Engaging Faculty in the Assessment and Improvement of Critical Thinking using the CAT Instrument

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SACS/COC 2011 Annual Meeting

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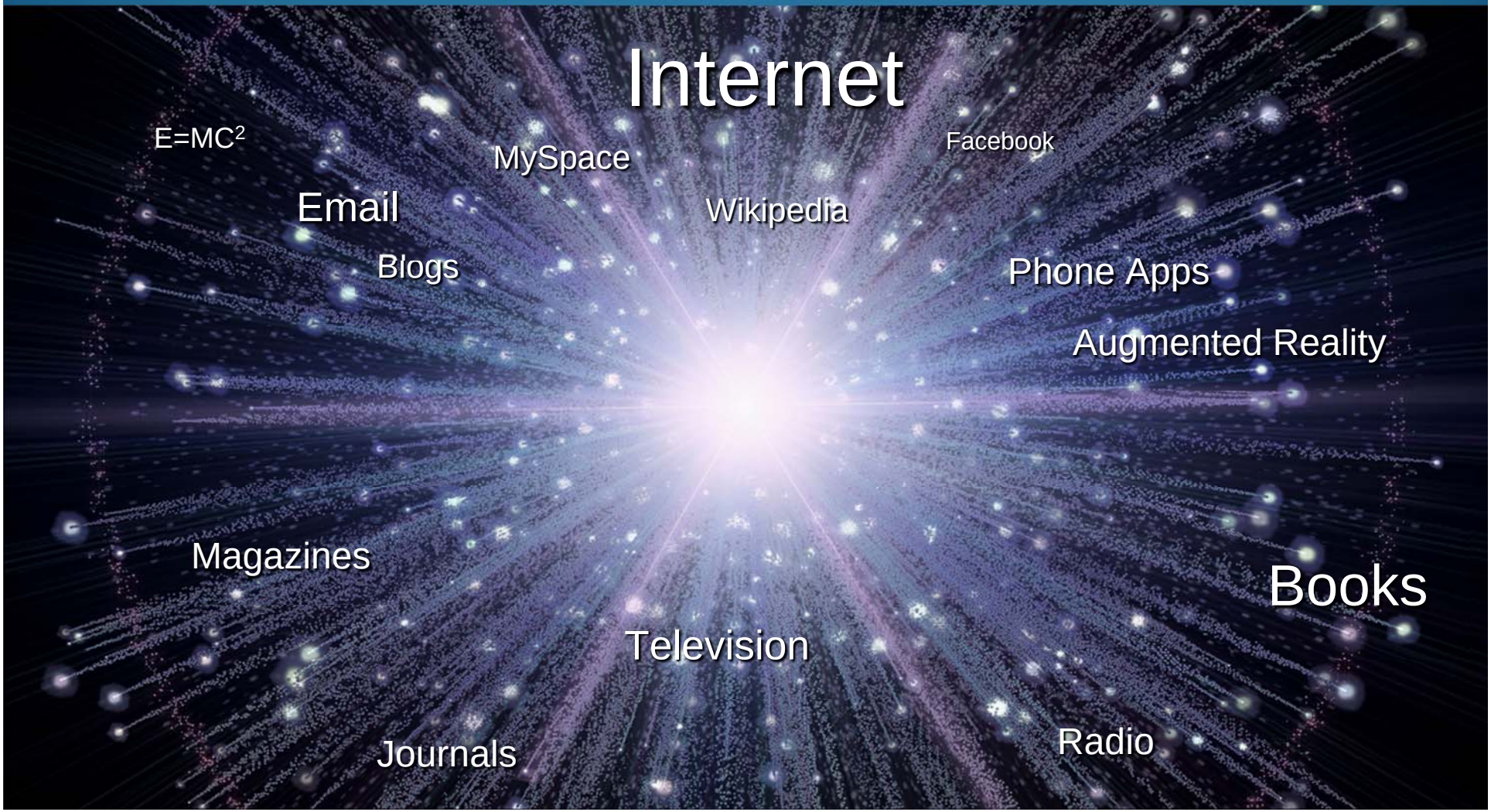
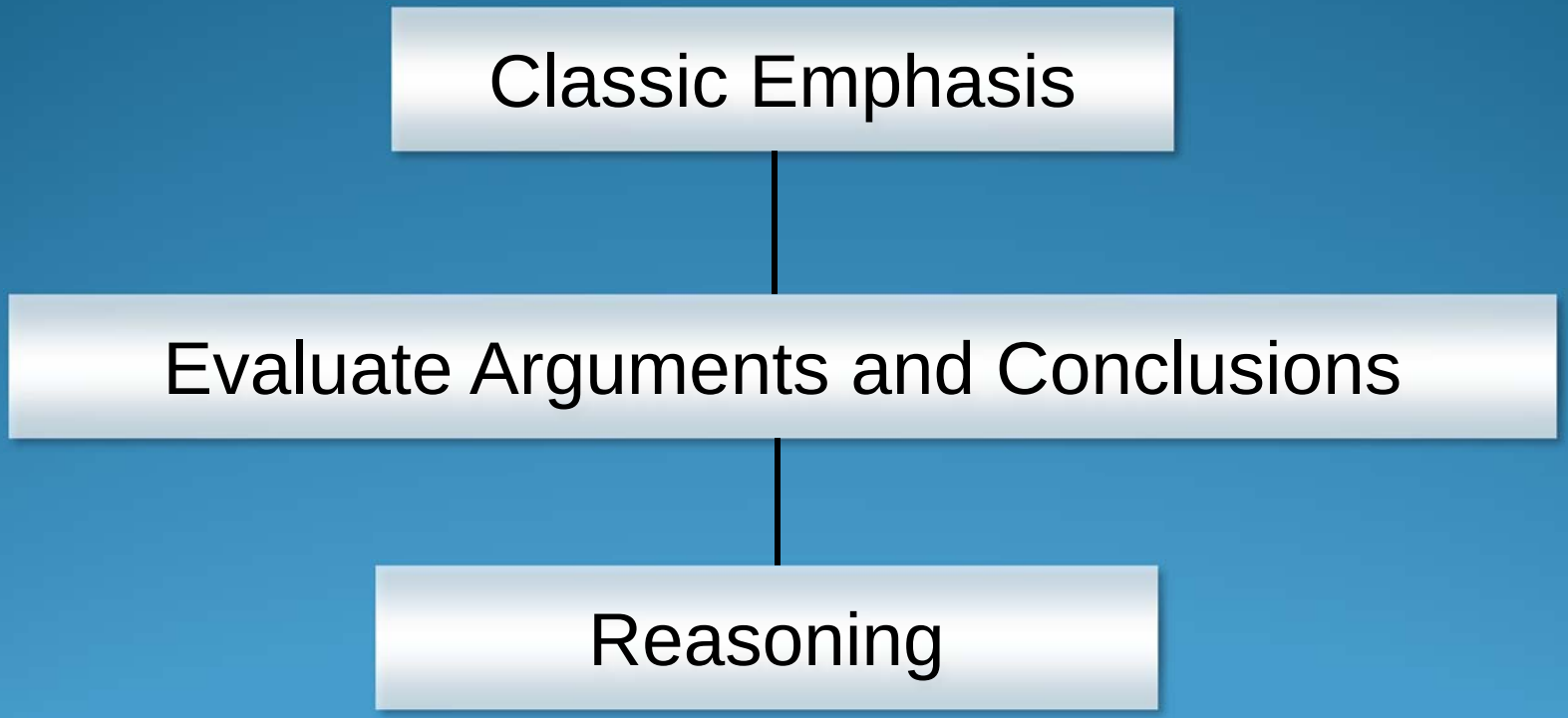
Importance of Critical Thinking

