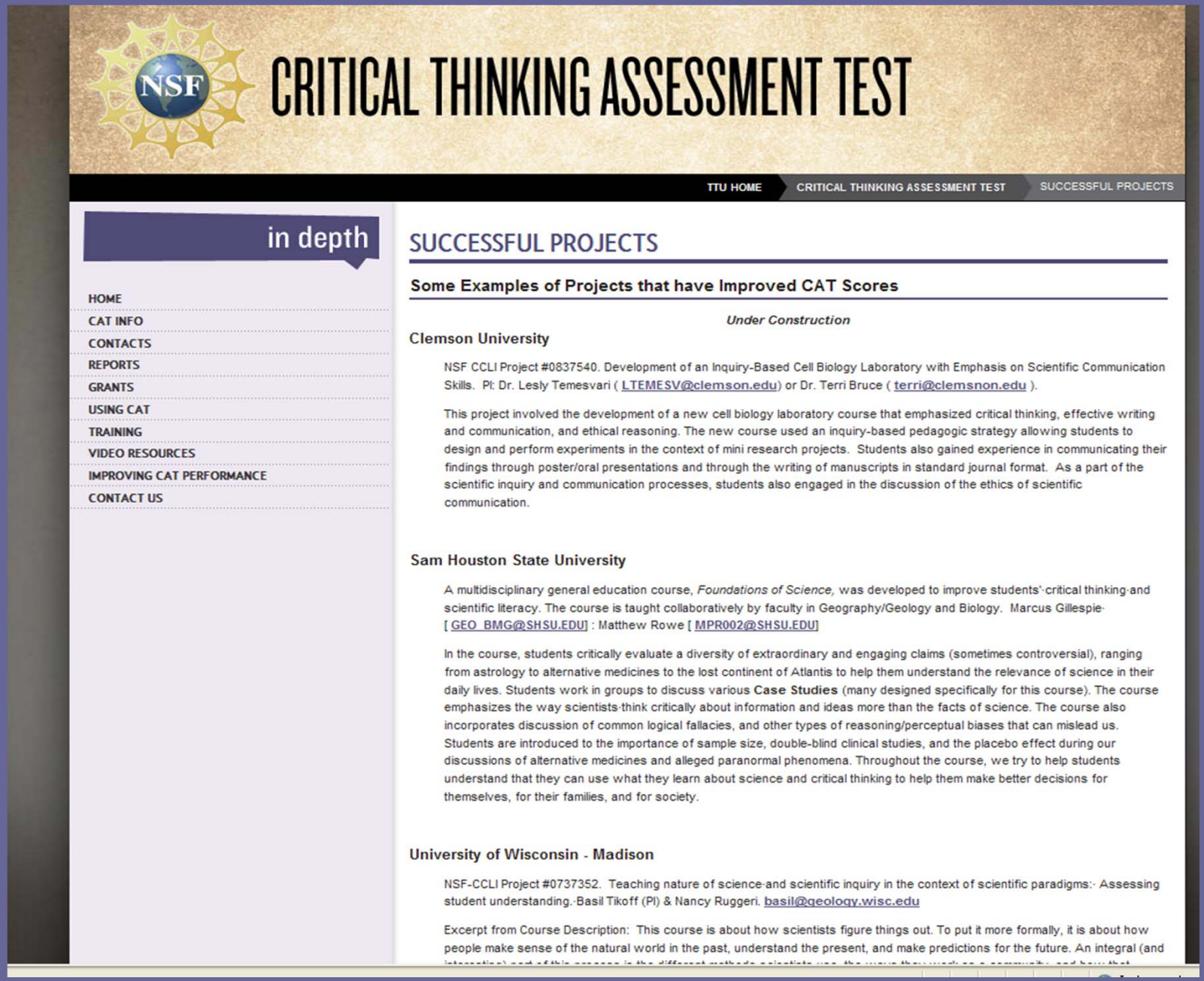
Learning & Problem Solving

- 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.

