

# Designing Discipline-specific Critical Thinking Scenarios



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# TH!NK Student Learning Outcomes

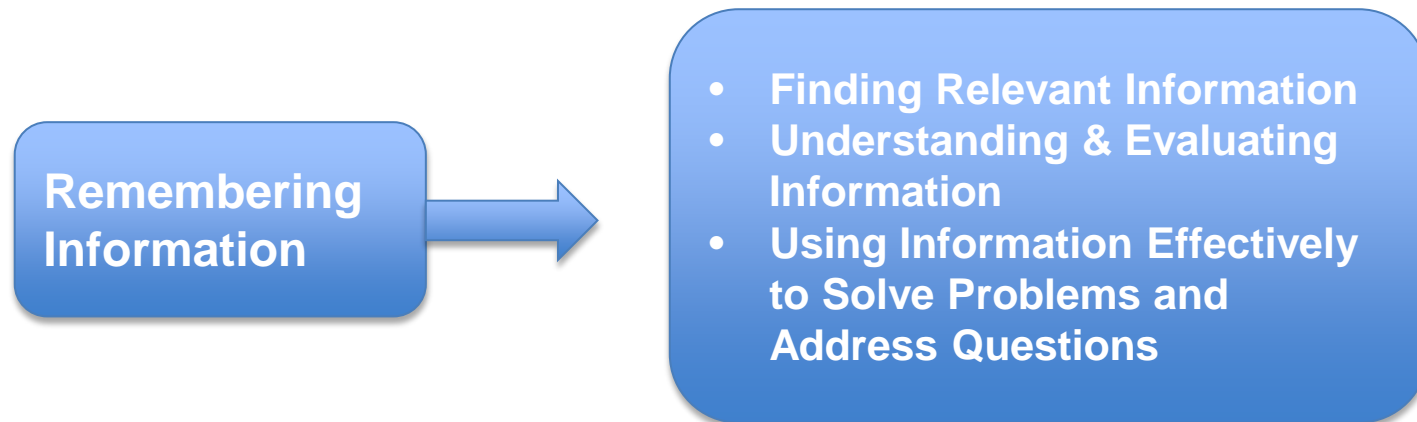
Outcome A: Students will explain the intellectual standards for critical and creative thinking.

Outcome B: Students will evaluate the work of others using the intellectual standards for critical and creative thinking.

Outcome C: Students will apply critical and creative thinking skills and intellectual standards in the process of solving problems and addressing questions.

Outcome D: Students will reflect on their own thinking.

# The Changing Nature of Education



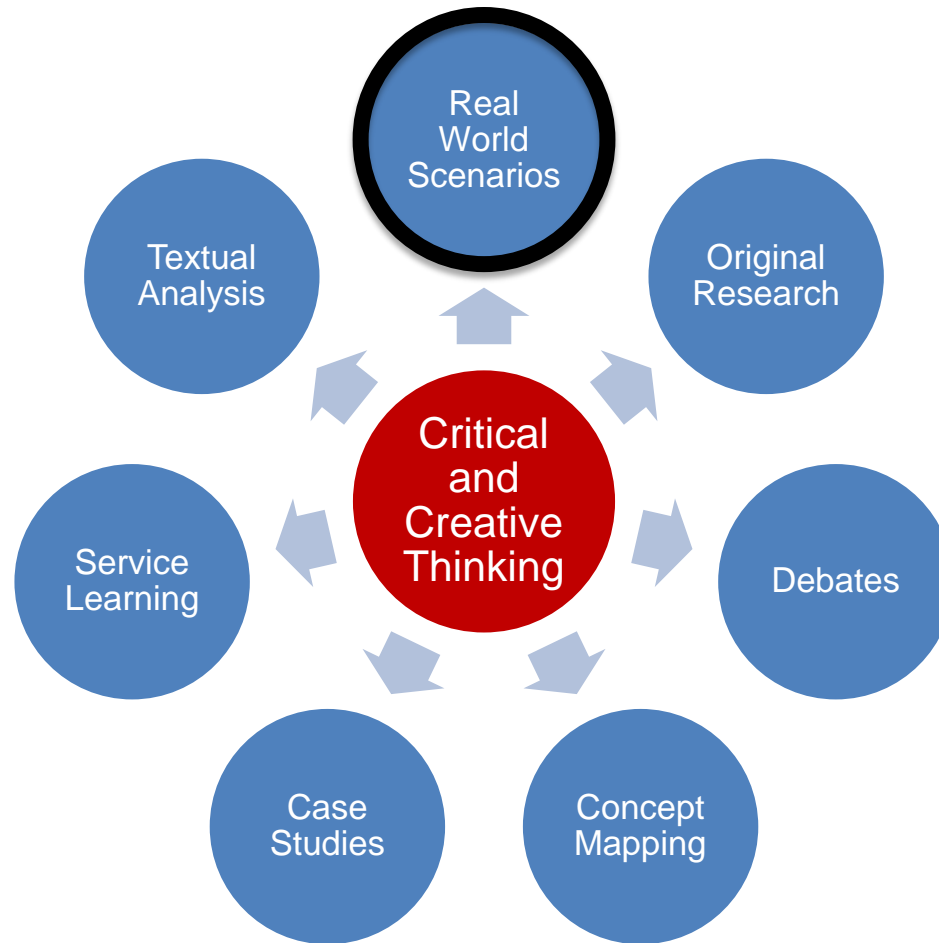
But there is often a disconnect between what we value and what we assess.  
How we assess influences what students learn!

