Getting Faculty Involved in Assessing and Improving Critical Thinking

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Importance of Critical Thinking

Explosion of Information

Internet

E=MC²
Email
MySpace
Wikipedia
Facebook
Phone Apps
Augmented Reality
Books
Magazines
Blogs
Television
Radio
Journal
What is Critical Thinking?

Classic Emphasis

Evaluate Arguments and Conclusions

Reasoning
What is Critical Thinking?

Classical Emphasis

Evaluate Arguments and Conclusions
- Reasoning

Expanded Contemporary Emphasis

Evaluate Ideas And Plans
- Problem Solving

Evaluate One’s Own Understanding
- 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
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 80 Institutions Collaborating
Designing the CAT Instrument

Faculty Driven: High Face Validity Involved in Scoring

Construct Validity: Learning Sciences

CAT

Engaging for Students

Reliable & Consistent Scoring Essay Responses
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

Institution

8 – 14 Faculty Involved in Scoring

2 - 3 Representatives

CAT Regional Training
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

- Informal Learning Experiences
- Classroom Learning Experiences
- Program Outcomes
- College Outcomes
- Value Added Enter vs. Exit
- Tracking Outcomes Over Time
- Norm Referenced
Closing the Loop in Assessment and Quality Improvement

1. Assess Student Performance
2. Improve Student Learning
3. Increase Faculty Awareness of Student Weaknesses (Faculty Participate in Test Scoring)
4. Increase Faculty Awareness of Effective Practices
SUCCESSFUL PROJECTS

Some Examples of Projects that have Improved CAT Scores

Clemson University

NSF CCLI Project #0537540, Development of an Inquiry-Based Cell Biology Laboratory with Emphasis on Scientific Communication Skills. PI: Dr. Lesly Tenesvari (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.

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_RMG@shsu.edu) and 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. Bassik Tikoff (PI) & Nancy Ruggeri, bassik@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 interconnected) part of this process is the different methods scientists use to do their work and the ways they communicate their results to others.
Northwestern NSF Project

Faculty Development Workshops & Participation in CAT Scoring

Impact on Teaching Attitudes & Practices
Institutional Involvement

Northwestern University

City Colleges Of Chicago
Goals

1. Reflect critically on key issues in learning and teaching in higher education.
2. Develop their learning, teaching, and assessment practices to facilitate higher order student learning outcomes.
3. Redesign an existing course or develop a new course that implements these new learning and teaching practices.
4. Improve STEM students’ higher order learning outcomes.
Hypothesis

Faculty Involvement Scoring CAT & Course Improvement

Vs.

Standard Faculty Development Workshops

Impact on Teaching
Assessments

Faculty Instructional & Assessment Practices

Faculty approaches and conceptions of teaching

Student Learning Outcomes
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