



Engaging Faculty in Assessing and Improving Students' Critical Thinking

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Importance of Critical Thinking

Explosion of Information

Internet

$E=MC^2$

MySpace

Facebook

Email

Wikipedia

Blogs

Phone Apps

Augmented Reality

Magazines

Books

Television

Journals

Radio

The Changing Nature of Education

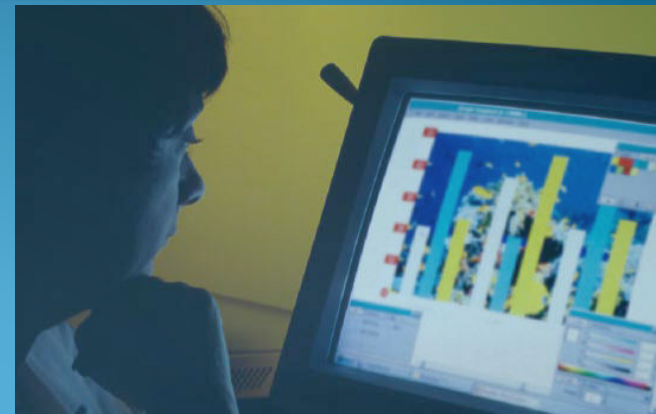
**Remembering
Information**



Finding Relevant Information

**Understanding & Evaluating
Information**

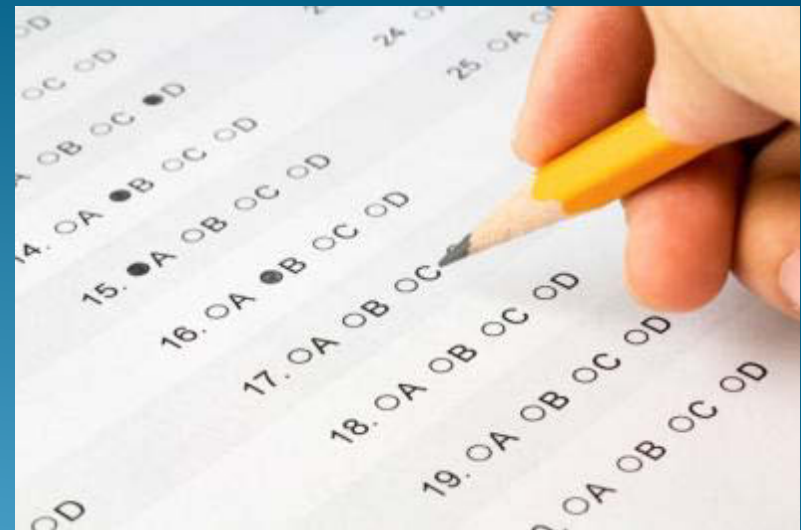
Using Information Effectively



Disconnect Between What is Considered Important and What We Assess



Critical Thinking



Factual Knowledge

What is Critical Thinking?

Classic Emphasis

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

Why Assess Critical Thinking?

Need to Measure Success for Accountability

Assessment Drives Improvement Efforts

How We Assess - Determines What Students Learn

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.