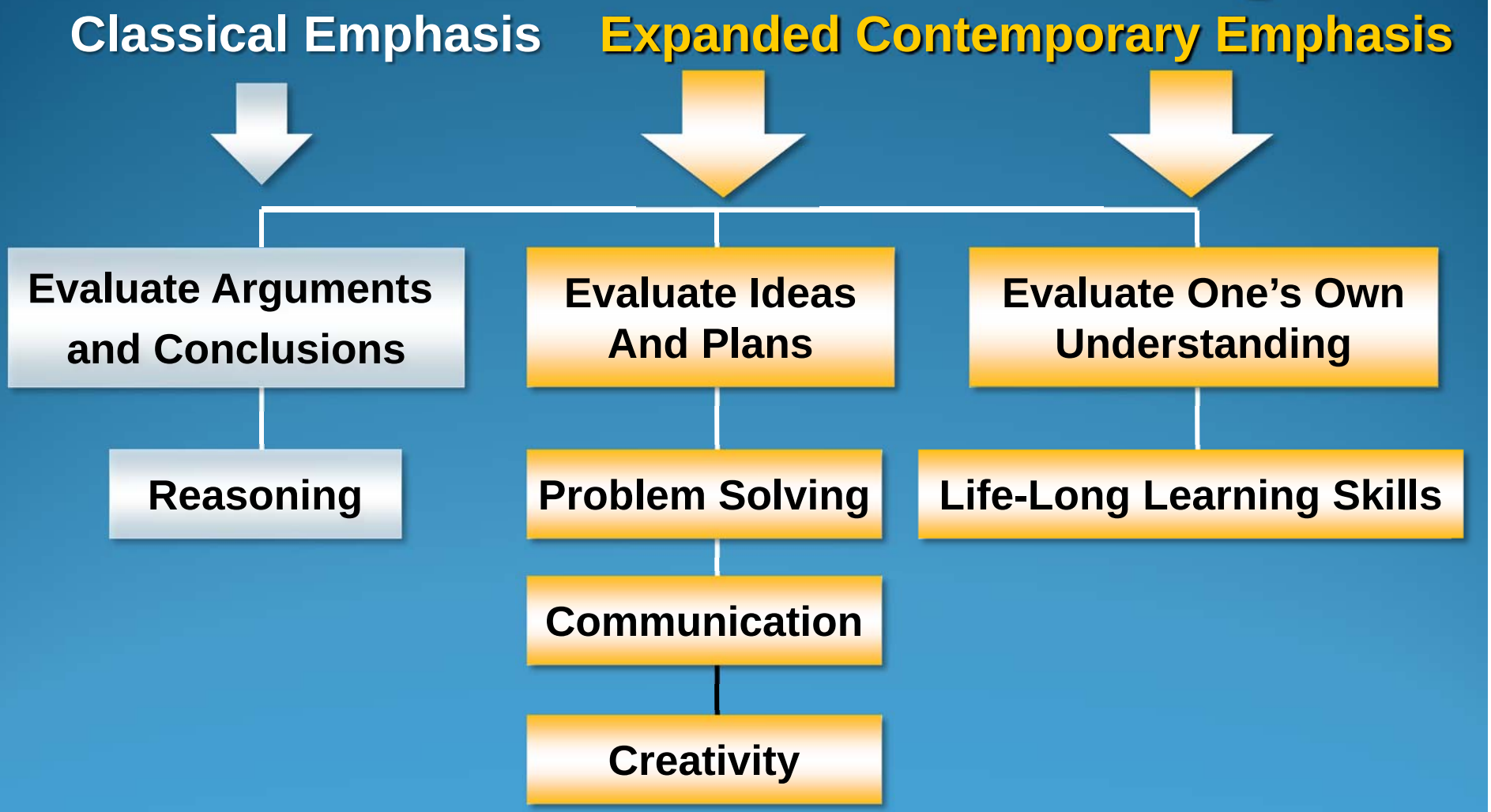
Explosion of Information



What is Critical Thinking?



What is Critical Thinking?



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

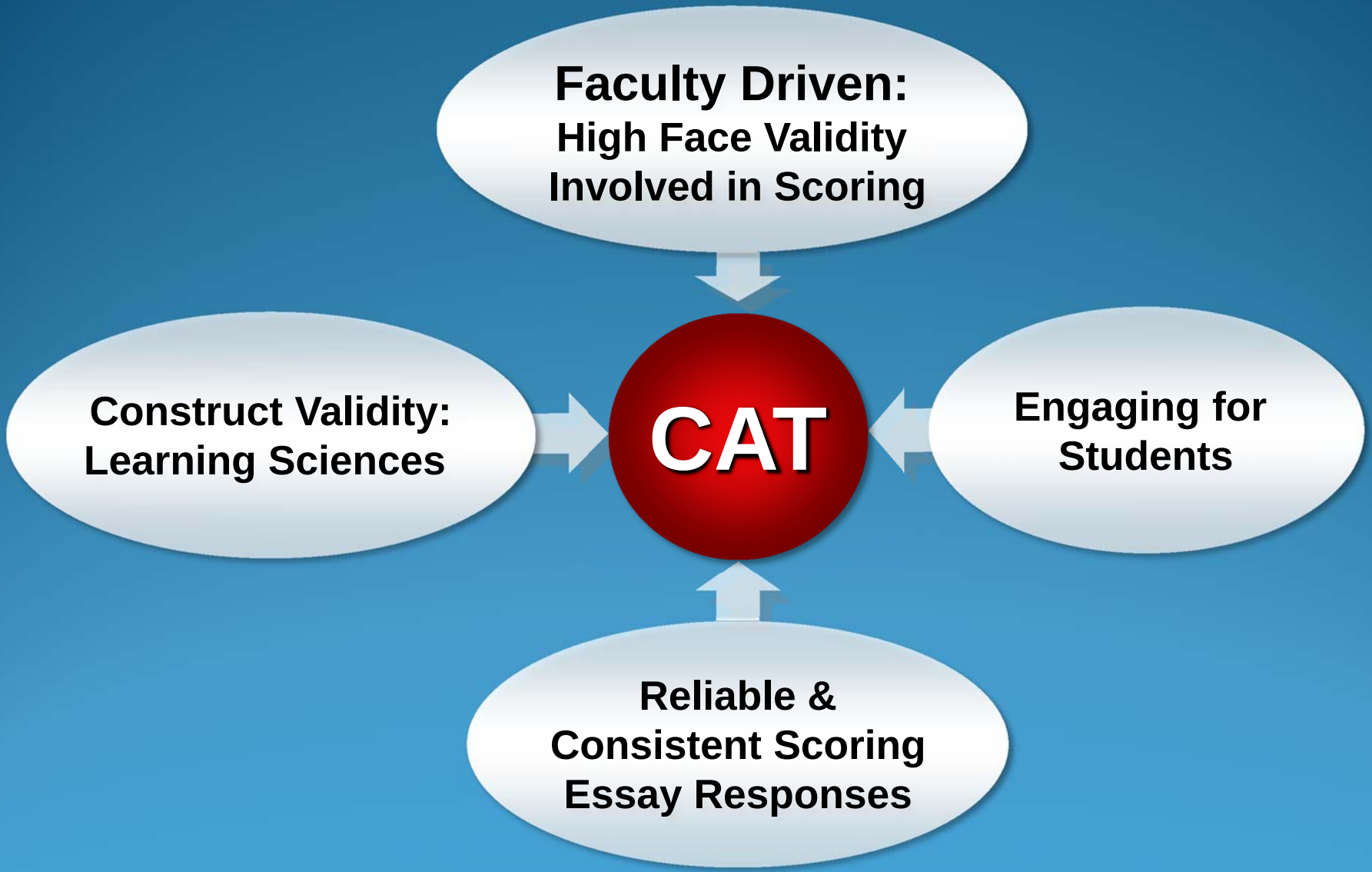
Collaborate With Other
Institutions To Refine CAT
2004 - 2007