# Why Incorporate and Assess Critical Thinking in Your Course?

How we assess influences what students learn!

Emphasizing critical and creative thinking skills in disciplinary content allows students to generalize beyond that content.

# Examples of Effective Practices for Teaching Critical and Creative Thinking



# Sue's Data

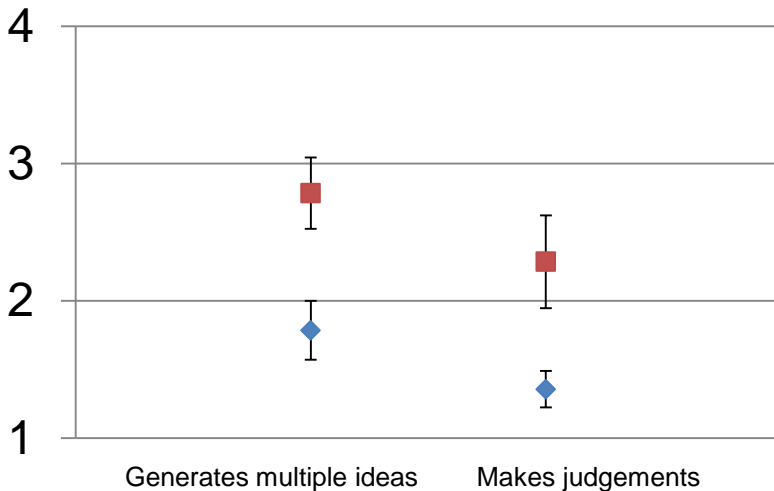
	Skill Assessed by CAT Question	Max points	Pre Mean	Post Mean	Probability of difference <sup>a</sup>	Effect size <sup>b</sup>
Q1	Summarize the pattern of results without making inappropriate inferences.	1	0.71	1.00	*	+.86
Q6	Provide alternative explanations for spurious associations.	3	1.93	2.36	*	+.69
	<b>CAT Total Score</b>	<b>39</b>	<b>23.33</b>	<b>26.02</b>	<b>*</b>	<b>+.67</b>

## Transferrable gains measured by CAT

Mean scores on pre-/post- Critical Thinking Assessment test. N=14

a. \* p<.05 \*\*p<.01 \*\*\*p<.001 (2 –tailed)

b. Mean difference divided by pooled group standard deviation. (0.1 - 0.3 = small effect; 0.3 - 0.5 = moderate effect; >0.5 = large effect)



## Discipline-specific gains on research papers

Mean rubric scores with standard error of control group versus test group. N=14 for both groups. p= 0.0064 and p= 0.016 (2 –tailed) for each question respectively.

Blue = control; Red = THINK

# Skill Set 1

- Provide alternative interpretations for information or observations that have several possible interpretations.
- Identify additional information or evidence needed to evaluate the alternative interpretations.

## Sample Scenario (exaggerated)

A scientist working in 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% of criminals consumed bread prior to the criminal activity.
- Crimes rates are extremely low in areas where bread is not consumed.