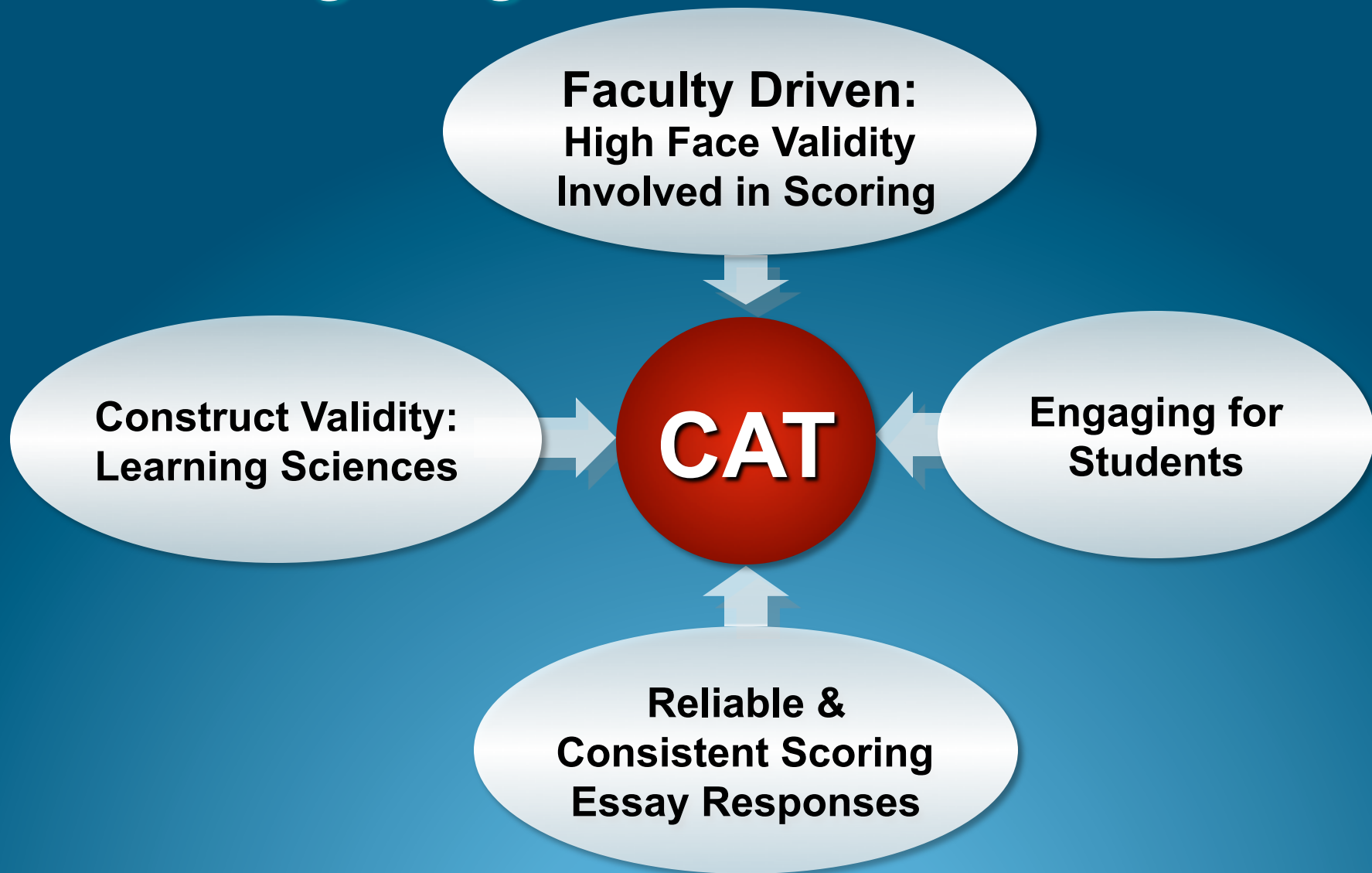
Learn & apply new information.

Use mathematical skills to solve real-world problems.

Communication

Communicate ideas effectively.

Designing the CAT Instrument



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.

