



Case Studies of Engaging Faculty in Assessing Critical Thinking Skills

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- The Development of the CAT Instrument and the National Dissemination of the CAT Instrument is supported by the National Science Foundation.
- 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.

History of CAT Development

**Preliminary Work
At TTU 2000 - 2004**



**Refine Test with National Input
Expand National Dissemination
& Support Assessment in NSF
Projects**

Over 200 Institutions Collaborating



Guam

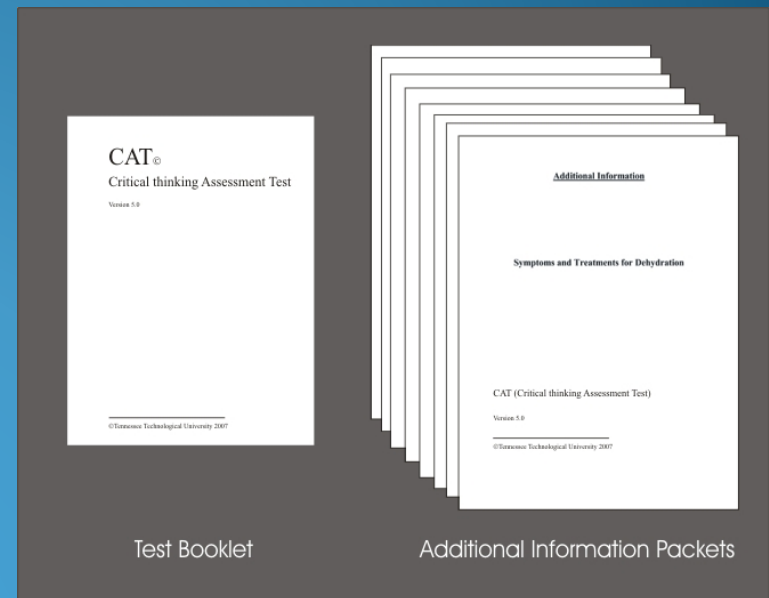


Hawaii



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

- 99.9 percent 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 described above strongly support the scientist's hypothesis? Yes ___ No ___

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

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

Faculty Are Using the CAT To



**Identify Student
Weaknesses**



**Improve
Course Assessments**



**Identify Strategies for
Improving
Critical Thinking**

Identify Relevant Skill Areas on Checklist

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.

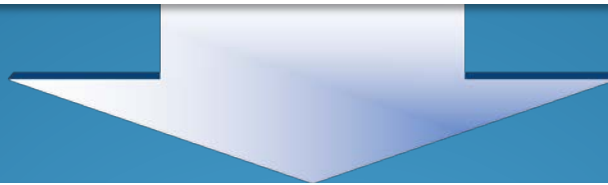
Q13: Identify suitable solutions for a real-world problem using relevant information.

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.

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

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

Discipline Specific Analog

Read the following thesis from a student's analysis of Claude McKay's poem "If We Must Die":

"If We Must Die" is a poem about having valor on the battlefield. The speaker is a military commander rallying his troops before a big battle. This is evident by looking at the war-like language McKay uses throughout the poem, such as "let us nobly die," "we must meet the common foe," "our precious blood," and "dying, but fighting back."

1. To what extent do the quotations provided support the student's interpretation of the poem?
2. Provide an alternative interpretation of McKay's use of war-like language.
3. Identify 3 types of additional information that would help you investigate McKay's intent in writing the poem and explain why each source would be helpful.

Using Headlines to Develop Discipline Analog

**Girls Who Play Soccer Have More Success in
STEM Fields**

**Consuming High Fat Dairy Products Leads to
Lower Obesity than Consuming Low Fat Dairy
Products**

**Frequent Reliance on Social Services Yields
Shorter Life Span**

Eating Fast Food Leads to Depression

Skill Set 2: Encouraging Effective Course Assessments

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.