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

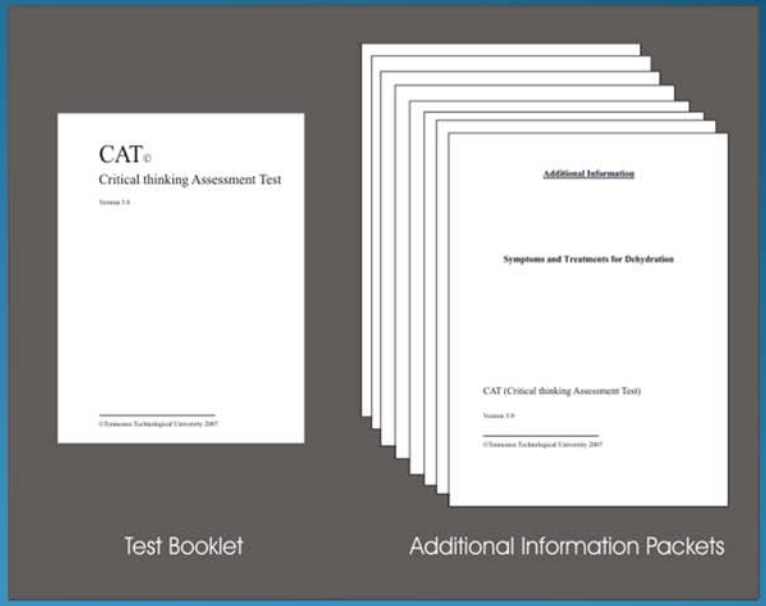
- Separate relevant from irrelevant information.
- Integrate information to solve problems.
- Learn & apply new information.
- Use mathematical skills to solve real-world problems.

Communication

- Communicate ideas effectively.

CAT Features

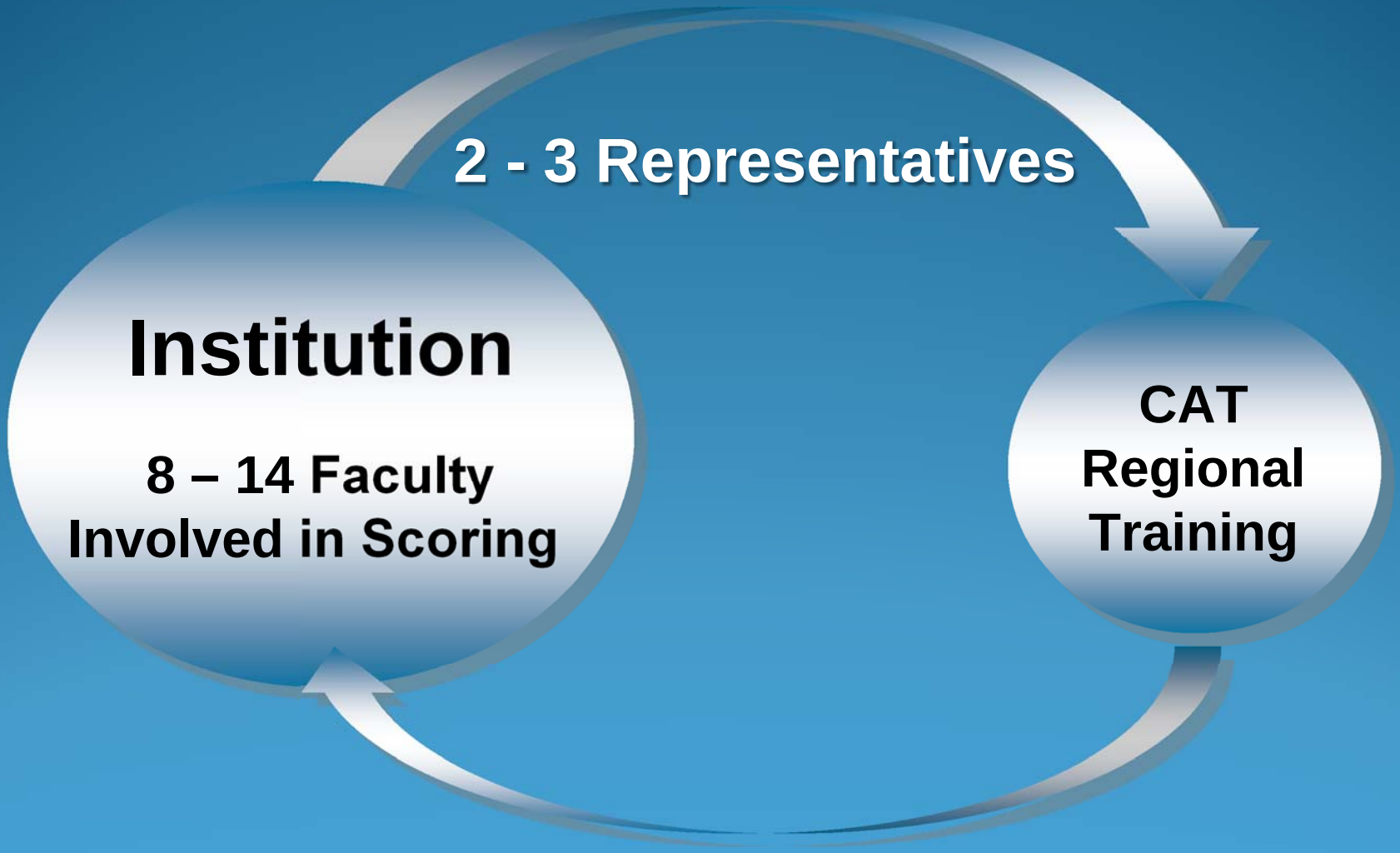
- One hour exam
- Mostly short answer essay
- Faculty scored in workshops
- Detailed scoring guide
- Reliable
- Valid