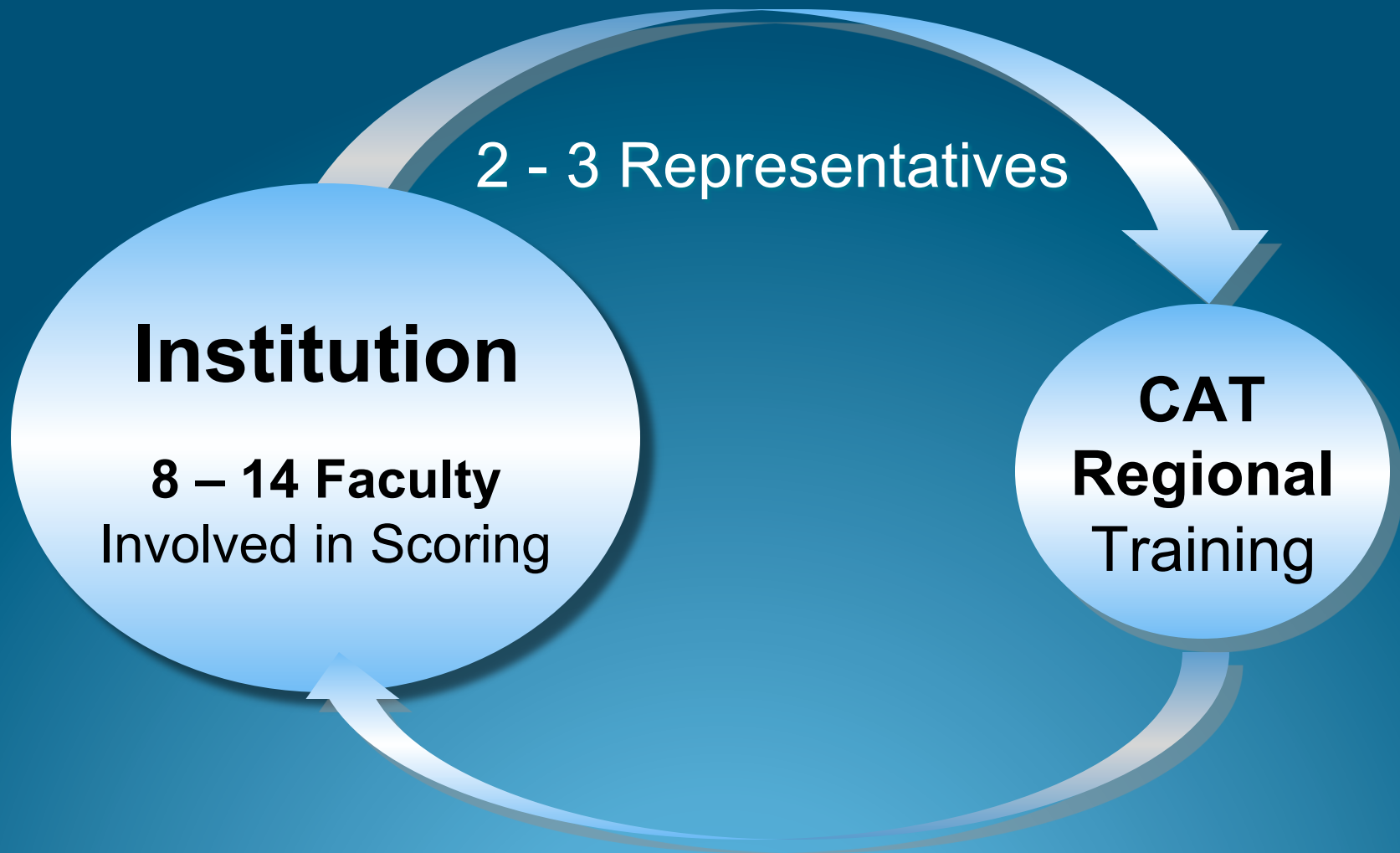
- 99.9% of the people who committed crimes consumed bread prior to committing crimes.
- Crime rates are extremely low in areas where bread is not consumed.

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?

