

An Overview of CAT App Development for the CAT Instrument

**Center for Assessment & Improvement of Learning
Tennessee Tech University**



National Science Foundation's IUSE Program under grant 1022789.

CAT App Workshop

- 1. Briefly discuss best practices in the teaching and assessment of critical thinking**
- 2. Introduce two Skill Sets associated with CAT Apps**
- 3. Discuss and Brainstorm potential discipline topics**
- 4. Begin development and provide feedback on individual CAT Apps**

The Changing Nature of Education



**Remembering
Information**

Finding Relevant Information

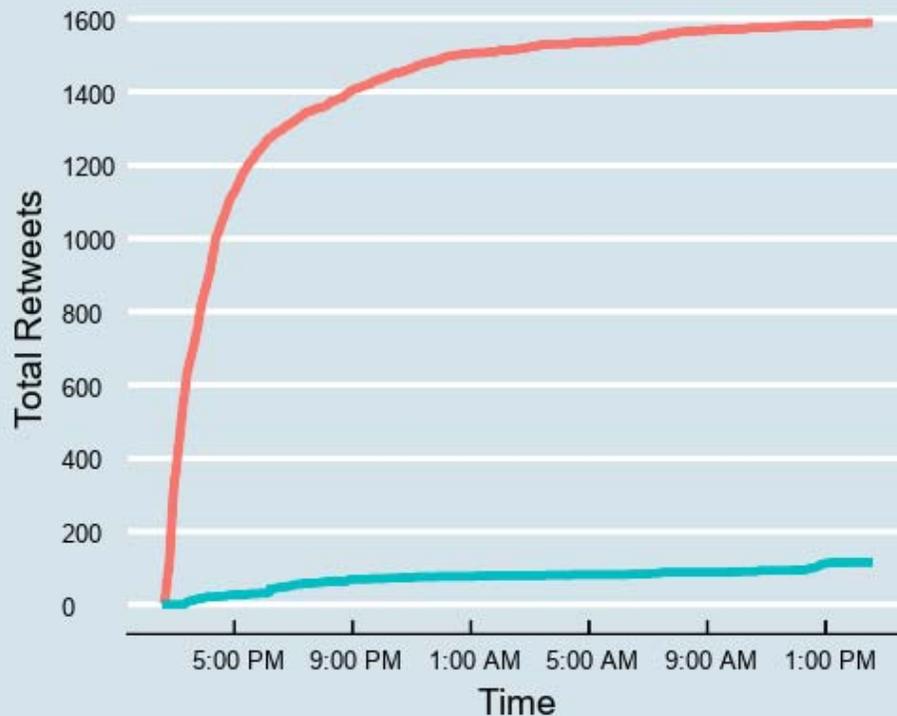
**Understanding & Evaluating
Information**

Using Information Effectively

Viral Nature of Misinformation

How Misinformation Spreads on Twitter

Total Retweets Over 24 Hours, Monday April 23 to Tuesday April 24



False Account



Accurate Account



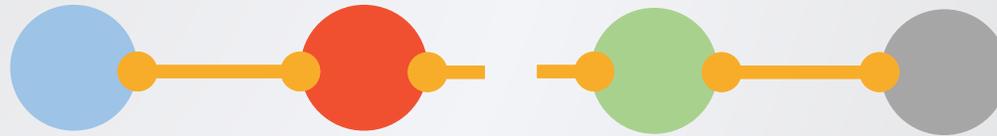
@chrismeserole

Importance of Critical Thinking

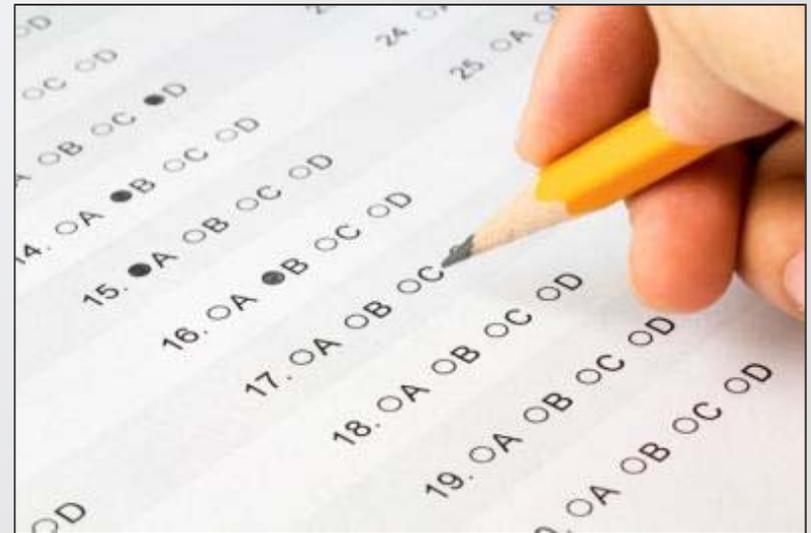
99% of faculty reported critical thinking skills essential or very important (HERI, 2009)