Cost

$6 Test, $200 Year Participation Fee

National Dissemination Model



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____

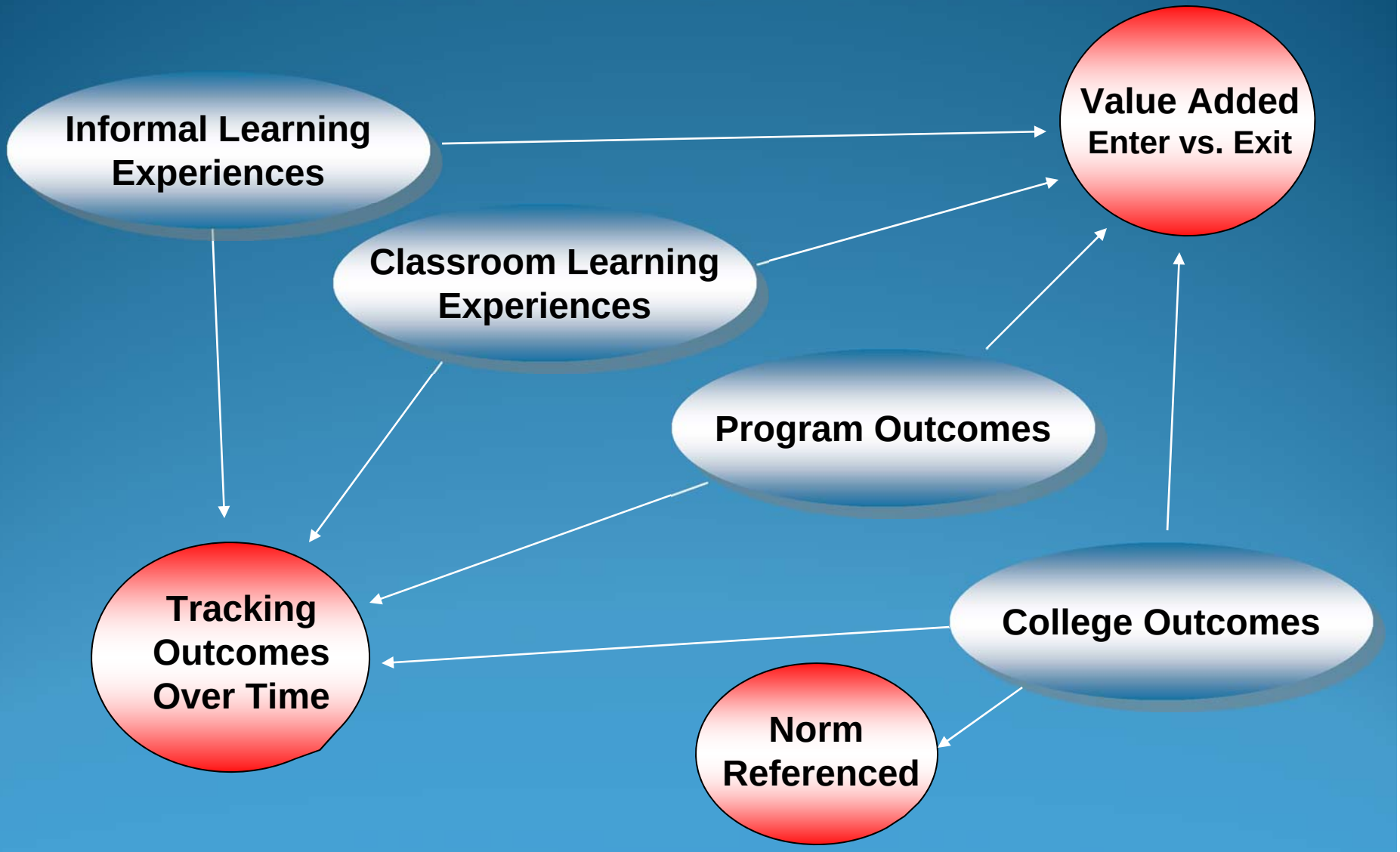
Are there other explanations for the data besides the scientist's theory? If so, describe.

_____

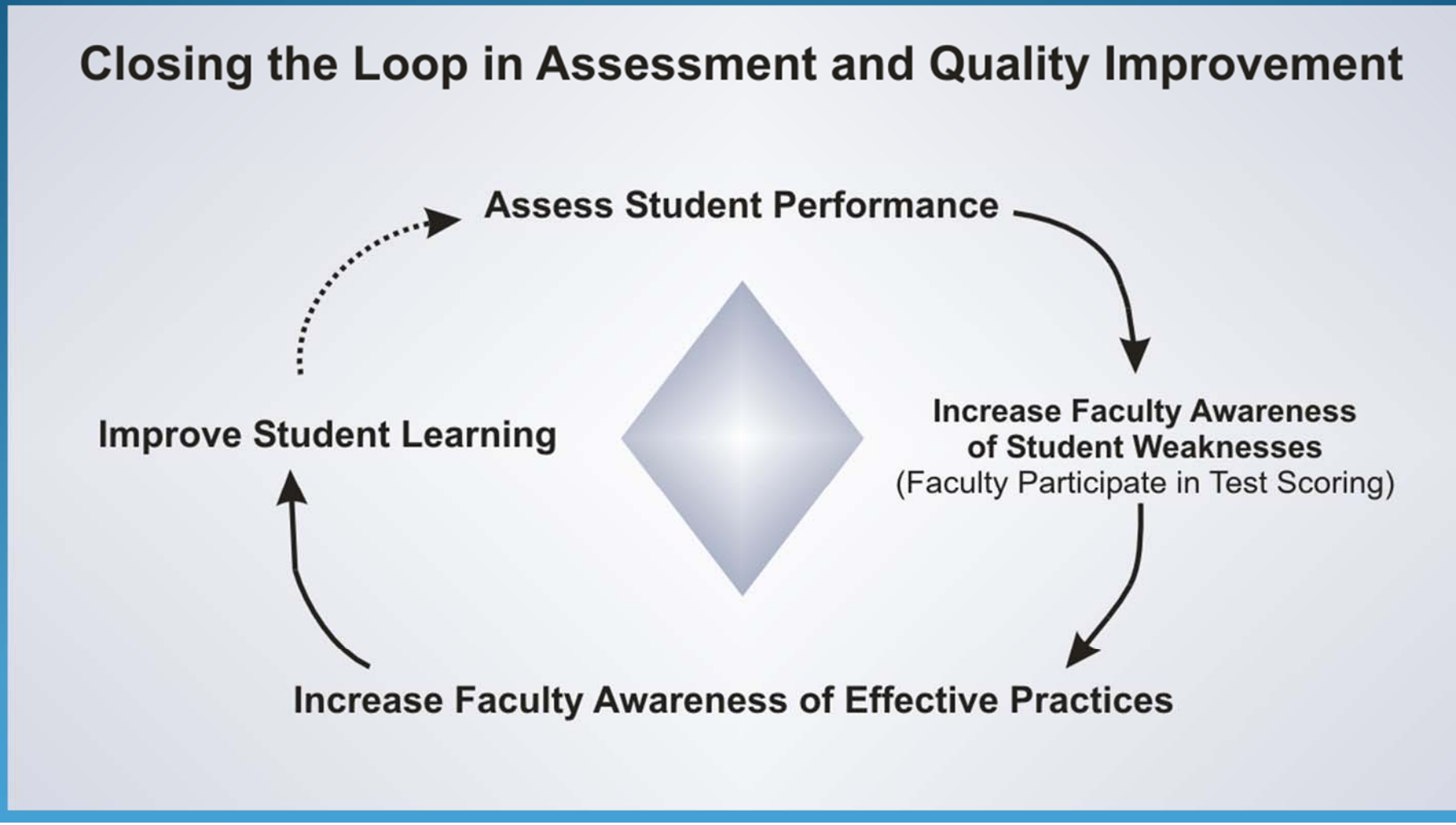
What kind of additional information or evidence would support the scientist's theory?