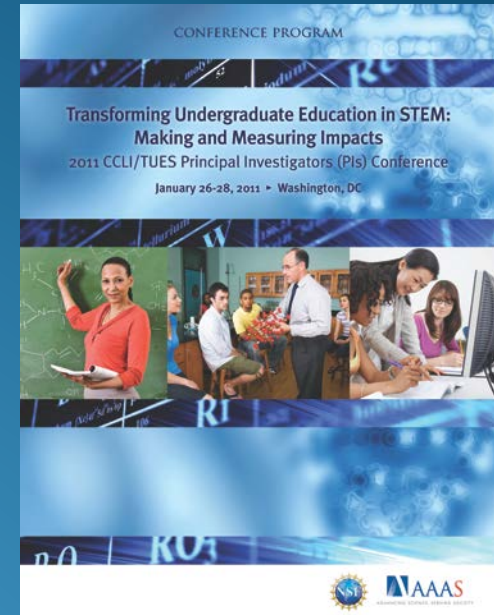
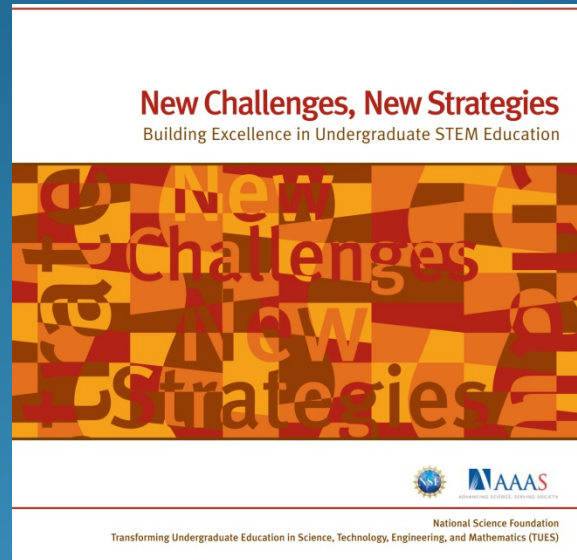
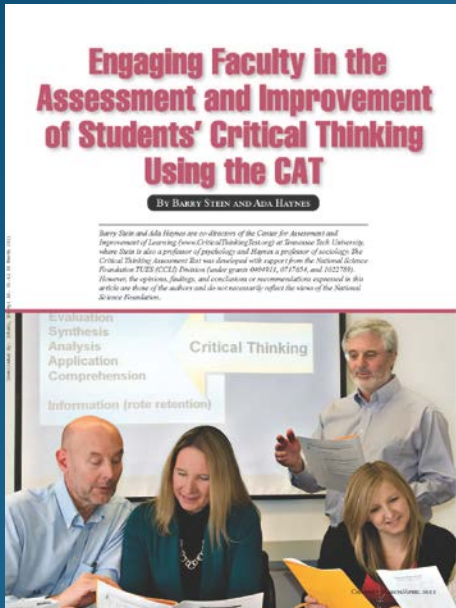
Explain how changes to a real-world problem situation might alter the recommended solution.



**Selecting New
Lab Equipment**

**Solving a Community
Problem – Feral Cats**

**Designing a Set
For a Play**



www.CriticalThinkingTest.org

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***Using the CAT to Assess LMU's
Creative & Critical Thinking
Undergraduate Learning Outcome***

McKenzie Sweeney
Research Associate
Office of Assessment

- Why the CAT?
- Assessment Process at LMU
 - Faculty-driven
- Impact & Insights

2010

- LMU adopted Undergraduate Learning Outcomes
 - **Creative and Critical Thinking:**
 - Students will be able to ask questions, solve problems and produce works through the innovation of ideas and concepts and by developing and justifying solutions through critical evaluation and analysis.