75% of employers wanted more emphasis on critical thinking, problem solving, creativity, and communication (AACU, 2013)

Understanding the Disconnect



Teaching Critical Thinking

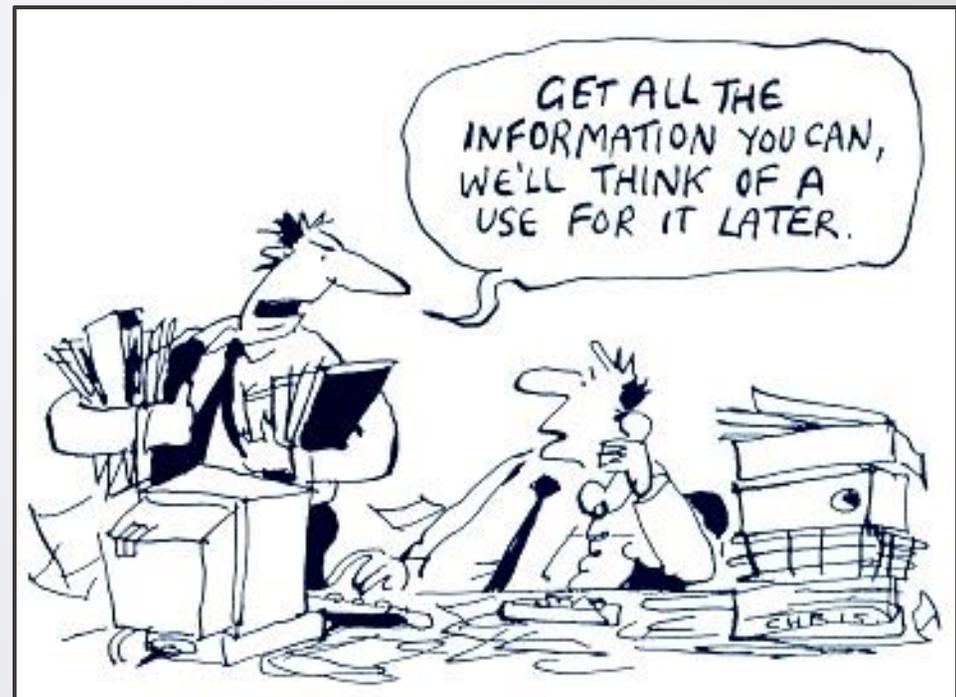


Assessing Factual Knowledge

Faculty and Assessment

**Not trained in
assessment**

**View assessment
as removed or
antagonistic**



More Than A Number



Why Assess Critical Thinking?

Need to Measure Success for Accountability

Assessment Drives Improvement Efforts

How We Assess - Determines What Students Learn

Skill Checklist for the CAT Instrument

	CAT QUESTIONS
	Q1: Summarize a pattern of information without making inappropriate inferences.
	Q2: Evaluate how strongly correlational-type data supports a hypothesis.
	Q3: Provide alternative explanations for observations.
	Q4: Identify additional information needed to evaluate a hypothesis or particular explanation of an observation.
	Q5: Evaluate whether spurious relationships strongly support a claim.
	Q6: Provide alternative explanations for spurious relationships.
	Q7: Identify additional information needed to evaluate a hypothesis/interpretation.
	Q8: Determine whether an invited inference in an advertisement is supported by information.
	Q9: Provide relevant alternative interpretations of information.
	Q10: Separate relevant from irrelevant information when solving a real-world problem.
	Q11: Analyze and integrate information from separate sources to solve a real-world problem.
	Q12: Use basic mathematical skills to help solve a real-world problem.
	Q13: Identify suitable solutions for a real-world problem using relevant information.
	Q14: Identify and explain the best solution for a real-world problem using relevant information.
	Q15: Explain how changes in a real-world problem situation might affect the solution.