National Dissemination Model



Over 180 Institutions Collaborating



Guam

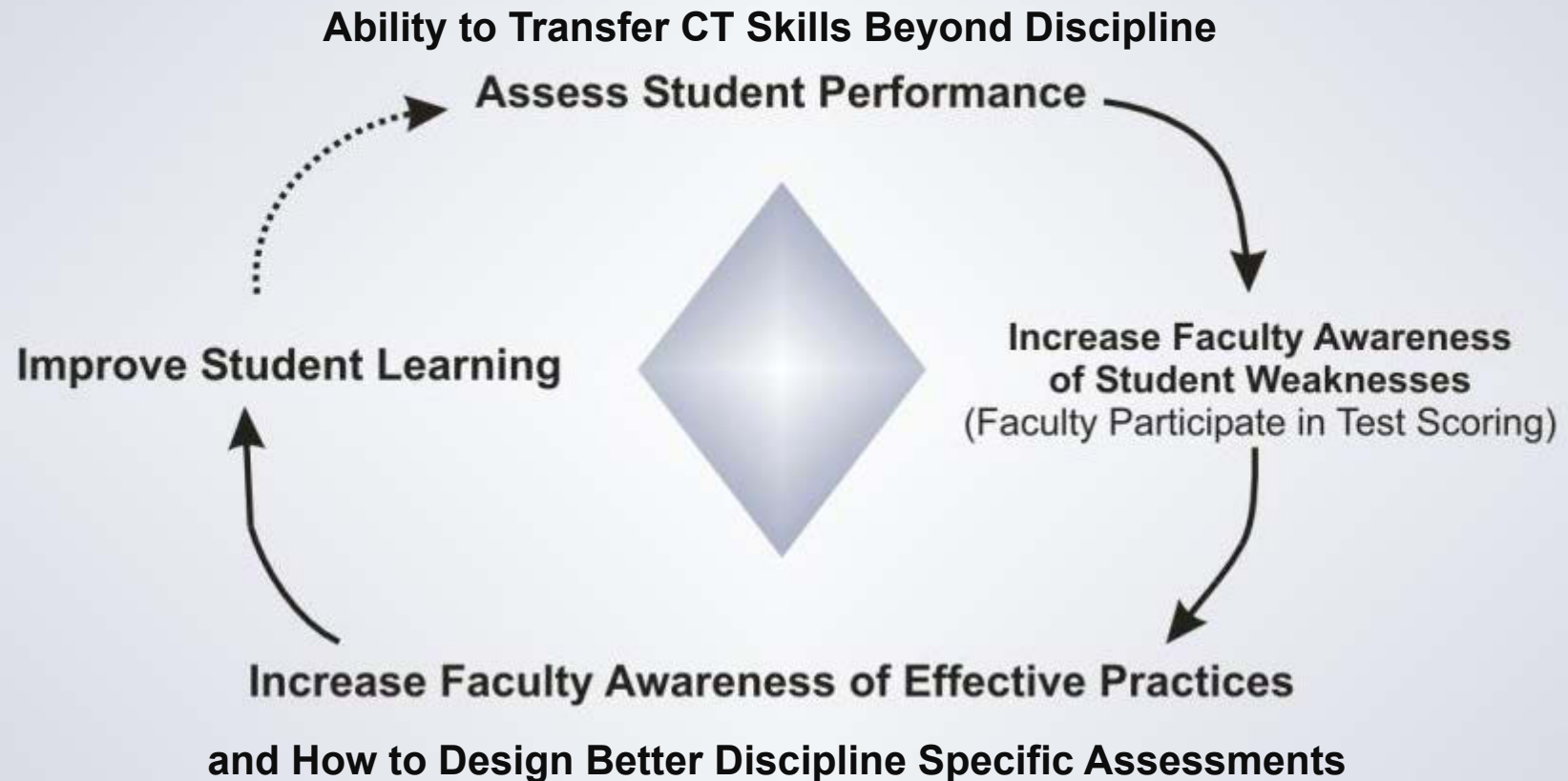


Hawaii

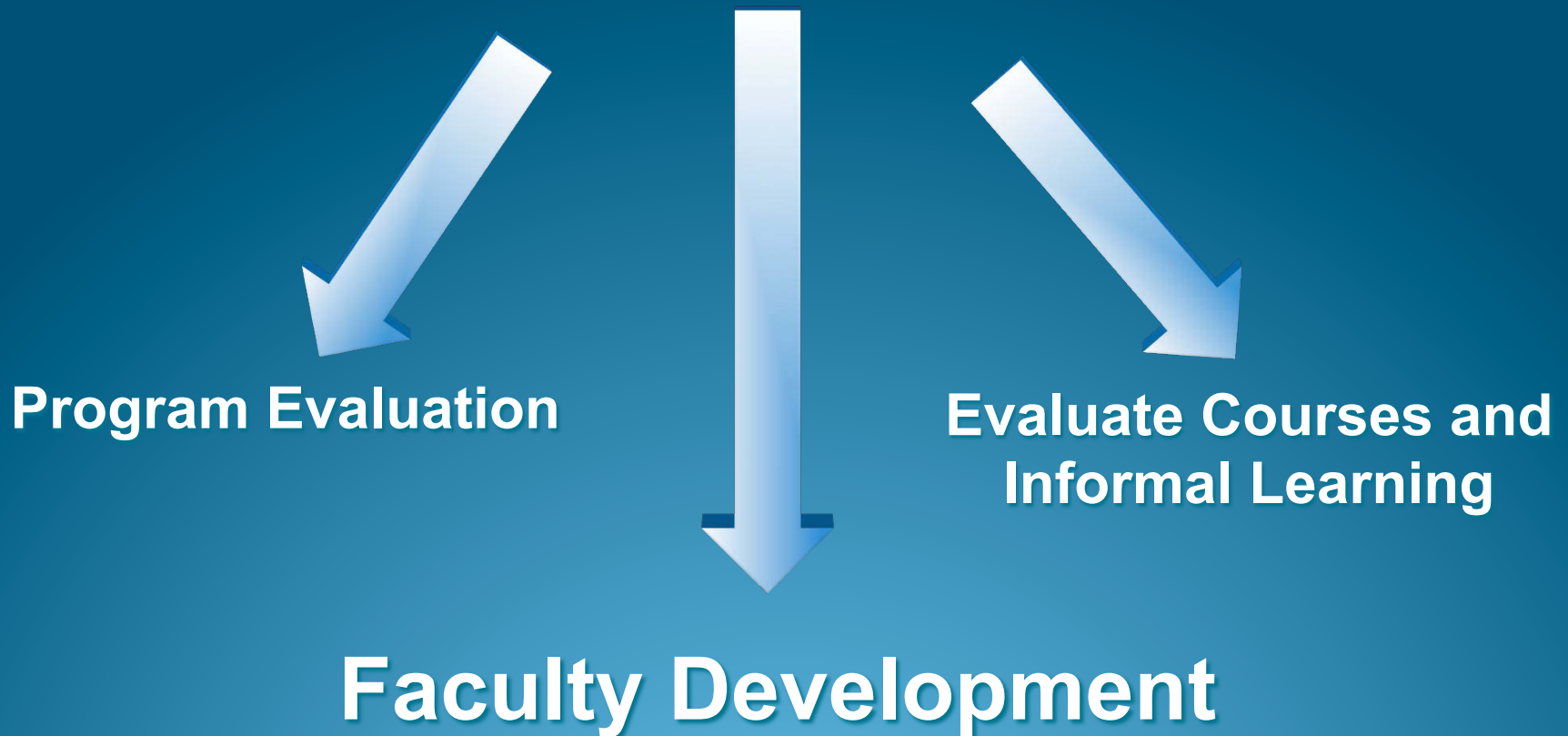


Closing the Loop in Assessment and Quality Improvement

Closing the Loop in Assessment and Quality Improvement



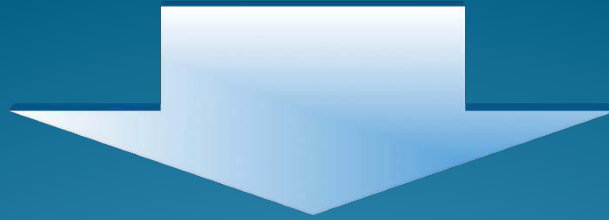
How the CAT is Used



Professional Development: Faculty Involvement in CAT Scoring