2012

- Began to focus on Creative & Critical Thinking ULO
- Selected the CAT
 - Short essay format
 - Faculty developed & scored

Faculty-driven Process:

- Assessment Advisory Committee recommended Faculty Leaders
- Faculty Leaders partnered with the Office of Assessment to lead CAT

Summer 2012:

- CAT Training

Fall 2012:

- Freshman took CAT

Spring 2013:

- Seniors took CAT

Be a Lion



Take the CAT

The CAT
(Critical thinking Assessment Test)
is a test of your ability to
**evaluate information &
creatively solve
problems**

***Only 100 seniors
will be invited to
participate**

*Current & future
students will
benefit from
what is learned

\$20 cash for one hour of your time
Thought-provoking questions

Watch for an exclusive invitation in your *Lionmail*

If you are one of the chosen few,
take some time to give back to LMU

LMU|LA
Office of Assessment
assessment@lmu.edu

Assessment Process



Summer 2013:

- Faculty Leaders recruited 10 colleagues to score over 2 days

Fall 2013:

- Internal report generated
 - NSSE data
 - Alumni survey data

Spring 2013:

- Presenting results to entire campus community

Spring 2015:

- Survey academic programs to learn about changes made

- Results will be interpreted and acted upon by faculty
 - Pedagogy
 - Courses
 - Resource allocation
 - Assessment methods
- Faculty spent time on the scoring days discussing:
 - Students' weakest and strongest responses
 - Modifications to courses/assignments
 - Discipline-specific analogs
- Modeling rubric scoring this year on CAT scoring process

Questions?

For more on the use of the CAT at LMU:

Email: mckenzie.sweeney@lmu.edu

For more on assessment at LMU:

Website: www.lmu.edu/assessment

LMU|LA

Using the CAT to Assess Critical Thinking Skills in Pharmacy Students

**David Hawkins, PharmD
Vice President for Academic Affairs
and Dean of Pharmacy
California Health Sciences University**

Pharmacy Practice Skills that Require Good Critical Thinking Skills

1. **Provide the best** treatment for a given patient
2. **Interpret** relevant data to assess the patient's clinical condition
3. **Provide** alternative explanations for a patient's presenting problem
4. **Decide** when alternative treatments should be used to effectively manage a patient
5. **Identify** what information is needed to evaluate a patient's clinical response to treatment

Critical Thinking Skills Assessed by the CAT that Are Important to the Practice of Pharmacy

1. Provide alternative explanations for a pattern of evidence that has many possible causes.
2. Identify additional information needed to evaluate a hypothesis/interpretation
3. Provide relevant alternative interpretations of information
4. Identify alternative solutions for a real-world problem.
5. Identify and explain the best solution for a real-world problem using relevant information.

Using the CAT to Assess and Sharpen Critical Thinking Skills

- **Identify critical thinking skills in which students are most deficient at baseline**
- **Intentionally incorporate learning exercises throughout the curriculum that force students to further develop those skills**
- **Reassess critical thinking skills toward the end of the academic program**

CAT Results Showing Critical Thinking Skills that Pharmacy Students Need to Sharpen

Critical Thinking Skill	2008 Class Score	2009 Class Score	2010 Class Score	2011 Class Score
Providing alternative explanations Score Range: 0-3	1.0	0.89	1.29	1.09
Additional information needed to evaluate a hypothesis Score Range: 0-4	1.92	1.51	1.78	1.50
Identify alternative solutions Score Range: 0-3	1.08	0.92	1.45	1.16
Identify best solution Score Range: 0-5	2.16	2.17	2.69	2.74

Teaching for Critical Thinking

- The lecture transmits information, not knowledge
- Knowledge must be constructed in the minds of students
- Knowledge construction requires critical thinking
- Active learning strategies promote critical thinking
- TBL is an efficient pedagogical frame for engaging students in critical thinking and active learning

Documented Benefits of TBL

- Enhancing clinical problem solving (Bick et al; Beatty et al)
- Having a positive impact on student engagement and learning satisfaction (Chung et al; Clark et al)
- Improving student performance (Zgheib et al; Vasani et al; Thomas et al; Tan N, et al)
- Sharpening critical thinking skills and long-term retention (McInerney and Fink).