Sample Disclosed Question

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

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

Do the data described above strongly support the scientist's hypothesis? Yes____ No____

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

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

Teaching Critical Thinking



Benefits of Course-Based CT Assessment

How you learn
determines how
you will be able to
use knowledge

**SOLVING
REAL WORLD
PROBLEMS**

Infusing critical
thinking with
discipline
content prompts
application

**Use the CAT to Assess
Critical Thinking**

ASSESSING & IMPROVING CRITICAL THINKING

**Use the CAT as a Model for
Better Course Assessments**

Discipline Specific Assessments Modeled on the CAT

Used across
cultures

Used with all
course levels

Used in a wide
variety of
courses

Used to evaluate
real-world
problem solving

Critical Thinking Skill Set 1

How strongly does information support an idea.



Provide alternative interpretations for information or observations that have several possible interpretations.



Identify additional information or evidence needed to evaluate the alternative interpretations.



Patterns of Data

Historical Events

Literature



CAT App: Interdisciplinary

Courtney Cox believes that drinking alcohol keeps women skinny. She supports this argument with the following evidence.

- In a medical study, doctors found that women who drank moderate amounts of alcohol were less likely to be overweight or obese in the future.**

Strength of Support

Courtney Cox believes that drinking alcohol keeps women skinny. She supports this argument with the following evidence.

- In a medical study, doctors found that women who drank moderate amounts of alcohol were less likely to be overweight or obese in the future.

The evidence from the medical study *strongly supports* Courtney's argument. YES or NO

OR

How strongly does the evidence from the medical study support Courtney's argument?

Alternative Interpretations

Courtney Cox believes that drinking alcohol keeps women skinny. She supports this argument with the following evidence.

- In a medical study, doctors found that women who drank moderate amounts of alcohol were less likely to be overweight or obese in the future.**

What are other interpretations for the results of the medical study aside from Courtney's interpretation?

Additional Information

Courtney Cox believes that drinking alcohol keeps women skinny. She supports this argument with the following evidence.

- **In a medical study, doctors found that women who drank moderate amounts of alcohol were less likely to be overweight or obese in the future.**

What additional information would we need to more fully evaluate the situation?

Using Headlines to Develop CAT Apps

Girls Who Play Soccer Have More Success in STEM Fields

Frequent Reliance on Social Services Yields Shorter Life Span

Eating Fast Food Leads to Depression

CAT App: History

Abraham Lincoln is commonly known by many Americans as the 'Great Emancipator'. This nickname derives from Lincoln's signing of the Emancipation Proclamation. The text of this document declared on September 22, 1862 that slaves were "forever free." In signing this document, Abraham Lincoln single-handedly freed all slaves.

1. How strongly does the text of the Emancipation Proclamation support the conclusions that all slaves were freed?
2. Are there alternative interpretations for the intent of the Emancipation Proclamation? Provide an alternative interpretation.
3. Identify 3 types of additional information that would help you investigate the intent of the Emancipation Proclamation and explain why each source would be helpful.

CAT App: Chemistry

Michelle recently moved to Milwaukee, WI from Tallahassee, FL. Before moving, she bought a brand new Toyota Camry. On her way to work, Michelle noticed her tire pressure sensor light had come on. Michelle mentioned her tire problem to her co-worker Joe, who suggested that Michelle probably has a tire puncture. Joe recommends that Michelle get her tires patched as soon as possible to address the issue.

1. How strongly does the information provided support Joe's idea that Michelle's tires have leaks due to punctures?
2. List two alternative explanations.
3. What additional information is needed to evaluate these explanations?

M. Edington, Florida A&M University

Critical Thinking Skill Set 1

How strongly does information support an idea.



Provide alternative interpretations for information or observations that have several possible interpretations.



Identify additional information or evidence needed to evaluate the alternative interpretations.



Patterns of Data

Historical Events

Literature

Critical Thinking Skill Set 2

Separate relevant from irrelevant information when searching for information to solve a real-world problem.



Identify and explain the best solution for a real-world problem using relevant information.



Explain how changes to a real-world problem situation might alter the recommended solution.