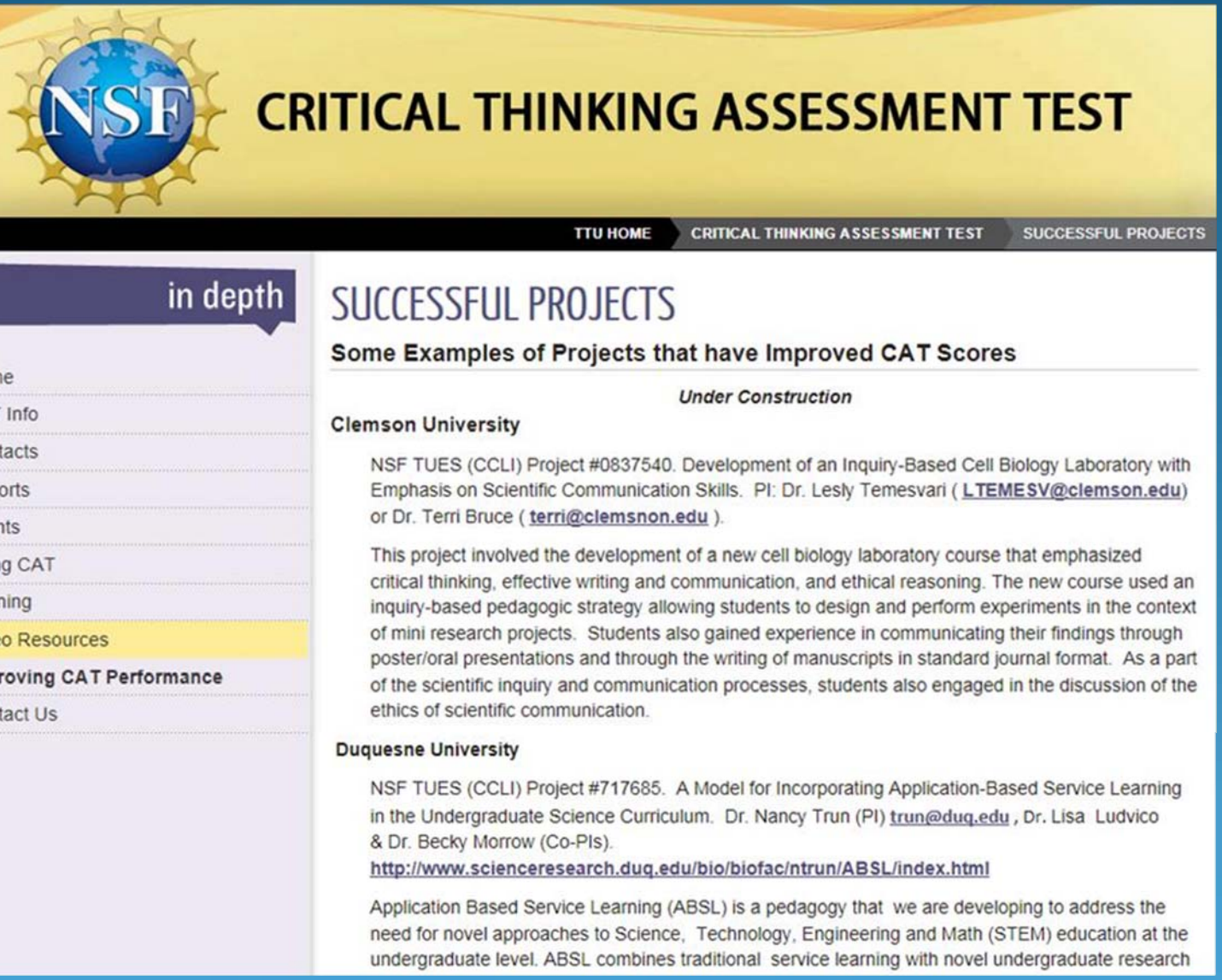
_____

Assessment Uses of CAT



Closing the Loop in Assessment and Quality Improvement




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 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@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.
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

Texas A&M University

Evaluate Undergraduate Learning Outcomes

Critical Thinking

Evaluate, analyze, and integrate information from a variety of sources

Use appropriate strategies and tools to represent, analyze, and integrate information

Develop critical, reasoned positions

Why CAT at Texas A&M

Chosen by faculty because

- **Scored by real people**
- **Our faculty score the tests**
- **Inter-rater reliability**
- **Department-level reporting**
- **Direct measure of student learning achievement**

CAT Used 4 Years

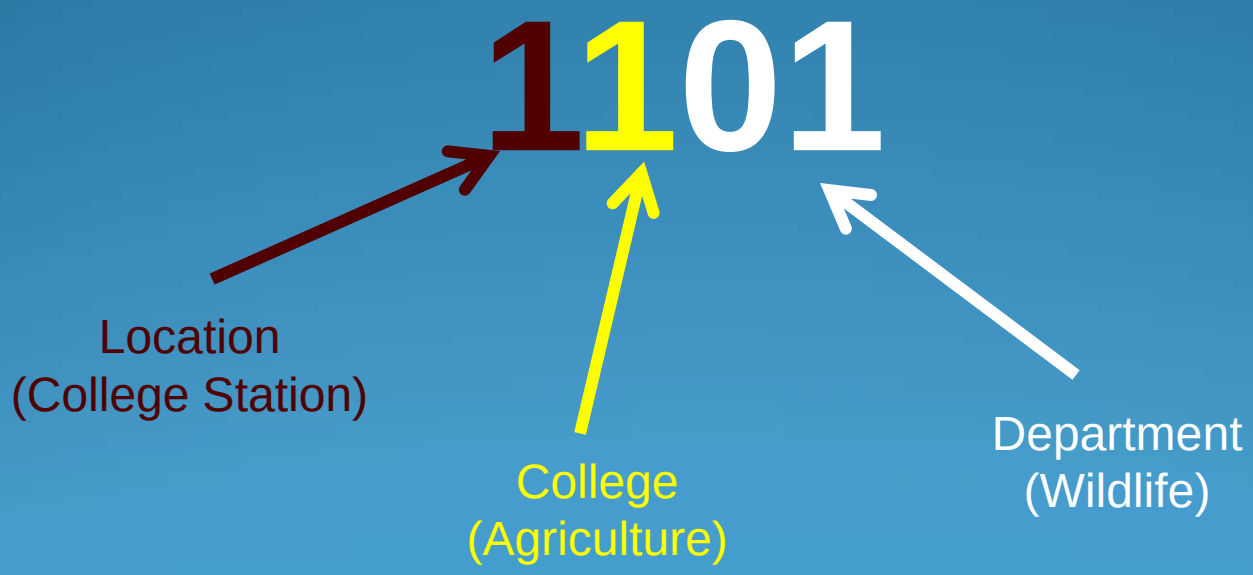
Sampling Strategy

- 500
- Upper-level students in their major
- 3-year cycle
  - 10 colleges, 2 satellite locations
  - 4 colleges/locations per year
  - Entire University after 3 years
  - Currently in 2nd year of cycle