Using the CAT as a Model for Developing Better Discipline Specific Assessments



Provide alternative interpretations and identify additional information or evidence needed to evaluate those interpretations.



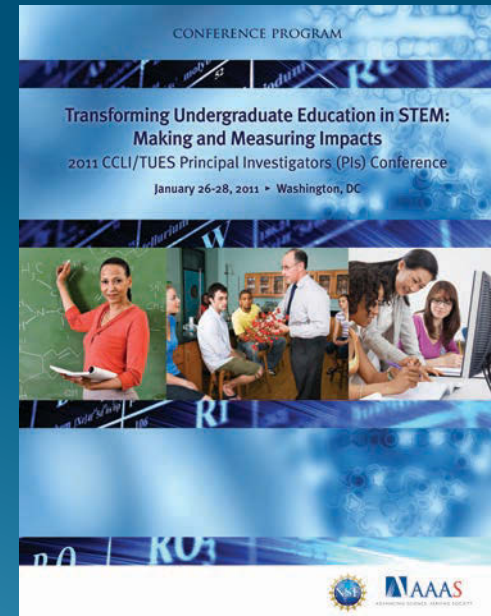
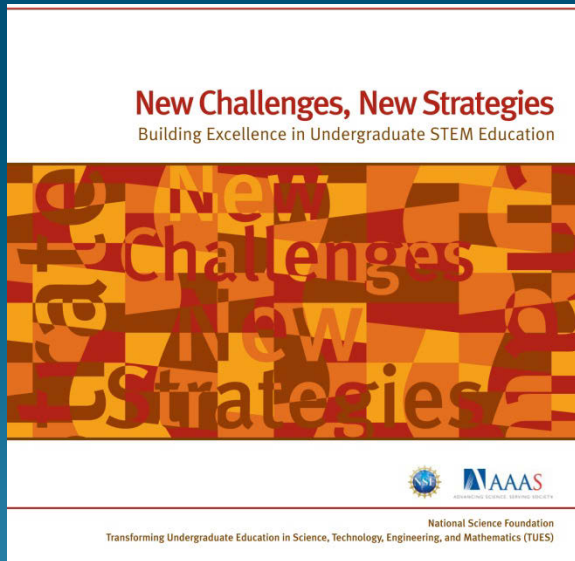
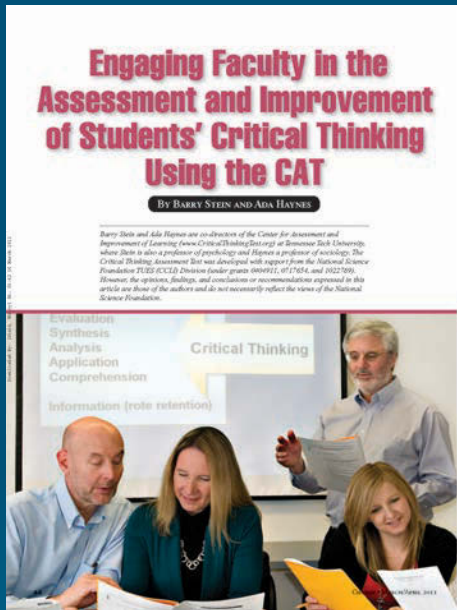
Patterns of Data