Selecting New Lab
Equipment

Solving a Community
Problem

Designing a Set for a Play

Real-World Problem Solving Ideas

- What Device should you buy or use for...
- What Treatment would be best for...
- Design an experiment to investigate...
- What is the best plan for...
(marketing, communicating, educating, etc.)

CAT App: Pharmacy

AM is a 45 year old female admitted to the hospital with complaints of pain and swelling in her left shin after a fall down the stairs. The symptoms have gotten worse with increased redness and weeping of the wound in the past 2-3 days. She thinks she has been having fevers at home and reports decreased appetite with increased fatigue. AM's past medical history includes diabetes type 2, hypertension and hyperlipidemia. She is currently on disability and does not work due to problems with her health. Her current medications include Lisinopril 20 mg daily, metformin 500 mg twice daily and simvastatin 5 mg daily and she reports an allergic reaction of anaphylaxis to penicillin. The patient is seen by the physician and diagnosed with cellulitis caused presumably by methicillin sensitive *Staphylococcus aureus* (MSSA). The wound is cultured and sent to the lab for review.

L. Fox, University of Wyoming

CAT App: Business

Scenario: You are the chief ethics officer for a toy manufacturer. One of your toys includes magnets and, because of these, has recently been banned by the Consumer Product Safety Commission (CPSC) for sale in the U.S.

Your CEO has asked for your recommendation about what to do with the company's existing inventory. The CEO's goal is to minimize financial damage to the company while maintaining the company's reputation as one that values child welfare. Your cousin, Terry, who did business in Central America ten years ago, informed you that consumer protection laws are much more lenient in Central America and suggested that you sell your inventory to toy retail outlets there.

N. Frost, Texas A&M University

Selecting & Evaluating Information



Example Rubric for Students to Use When Searching For Information

Define Search Goal: _____

Pre Search Rubric			Post Search Observations			
Type of Information Needed	Best Source	Why useful	Information available?	Meets quality standards?	Other Information Needed	Why Useful

Define Search Goal: _____

Pre Search Rubric			Post Search Observations			
Type of Information Needed	Best Source	Why useful	Information available?	Meets quality standards?	Other Information Needed	Why Useful

Define Search Goal: _____

Pre Search Rubric			Post Search Observations			
Type of Information Needed	Best Source	Why useful	Information available?	Meets quality standards?	Other Information Needed	Why Useful

Getting Started

1. Brainstorm possible constraints to the problem situation.

2. Select the constraints for your problem prompt.

3. Build your problem prompt based on the selected constraints.

Brainstorm possible constraints

Contaminants (Viruses, protozoans, bacteria, chemicals...)

Amount of water required (Number of hikers, number of days...)

Characteristics of the Hikers (Teenagers, Pregnant woman...)

Restrictions of the Natural Area (No campfires, water facilities...)

Location of the Natural Area

Weather (Flooding, Snow, low temperatures...)

Camping Style (Backpacking, Base camping...)

Select constraints

Contaminants (Viruses, protozoans, bacteria, chemicals...)

Amount of water required (Number of hikers, number of days...)

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Critical Thinking Skill Set 2

Separate relevant from irrelevant information when searching for information to solve a real-world problem.



Identify and explain the best solution for a real-world problem using relevant information.



Explain how changes to a real-world problem situation might alter the recommended solution.