Using CAT Local Coding

4 Digits

Example:



Course Embedded

- Administered in the fall
- Participating colleges' faculty contacted by college assessment liaisons
- Faculty asked to give up a class session
- Proctored by Office of Institutional Assessment staff
- **Incentive to faculty** = Department-level report (to be used in program assessment)

Institutional Review Board

- Faculty cannot be involved in recruiting students
- Faculty cannot be present during test
- Can give extra credit/participation grade
- Students sign consent form
- Initial next to name on class roster (roster sent to instructor)

Faculty Scoring

- One 8-hour scoring day (each year)
- 30 volunteers
- University-wide representation

Feed them, pay them, and they will come!

Utilization of Results

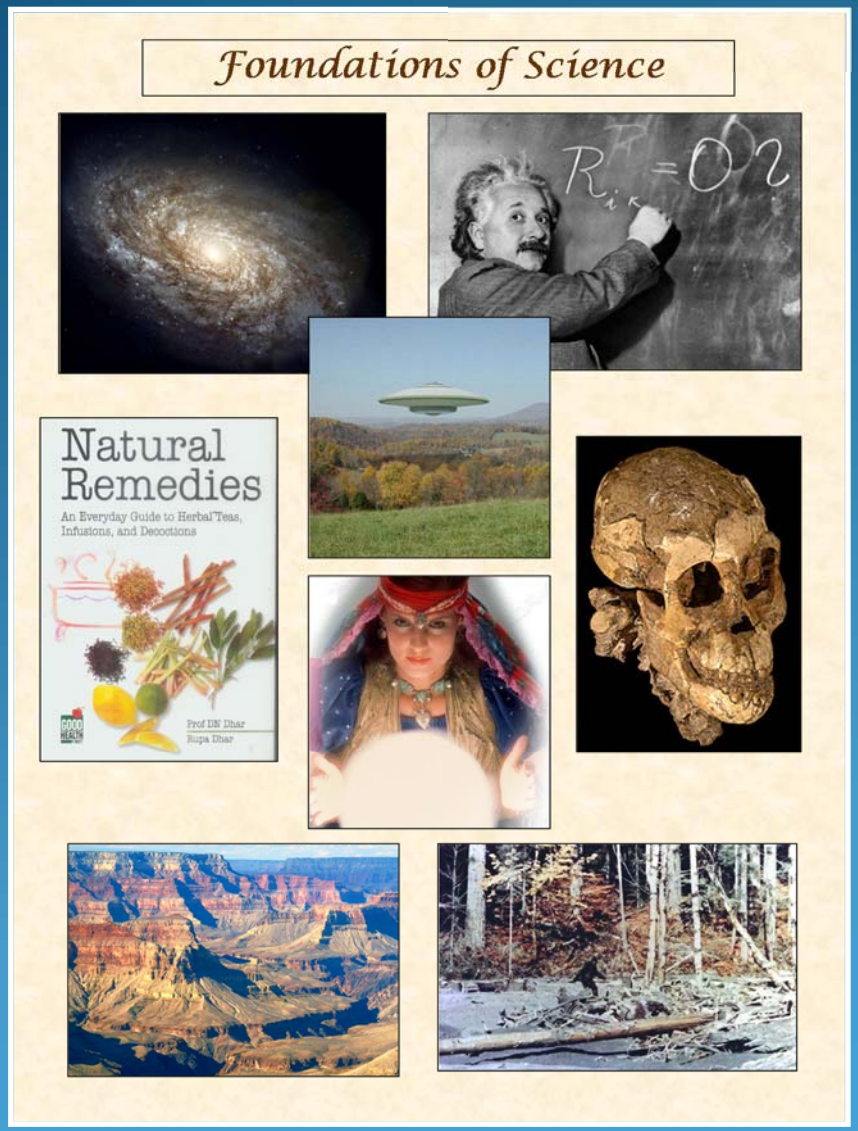
- General Education Assessment
  - SACSCOC 3.5.1
  - Texas Higher Education Coordinating Board (THECB) report – State mandated core objectives
  - Presidents' Alliance for Excellence in Student Learning and Accountability
- Program Assessment
  - SACSCOC 3.3.1.1
  - For programs with critical thinking outcomes
  - Curricular Improvement

Sam Houston State University's QEP to Improve Critical Thinking

Critical Thinking Assessment Test

Scientific reasoning

General Goals



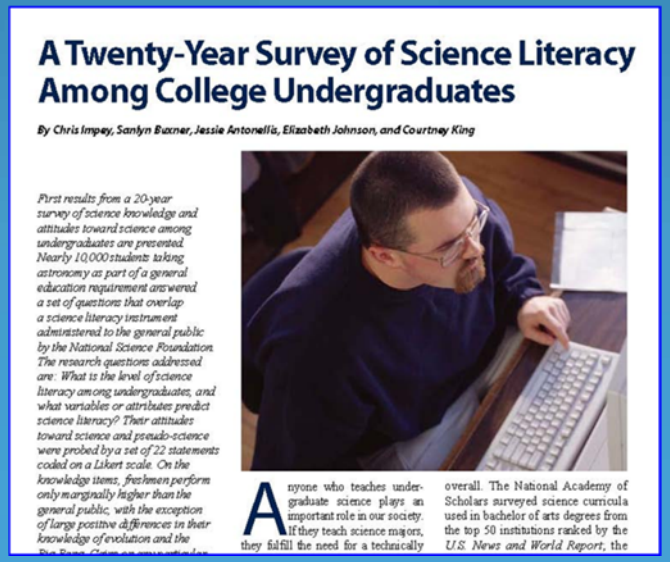
- ✓improve critical thinking skills
- ✓the importance of evidence and logic
- ✓engender scientific habits of mind

Why Did We Choose this QEP Topic

Carnegie Institution Report

✓ > **93%** of American adults are scientifically illiterate.

✓ > **78%** of *college graduates* are scientifically illiterate.