Historical Events



Literature



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.

Using the CAT for Professional Development at



**Meg Skinner, Director of Ellbogen Center for
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&

Erika Prager, University Assessment Specialist

Engaging Faculty in Assessment

~~Assessment
Forum~~

Teaching and
Learning
Symposia ✓

~~Individual
Faculty~~

Group
grants ✓

Engaging Faculty in Assessment

~~Annual
assessment
reports~~

Discussions
of what
matters ✓

~~Faculty
projects~~

Faculty Learning
Community/
Assessment
Academy ✓

Successful, but still somewhat fractured around campus

History of CAT

- School of Pharmacy discovered CAT in 2010
 - Assessment Academy
 - Accreditation need
- Train-the-trainer workshop
 - Utility and usefulness for other programs
- Pharmacy, Social Work, Veterinary Sciences began using in 2011
- Spring Colloquium on Critical Thinking – Spring 2012
- Expanded further in 2012 and 2013
 - College of Business, Geology/SMTC, and Zoology/Physiology
 - Kinesiology/Health and Nursing



How CAT Project is Organized

- Every project has unique administration
 - Longitudinal vs. cross-sectional studies
 - Different research questions
- Centrally coordinated through Academic Affairs and ECTL
- Cross-program discussions and projects through scoring, Assessment Academies, and new Faculty Learning Community
- Principal goal is faculty development



Plans for 2013-14

- **Analyze/discuss results and scoring**
 - Compare/contrast results by program and for UW overall
 - Examine accuracy of faculty scoring
- **Develop analog questions**
 - Create year-long faculty learning community
 - Finish developing first two UW specific example questions (Social Work and Pharmacy)
 - Work with Tennessee Tech as part of “test group” for creation of national database for analog questions
- **Resolve administration issues**
 - Overlap in administrations between programs



Faculty Reactions From Scoring the CAT

- Validates some suspicions regarding specific skills
- Challenges the way some faculty currently structure test questions (e.g. recall vs. critical thinking)
- Provides insight on how to deal with ambiguous student responses in class
- Rethinking their own grading rubrics



Faculty Reactions From Scoring the CAT

- Increases validity of open book tests
- Willingness to develop analog questions
- ★ Brings faculty together to discuss curriculum

Assessment can actually be fun!



From Scoring Tests to Faculty Development

- Invite them to share results at faculty development
- Faculty are credible to other faculty
- Sign up sheets – target interest immediately

Overall suggestion - Start small and try it



Questions?

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Changing Minds: Critical Thinking and Teaching Development

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Overview

1. Goals & Hypotheses of study
2. Theoretical Rationale
3. Study Design
 - Participants
 - Design
 - Measures
4. Some very early findings



DUE-0942404

Goals

1. To use critical thinking as a higher-order learning skill to promote change in faculty conceptions of teaching and learning.
2. To motivate faculty to make changes to their teaching of critical thinking by providing them with data about their students' critical thinking.
3. To see if the changes that faculty make in their teaching lead to changes in how students perform on critical thinking tests.