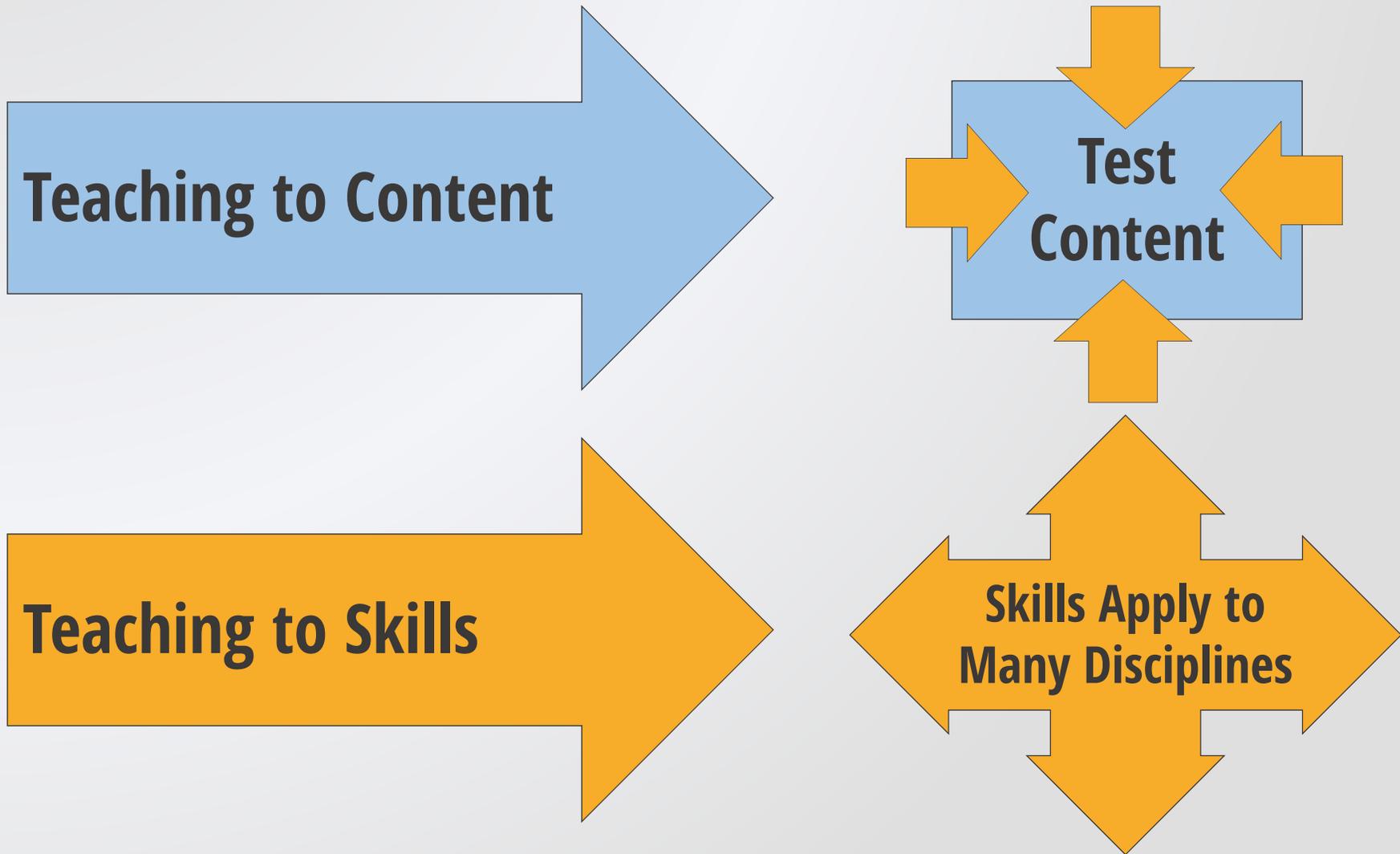


Selecting New Lab
Equipment

Solving a Community
Problem

Designing a Set for a Play

Teaching to the Test



Teaching to Content

**Test
Content**

Teaching to Skills

**Skills Apply to
Many Disciplines**

Creating a Community

Identify
Student
Weaknesses

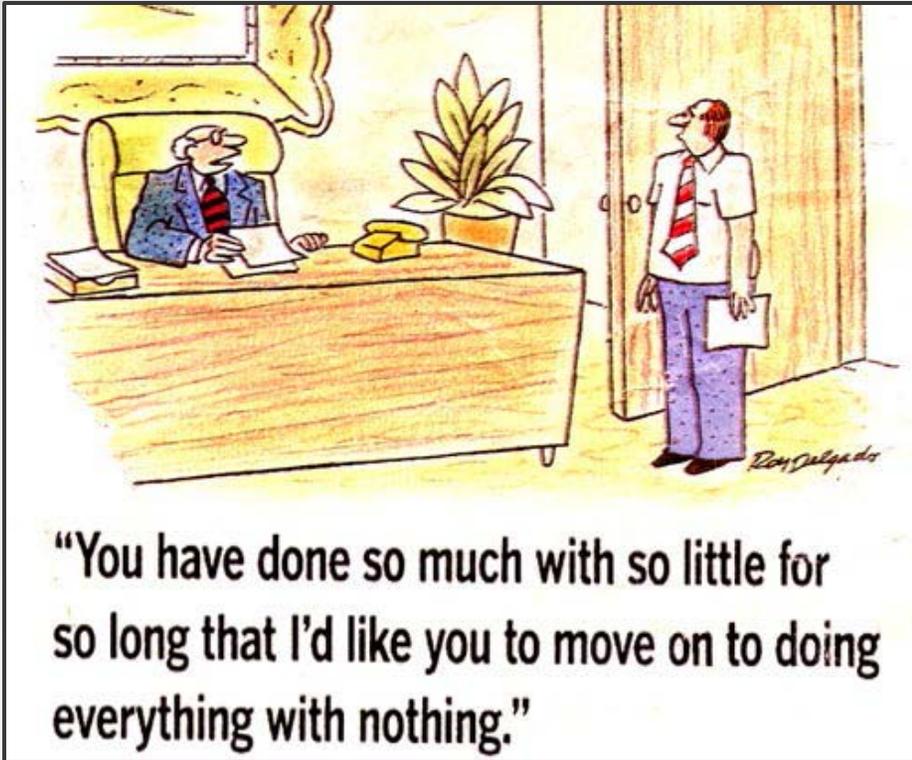
Recognize Faculty
Strength
and Weaknesses