A Twenty-Year Survey of Science Literacy Among College Undergraduates

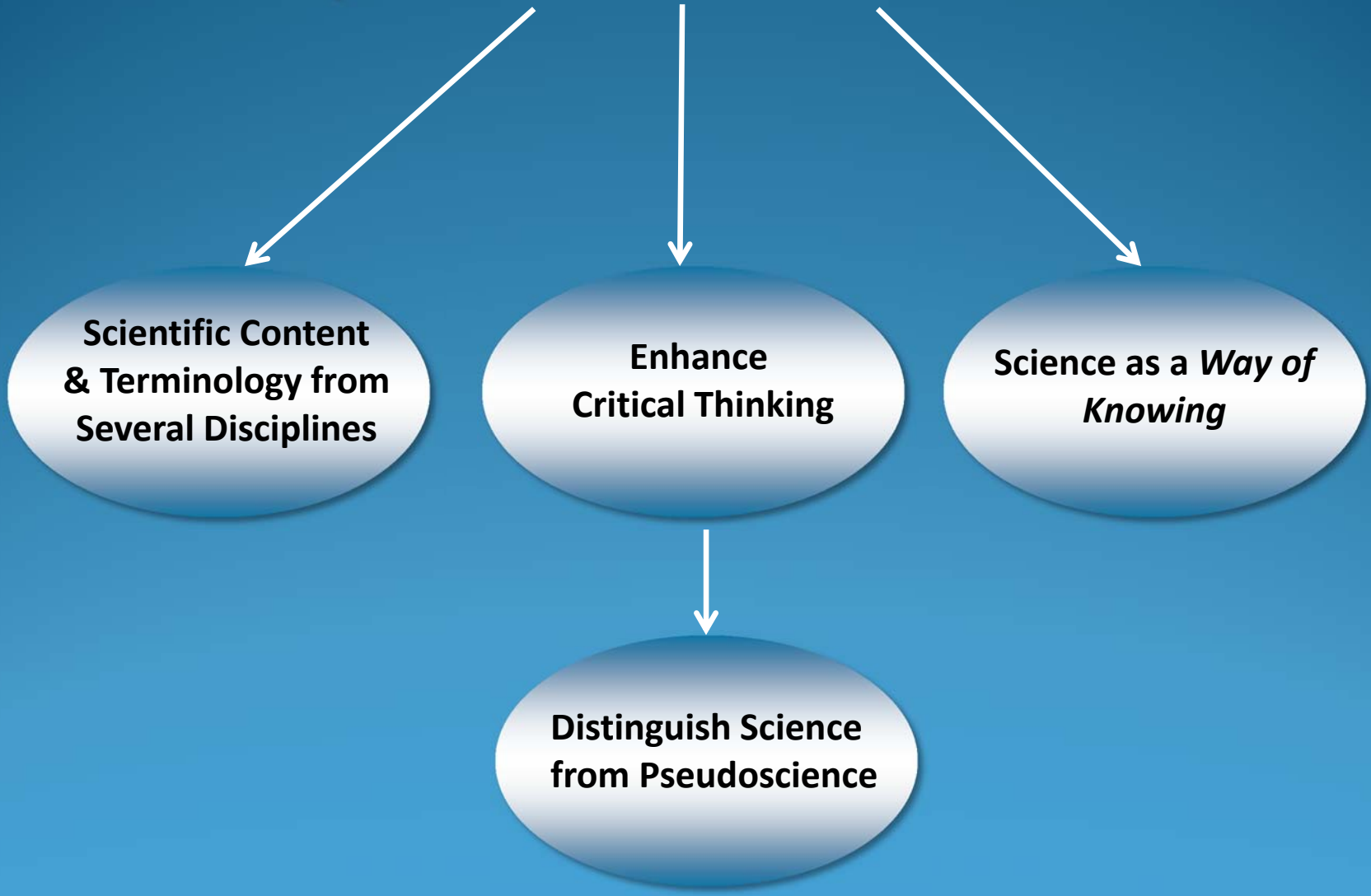
By Chris Impey, Sanlyn Buxner, Jessie Antonellis, Elizabeth Johnson, and Courtney King

First results from a 20-year survey of science knowledge and attitudes toward science among undergraduates are presented. Nearly 10,000 students taking astronomy as part of a general education requirement answered a set of questions that overlap a science literacy instrument administered to the general public by the National Science Foundation. The research questions addressed are: What is the level of science literacy among undergraduates, and what variables or attributes predict science literacy? Their attitudes toward science and pseudo-science were probed by a set of 22 statements coded on a Likert scale. On the knowledge items, freshmen perform only marginally higher than the general public, with the exception of large positive differences in their knowledge of evolution and the

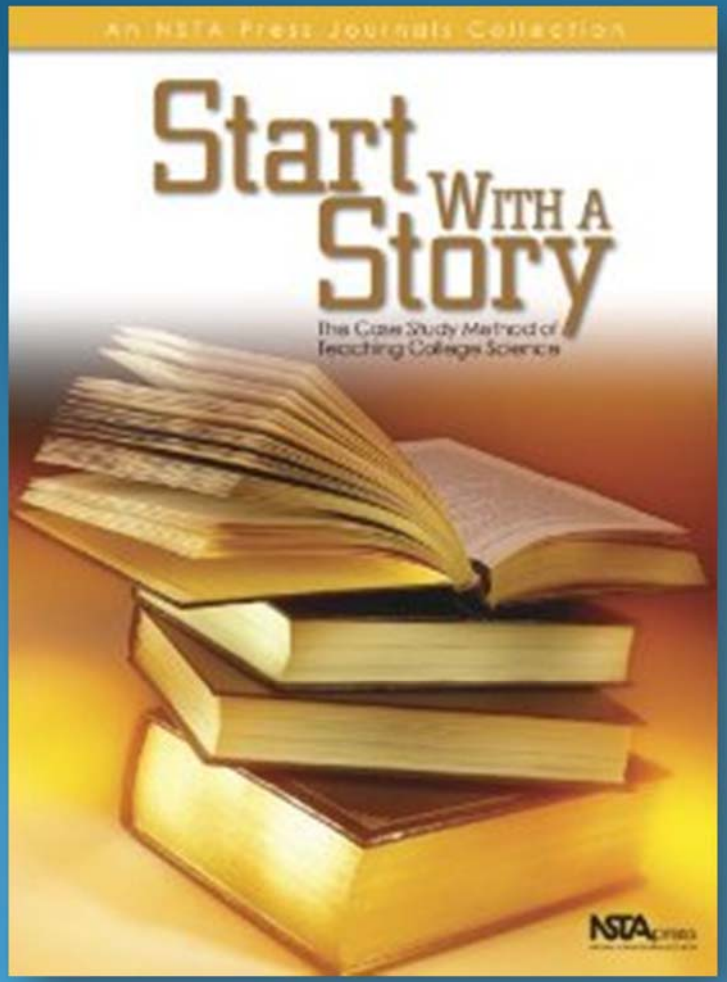
Anyone who teaches undergraduate science plays an important role in our society. If they teach science majors, they fulfill the need for a technically

overall. The National Academy of Scholars surveyed science curricula used in bachelor of arts degrees from the top 50 institutions ranked by the *U.S. News and World Report*, the