Study Participants

Faculty

**11 City Colleges of Chicago
&
9 Northwestern University**

**Anatomy
Astronomy
Biology
Calculus
Chemistry
Chemical Engineering
Electrical Engineering
Linguistics
Physics
Quantum Mechanics**

Study Design

Summer — **Year 1** — Fall & Winter

Summer — **Year 2** — Fall & Winter

Preparation

10 CCC & 9 NU
faculty
recruited

Faculty learn about
the CAT test

Faculty develop
course specific
assessments of
critical thinking
(analogues)
modeled on the CAT
test

Baseline

Data collected
on faculty approaches
to
teaching and
conceptions
of critical thinking and
assessment

CAT test & course
specific assessments
administered pre &
post course

Faculty teach as usual

Intervention

Faculty review CAT
& course specific
assessment
data

Faculty participate in
interactive
workshops on critical
thinking pedagogy

Faculty develop plans
to enhance students'
critical thinking

Post

Faculty make
changes to their
teaching

CAT test & course
specific
assessments
administered
pre &
post course

Year 2 Spring: Compare: student learning gains; faculty teaching practices; faculty approaches to teaching; faculty conceptions of critical thinking & assessment

Faculty Commitment

Faculty Participation:

- One Northwestern faculty left program due to time commitments; and two City Colleges faculty left program in 2nd year: one became chair; one left the college.

Faculty Engagement with Program:

- All faculty were highly engaged in the process: all engaged the CAT data; attended the workshops; constructed analogues)
- All faculty developed and implemented activities to enhance critical thinking in their courses.

Activities that Faculty Developed to Promote Critical Thinking

CAT skills focus of activities

- generating alternative explanations
- identifying additional information required to evaluate a hypothesis
- solving real world problems

Variation in Activities

Intensity

- single activity vs. series of linked activities

Nature

- in class vs. homework assignment
- hands on inquiry-based activities vs. worksheet data
- group activity/discussion vs. individual work

Case Study: Critical Thinking Quiz

Northwestern Engineering Course

- Students: 15 Juniors, seniors, grad students
- Time: twice a week – Tue. & Thur. - for 1.5 hours
- Format: Presentation/discussion

CTQ Learning Outcomes

1. Develop dynamic group thinking skills.
2. Develop awareness of multiple perspectives to each problem.
3. Learn to present, defend, evaluate critical responses.
4. Develop critical skills with different team partners.

Case Study (cont.)

Description of Activity

- 20 minutes once a week (sometimes bi-weekly)
- Students break into 4-5 Quiz-Teams – of 3 students
- Each group discusses 3 problems for 5-7 min.
- Students use hole-punch to commit to multiple choice answers
- Each Quiz-Team shares their answers and reasoning for 3 minutes with the class
- Quiz-Team partners change every two quizzes

Instructor Comments on Activities

The students were engaged by the activity and were clearly invested in discussions. Spirited discussions would persist for several of the groups. Group dynamics clearly affected the collective decision -- sometimes the loudest voices in a group would talk more timid ones away from the correct answer.

Even when students all got a problem wrong, they seemed quite satisfied to have had the chance to talk through their best answer with their group, and they all seemed to recognize the missing piece which kept them from getting the correct answer when it was shown to them.

Learning Outcomes & CAT Question

(as Identified by Faculty)

Discussing problems with peers

- #2 Evaluate how strongly correlation type data support a hypothesis.
- #4: Identify additional (or more precisely what information is needed) information needed to evaluate a hypothesis/interpretation.
- #5 Evaluate whether spurious relationships strongly support a claim.
- #7: Identify additional information needed to evaluate a hypothesis/interpretation.

Develop critical skills with different team partners

- #3: Provide alternative explanations for a pattern of results that has many possible causes.
- #6: Provide alternative explanations for spurious relationships.

Learn to present, defend, and evaluate critical responses

- #9 Provide relevant alternative interpretations of information.