Team-Based Learning



Individual Study
Guided Learning

Individual Test
Team Test
Discussion

Individual Application
Team Application
Wrap-up

Backward Course Design

1. What do you want your students to be able to do when they finish this topic or course?
2. What will your students need to know in order to do those things?
3. How do you facilitate that learning ?
4. How do you assess that learning?

We need to realize that

*we can improve student learning
only by improving student thinking.
We can improve student thinking
only by creating opportunities and
incentives for them to think.*

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

A 62 y/o African American woman with newly diagnosed hypertension is being managed on diuretic therapy. The patient has a history of acute gouty arthritis. She read on WebMD that diuretics can precipitate an acute attack of gout.

Which blood pressure medication should replace the diuretic?

- A. Tenormin (Atenolol)
- B. Cozaar (Losartan)
- C. Zestril (Lisinopril)

Provide alternative explanations for a pattern of results that has many possible causes.

A 52 y/o male patient with a seizure disorder has been placed on 300mg of Dilantin daily. Despite this usual daily dose, the patient continues to have 1-2 seizures every 3-4 days.

What are three possible explanations for the lack of seizure control in this patient?

Identify additional information needed to evaluate a hypothesis

A patient was admitted to a hospital for a heart infection. All admitting labs were normal. The patient was taking gentamicin 40 mg twice daily for his heart infection. Two days after being admitted the patient's kidney function tests were found to be remarkably elevated. Since gentamicin may cause kidney dysfunction in some patients it was discontinued.

What additional information is needed to support the hypothesis that gentamicin may have caused acute kidney failure in this patient?

Baseline –Post Test Scores

Skill Assessed	Baseline Mean	Post Test Mean	Effect Size
Interpreting Graphs	0.62	0.78	+0.34*
Provide Alternative Explanations	1.03	1.56	+0.54***
Spurious Information supports Hypothesis	0.82	0.92	+0.31*
Separate Relevant vs Irrelevant	2.92	3.23	+0.36*
Apply relevant information to evaluate problem	1.30	1.05	-0.40**
* p<.05, ** p<.01, *** p<.001			

Bick RJ, Oakes JL, Actor JK, et al. Integrative Teaching: Problem Solving and Integration of Basic Science Concepts into Clinical Scenarios using Team-Based Learning. *J Int Assoc Med Sci Ed* 2009; 19 – 1:26-34.

Beatty S, Kelley K, Metzger A, et al. Team-based learning in therapeutics workshop sessions. *Am J Pharm Ed* 2009; 73:1-7.

Chung E-K, Rhee J-A, Baik Y-H, et al. The effect of team-based learning in medical ethics education. *Med Teacher* 2009; 31:1013-1017.

Clark MC, Nguyen HT, Bray C, et al. Team-based learning in an undergraduate nursing course. *J Nurs Educ* 2008; 47:111-117.

Zgheib NK, Simaan JA, Sabra R. Using team-based learning to teach pharmacology to second year medical students improves student performance. *Med Teacher* 2010; 32:130-135.

Vasan NS, DeFouw DO, Holland BK. Modified use of team-based learning for effective delivery of medical gross anatomy and embryology. *Anat Sci Educ* 2008; 1:3-9.

Thomas PA, Bowen CW. A controlled trial of team-based learning in an ambulatory medicine clerkship for medical students. *Teaching and Learning in Medicine* 2011; 23:31-36.

Tan N CK, Kandiah N, Chan Y H, et al. A controlled study of team-based learning for undergraduate clinical neurology education. *BMC Med Educ* 2011; 11:91.

McInerney MJ, Fink D. Team-based learning enhances long-term retention and critical thinking in an undergraduate microbial physiology course. *Microbiology Educ* 2003; 4:3-12.