

# Learning Outcomes Assessment - Critical Thinking

Assessment ID: 204

Assessment Type: General Learning Outcome

Year/Term: 2010 / 2

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Program: Education

Prefix / Course Number: SSCI / 101

**High Impact Practice (HIP):**

- |  |   |
|--|---|
| <input type="checkbox"/> First Year Experience                       | <input checked="" type="checkbox"/> Learning Community          |
| <input type="checkbox"/> Leadership Training                         | <input type="checkbox"/> Co-Curriculum                          |
| <input checked="" type="checkbox"/> University Writing Requirement   | <input type="checkbox"/> Collaborative Assignments and Projects |
| <input checked="" type="checkbox"/> Undergraduate Research           | <input type="checkbox"/> Diversity / Global Learning            |
| <input type="checkbox"/> Service Learning / Community-Based Learning | <input type="checkbox"/> Internship / Practicum / Field Work    |
| <input type="checkbox"/> Performance                                 | <input type="checkbox"/> Portfolio                              |
| <input type="checkbox"/> Capstone Project                            |   |

Learning Outcome: Critical Thinking

Assessment Method/Tool: Rubric

Measurement Scale: 1 - 3

Sample Size: 26

	Developing (# of students)		Adequate (# of students)		Proficient (# of students)	
	#	%	#	%	#	%
1. Identifies and explains issues	10	38.5%	11	42.3%	5	19.2%
2. Recognizes contexts and assumptions	7	26.9%	6	23.1%	13	50.0%
3. Acknowledges multiple perspectives	6	23.1%	15	57.7%	5	19.2%
4. Evaluates evidence to reach conclusions	11	42.3%	9	34.6%	6	23.1%
<b>Averages: (based on <u>26</u> student sample size)</b>	8.5	32.7%	10	39.4%	7.25	27.9%

**Benchmark:** 85% Institutional benchmark goal for percent of students to meet "Adequate" or "Proficient" levels  
 (This institutional benchmark does not take into account the level of the course and the preparedness of the students in the sample. Results will help the institution understand the learning needs of participating students.)

**Percent Achieving Benchmark** 67.3% Actual percent of students meeting "Adequate" or "Proficient" levels

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**Question / Prompt / Assignment:** Science 101  Scientific Method  
**(used for the assessment)** Lab 1: Soak It Up  
Pre Lab Questions

(CTQ = Critical Thinking Question)

You have each brought to class two sheets of paper towel from home, along with some other data.

1.  What brand of paper towel do you have?

2.  How many sheets are there per roll of that brand?

3.  What is the cost per roll for your paper towels?

4.  What is your reason for using this brand of paper towel?

\_\_\_\_\_

CTQ: What are some other reasons a person might choose one brand of paper towel over another? List at least three.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Consider this slogan:  With Brawny® paper towels in the house, you've got the strength to get things done.

Does this slogan address any of the reasons you gave above for choosing a paper towel? If not, what other reason might this slogan address?

\_\_\_\_\_

\_\_\_\_\_

Consider this advertisement for Bounty paper towel Huge Roll size:  Huge Roll. Huge value.\* The same super strength, super absorbency, and cloth-like durability that you know and love in a roll that's big enough to keep up with your whole family.

This statement gives several reasons to choose this product. List four, and put a star next to the ones you already identified above.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Let s consider the qualities of Value and Absorbency.

Suppose I poured a jug of water onto the floor and asked you to mop it up with Mr Green Paper towels, which cost \$1.09 per roll, and it takes you a full roll of 100 sheets to mop up the mess.

Now suppose Shannon pours another jug of water onto the floor, and you are able to mop it up with only ½ a Huge Roll of Bounty, which costs \$3.09 and has 200 sheets.

Which brand of paper towel had better absorbency per sheet? Show your calculations:

Which brand of paper towel is a better value? Show your calculations:

CTQ: What assumption have you made in answering the above two questions?

\_\_\_\_\_

\_\_\_\_\_

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Ø For the next section, work with your team members to answer the questions.

□ In our next class period, we will have a lab in which you will calculate the absorbancy and the cost-per-volume of water absorbed for your brand of paper towel and three others.

□ Design an experiment to measure the absorbancy of a sheet of paper towel. Describe your procedure, and how you will be sure your work can be reproduced most precisely.

Equipment:

Experimental Procedure:

□ CTQ: Why is reproducibility important in scientific experiments?

□ CTQ: When it comes to precision and reproducibility, how close is close enough? (Do you think your measurements of the absorbancy of a sheet of paper towel will be reproducible to the drop? The nearest tablespoon? The nearest cup? Quart?)

□ CTQ: What sources of experimental error do you expect in your experiment? Which ones are unavoidable, and which ones can you control?

**Commentary / Explanation:**  
(provide context within the course/activity for the question/prompt/assignment)

This assignment was a Pre-Lab exercise for the first lab in Science 101. It was given on the first day of the fall term of 2010. It was designed to get students ready for a lab in which they measured the absorbency vs. cost of several brands of paper towel. Students had little to no background in science or the scientific method, so this exercise provides some insight into the initial state of critical thinking abilities as students begin the Science 101-103 sequence.

**Data Analysis: What do these results mean?**  
(what do the results indicate regarding student proficiency in the outcome assessed)

Overall, the students did not achieve the 85% adequate or proficient benchmark. Given that this was insight into an initial state, the result comes as no surprise. I was somewhat surprised that the trait in which performance was best was "recognizes contexts and assumptions". It was not surprising that the areas in which most students were marked as "developing" concerned "Identifies and explains issues" and "Evaluates evidence to reach conclusions". These two traits, in a science context, are ones in which I would expect significant improvement during the course of education in the scientific method.

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**Closing the Loop:** I see this phase of the data collection as only the first half of a larger whole. It is not surprising that incoming students are not ranked as highly proficient critical thinkers in a scientific context. What would be surprising would be if they finished Science 101 or the Science 101-103 sequence without showing significant improvement. There is, for example, a landmark study in physics by Halloun and Hestenes (1985) called "Common sense concepts about motion". The authors administered a "Force concept inventory" to incoming physics students to test their understanding of basic physics concepts. It was not at all surprising that incoming students scored poorly on this assessment. What was shocking, and has driven much discussion about the teaching of physics, is that students did just as poorly on the assessment after taking their first year of physics as they had in the beginning! I look forward to assessing my science students' critical thinking abilities again after they have taken the 101-103 sequence. If they do not show significant improvement, then I shall have to radically rethink my teaching methods. I would like to develop something like the Halloun and Hestenes Force Concept Inventory for beginning science students that I could administer each year at the beginning of fall term and again at the end of spring term. Teaching a sequence of three courses in which I have mostly the same students throughout the year, gives a great opportunity to observe critical thinking development over more than the usual ten-week limitation.

**Student Samples (optional):**  
(web links to posted, online files)

Developing Example (web address)

Adequate Example (web address)

**NOTE: Student names cannot be used  
on the samples.**

Proficient Example (web address)