Examples of Effective Practices for Teaching Critical Thinking

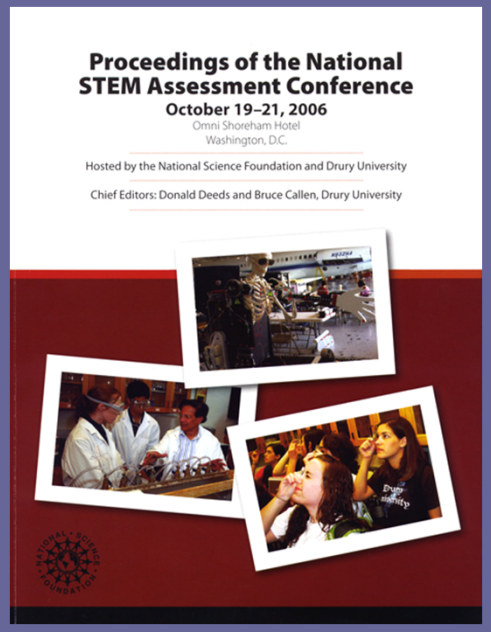

CRITICAL THINKING ASSESSMENT TEST
TTU HOME
CRITICAL THINKING ASSESSMENT TEST
SUCCESSFUL PROJECTS
in depth
HOME
CAT INFO
CONTACTS
REPORTS
GRANTS
USING CAT
TRAINING
VIDEO RESOURCES
IMPROVING CAT PERFORMANCE
CONTACT US
SUCCESSFUL PROJECTS
Some Examples of Projects that have Improved CAT Scores
Under Construction
Clemson University
NSF 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@clemsnon.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.
Sam Houston State University
A multidisciplinary general education course, Foundations of Science, was developed to improve students' critical thinking and scientific literacy. The course is taught collaboratively by faculty in Geography/Geology and Biology. Marcus Gillespie [GEO_BMG@SHSU.EDU] : Matthew Rowe [MPR002@SHSU.EDU]
In the course, students critically evaluate a diversity of extraordinary and engaging claims (sometimes controversial), ranging from astrology to alternative medicines to the lost continent of Atlantis to help them understand the relevance of science in their daily lives. Students work in groups to discuss various Case Studies (many designed specifically for this course). The course emphasizes the way scientists think critically about information and ideas more than the facts of science. The course also incorporates discussion of common logical fallacies, and other types of reasoning/perceptual biases that can mislead us. Students are introduced to the importance of sample size, double-blind clinical studies, and the placebo effect during our discussions of alternative medicines and alleged paranormal phenomena. Throughout the course, we try to help students understand that they can use what they learn about science and critical thinking to help them make better decisions for themselves, for their families, and for society.
University of Wisconsin - Madison
NSF-CCLI Project #0737352. Teaching nature of science and scientific inquiry in the context of scientific paradigms: Assessing student understanding. Basil Tikoff (PI) & Nancy Ruggeri. basil@geology.wisc.edu
Excerpt from Course Description: This course is about how scientists figure things out. To put it more formally, it is about how people make sense of the natural world in the past, understand the present, and make predictions for the future. An integral (and

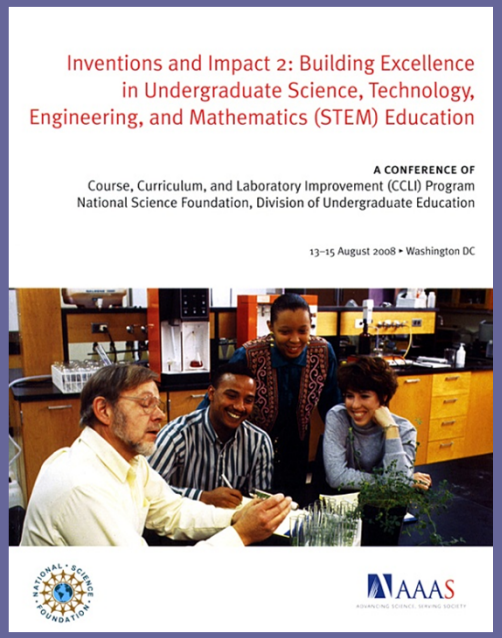
Motivating Faculty

- Participating in scoring session
- Establishing a faculty teaching community
- Provide small grants that provide resources for innovative practices
- Awards that include a dissemination component

Motivating Faculty

- Provide feedback through assessment
- Help faculty understand the connection between teaching, research, external grants, and service





Center for Assessment and Improvement of Learning

Tennessee Tech University

www.CriticalThinkingTest.org