Specific Course Goals



Pedagogies:



Case Studies & Team-based Learning

Ex: “Tragic Choices: Autism, Measles, and the MMR Vaccine”

We use *extraordinary claims* to engage the students' attention and increase motivation…

Students Work in Groups

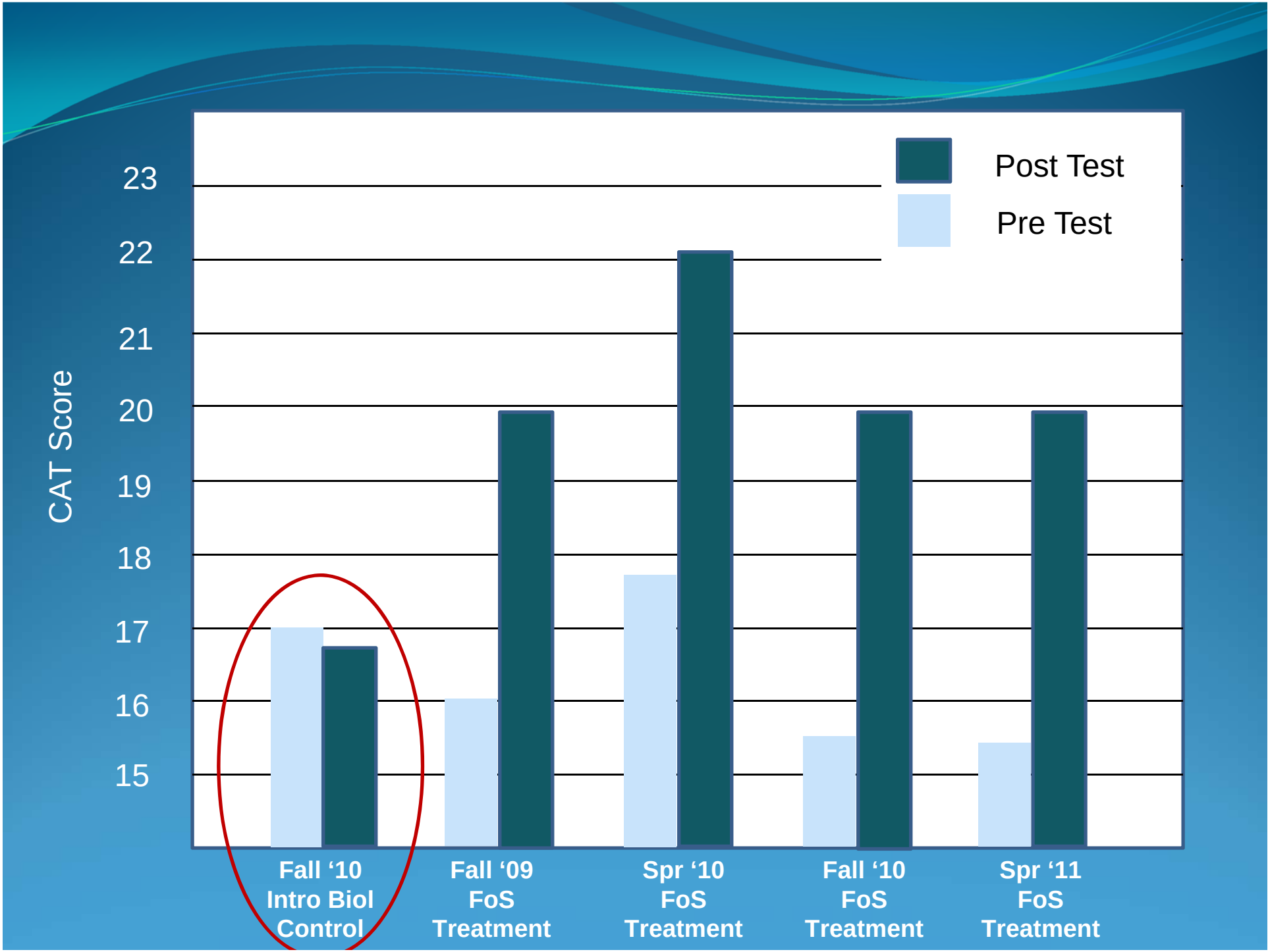
Groups Share Ideas

Peer Review

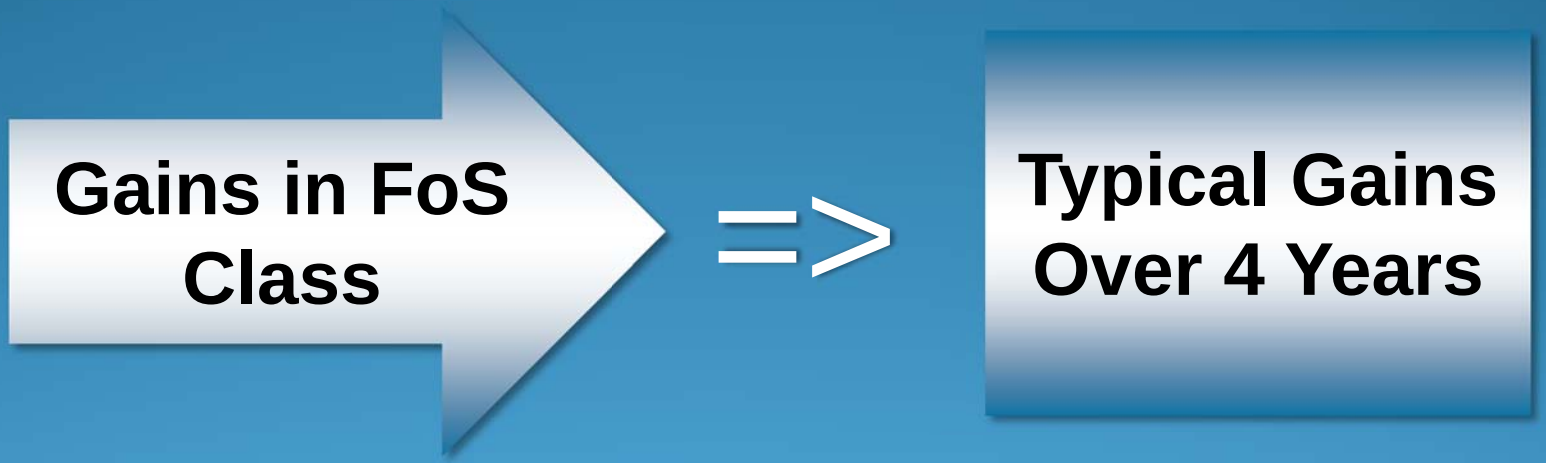
Assessing CT Gains

Pre-Test Post-Test Design
Using CAT Instrument

Treatment vs. Control


CAT Score
23
22
21
20
19
18
17
16
15
Post Test
Pre Test
Fall '10 Intro Biol Control
Fall '09 FoS Treatment
Spr '10 FoS Treatment
Fall '10 FoS Treatment
Spr '11 FoS Treatment

Perspective



Thank You

CAT National Dissemination Project

www.CriticalThinkingTest.org

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.