Develop a
Teaching
Community

Implement
Effective
Practices

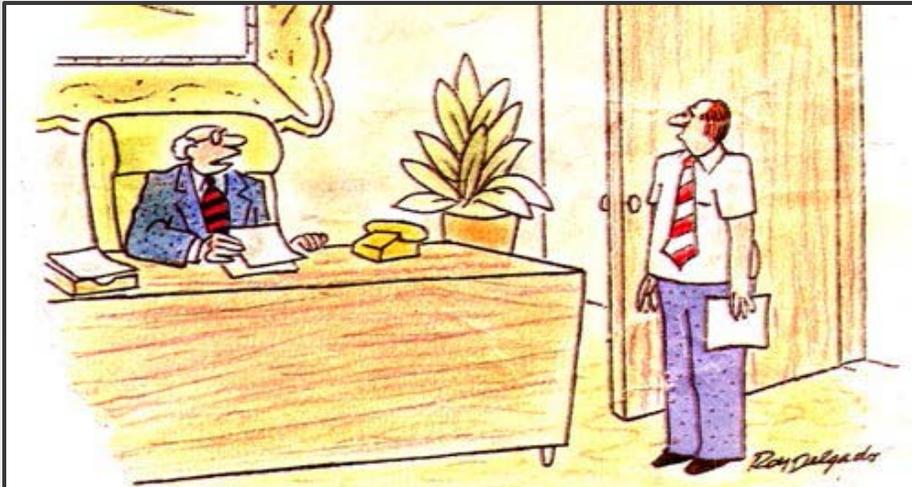
Use
Appropriate
Assessments

Motivating Faculty



- **Pay faculty to participate in scoring sessions**
- **Establishing a faculty teaching community to discuss results**
- **Provide small grants that provide resources for innovative practices or developing discipline specific CAT APPS**
- **Opportunities for funding and publication**

Motivating Faculty



“You have done so much with so little for so long that I’d like you to move on to doing everything with nothing.”

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

Successful Projects

CAT (Critical-thinking Assessment Test) / Reports & Publications

- CAT Home
- Getting Started
- About the CAT
- New Administration Options
- Ordering CAT Materials
- Training & Services
- CAT Applications in the Discipline
- Reports & Publications
- Successful Projects**
- User Experiences
- Returning CAT Materials
- Frequently Asked Questions
- Contacts

Successful Projects

Some Examples of Projects that have Improved CAT Scores

City University of New York (CUNY)

NSF TUES Project #0942790. CREATE Cornerstone--Inspiring undergraduates to persist and succeed in the Biology major. PI: Dr. Sally Hoskins shoskins@ccny.cuny.edu Related Website: www.teachcreate.org

The CREATE Cornerstone course adapted the CREATE approach for first-year students with the goal of building transferable science learning skills and deepening students' understanding of the nature of science. Students gained in critical thinking and experimental design abilities, and also showed maturation of epistemological beliefs about science (Gottesman and Hoskins, 2013, <http://www.lifescied.org/content/12/1/59.full>).

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

Why Use the CAT with CAT Apps

Establish Validity of CAT Apps

Demonstrate Transfer Beyond Discipline Content

Compare to Gains Over a 4-Year Education

Using CAT Apps with the CAT



Thank You

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.