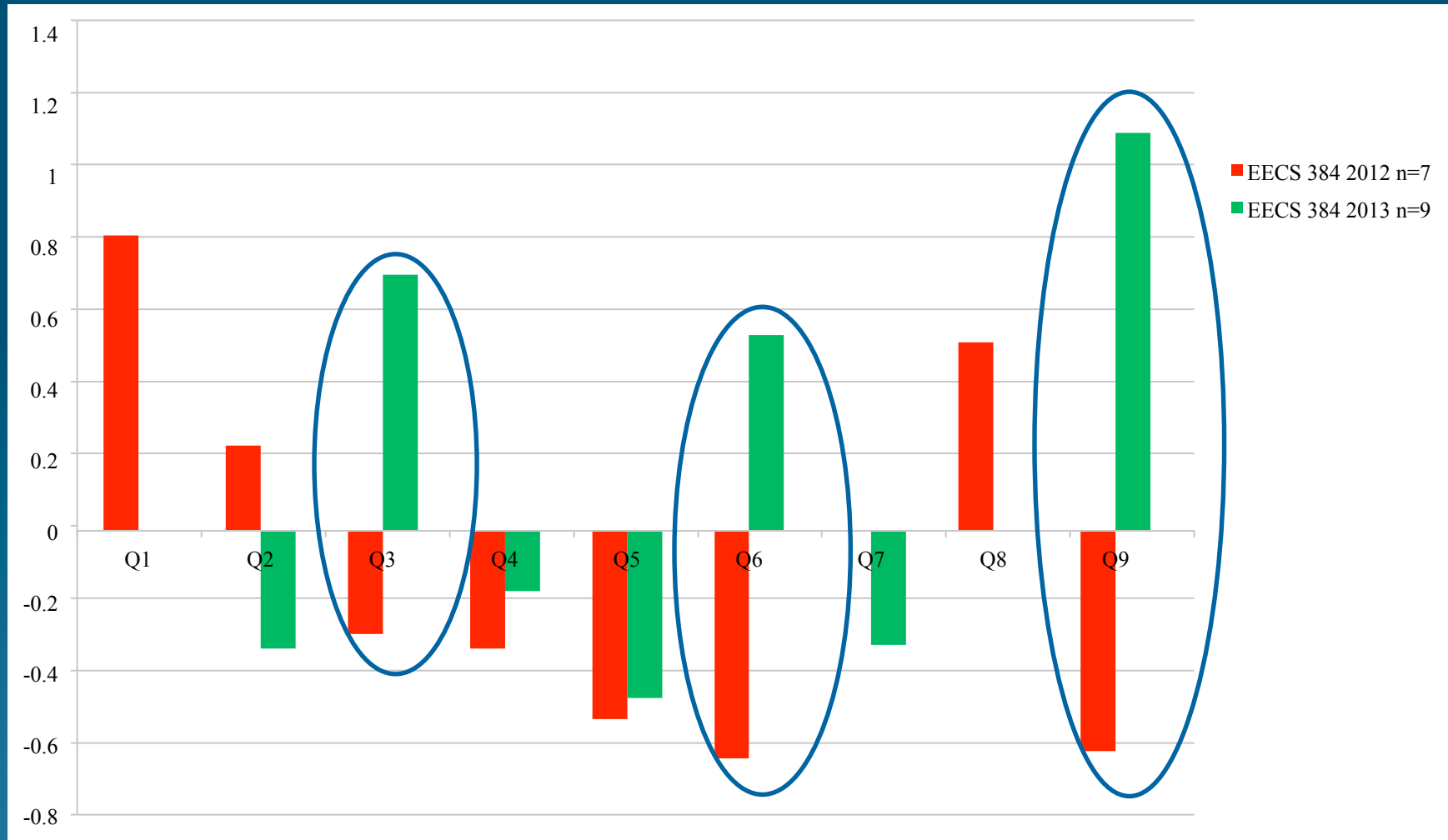
Case Study: Learning Outcomes in terms of CAT Skill Areas and CAT Question

Learning Outcomes	<i>CAT Skill Areas</i>			
	Evaluate/ interpret info	Problem Solving	Creative Thinking	Effective Communication
Dynamic group thinking skills	2, 5	4,7	4,7	2, 4, 7
Develop awareness of multiple perspectives				
Present, defend, evaluate critical responses			9	9
Critical skills with different team partners			3,6	3,6

Results: Student Gains in Critical Thinking



Results: Student Gains in Critical Thinking



Thank You

[www.Northwestern.edu/searle/programs/
facultyprograms/CTSI_program.html](http://www.Northwestern.edu/searle/programs/facultyprograms/CTSI_program.html)

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