Questions:

1. Do the data strongly support the hypothesis?
2. Are there other explanations for the data besides the scientist's hypothesis? If so, describe.
3. What kind of additional information or evidence would support or oppose the scientist's hypothesis?

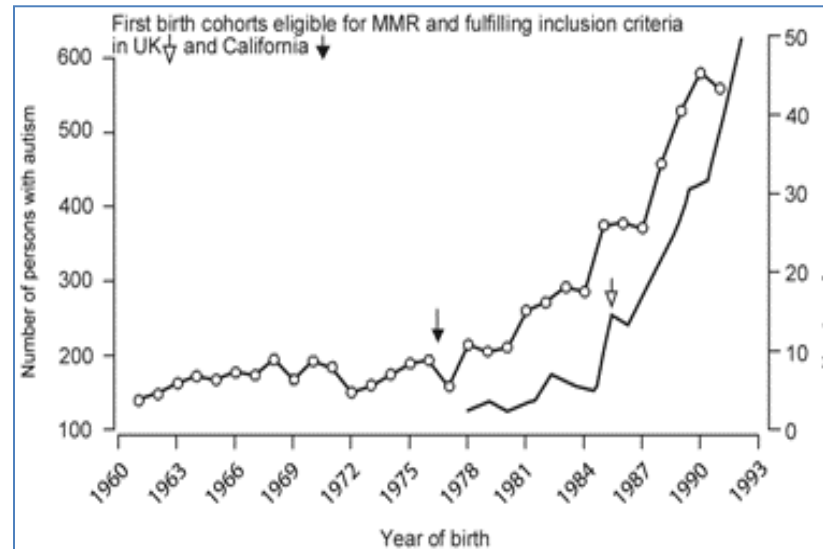


# Public Health Scenario 1

“But my Dad had the vaccine and still got the flu.”

1. Does this statement strongly support the idea that flu vaccines are not effective?
2. What are some alternative explanations for Dad getting the flu, besides that flu vaccine is not generally effective?
3. What other information would you need in order to support or oppose the different explanations?

# MMR/Autism Scenario



Wakefield A.J. *Lancet* 1999;354:949-50

1. What does the author of the graph want you to infer?
2. Give an alternate explanation for the data shown in the graph.
3. Suggest further data that you could gather to investigate the alternatives above.

## Possible Topics

Chemical Engineering: Students perform a distillation lab and must explain why their results differ from the ideal formula.

Civil Engineering: The Hyatt balcony collapse in Kansas City is analyzed and students must defend various constituents by offering other interpretations for the cause of the failure

## Current Headlines

- 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

# Create a Skill Set 1 Scenario

*Set up scenario – headline, figure from a journal article, public misperception of something in your discipline, results of an experiment with one interpretation, etc.*

1. Does the evidence strongly support the conclusion?
2. Are there other possible explanations? If so, describe.
3. What kind of additional information or evidence would support or oppose the original conclusion or any of the alternatives?

## 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 situation might alter the recommended solution.

# Possible Topics

- What device should you buy or use for \_\_\_\_\_ (lab equipment, new car, book to read...)?
- What treatment would be best for \_\_\_\_\_?
- What experimental design would be best to determine \_\_\_\_\_?
- Design a \_\_\_\_\_ for...
- What is the best plan for \_\_\_\_\_ (marketing, communicating, educating ...)?
- What format should I use to get this information across?

## Public Health Scenario 2

You are trying to decide whether or not to receive the flu vaccine this October. The shot is free, but you don't love getting shots (assume the nasal spray is not an option).

1. What kinds of information should you gather in order to decide whether to receive the shot?
2. Create two lists – pros and cons – for receiving the vaccine. Provide references for your arguments, and indicate whether you believe the evidence is valid and why. Considering the evidence, would you choose to receive the vaccine?
3. Now it is April and you have an opportunity to receive a flu vaccination. How might this change your decision and why?



## Create a Skill Set 2 Scenario

*Set up a scenario with a real-world problem or question.*

1. What kinds of information should you gather and from what kinds of sources?
2. Summarize relevant information (with sources) and advocate for a course of action based on your evaluation of the information and of priorities.
3. *Instructor changes situation context.* Explain how changes might alter the recommended solution.

# Acknowledgements

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- Autism/MMR and Public Health Scenarios developed by Sue Carson (NCSU).