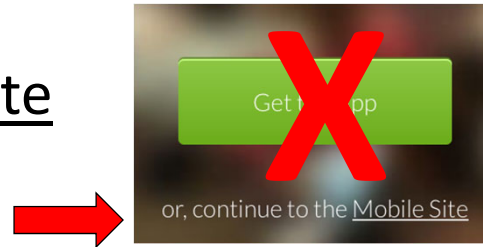




# Become a participant

1. Visit <http://tinyurl.com/muell1a> in web browser.
2. Don't login. Scroll down and click on 
3. Continue to the Mobile Site  
(Do **NOT** Get the App)
4. If prompted, Enroll in the course.
5. Wait for a question to appear.
6. Select or Type in your response.
7. Click **SUBMIT** or **POST**.



# Assessment of Interdisciplinary Projects

*Anja Mueller, Mike Carson, Eron Drake, Stephen Juris,  
James Therrell, Catherine Willermet*

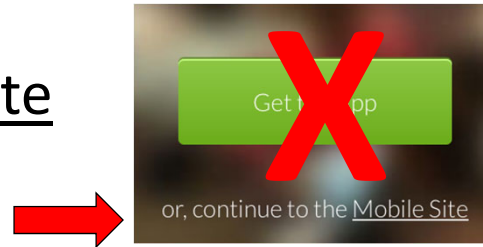
Central Michigan University

Mt. Pleasant, MI



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# Interdisciplinary Education

- Interdisciplinary education encourages students to:
  - Analyze complex problems from several perspectives
  - Place problems and solutions within a larger world context
  - Empathize with multiple stakeholders
  - Tolerate ambiguity and complexity

# Call from Students



Universities Allied for Essential Medicines (UAEM) conference March 2011 at Central Michigan University (CMU):

Students want General Education courses that

- cover real-life problems
- connect social problems with science solutions
- raise student social awareness to global health disparities
- have several designators so that students from different fields can meet and discuss problems from different perspectives
- Include activism

# Water as Life, Death & Power

- Crosslisted as ANT 250, BIO 250, CHM 250
- Taught in an interdisciplinary manner with all faculty present in all lectures
- Theme: cholera, a water-borne disease, in a global context.
- Lecture (content) combined with seminar (activism, group work)



Bacteria *Vibrio cholerae*.  
Image: Science Photo Library.

## Topics:

Water access

Water-borne pathogens

Water treatment

Power in global contexts

## Activism:

Student-run seminar

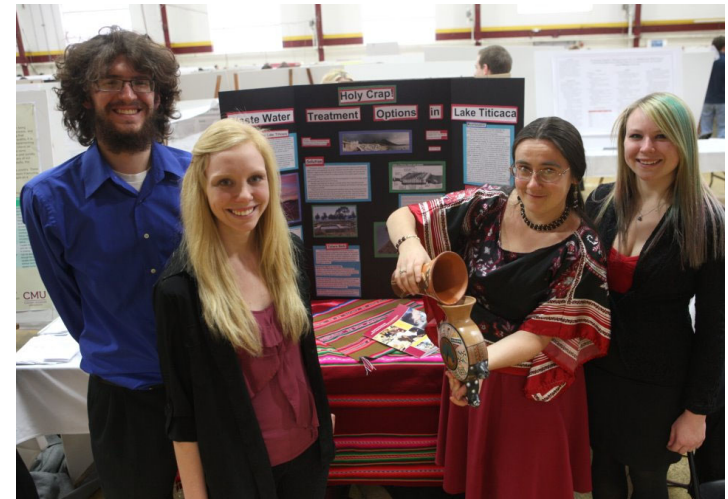
Group projects

Apply content to solve real-world problems

Present to larger audience (SRCEE)

# Group Projects

- Time-release treatment for schistosomiasis
- Michigan water bottle recycling and deposits
- Composting toilets at CMU
- Education on Hydrologic Fracturing
- City ordinances about green lawns
- Buffer zones on Iowa farms
- Lake Titicaca wastewater treatment
- Solar disinfection of water in Uganda



IUPUI Assessment Institute, October 14<sup>th</sup>, 2019

# How to measure interdisciplinary learning?

- What is interdisciplinary thinking?
  - Happens in stages (with jargon translated)

<i>Stage</i>	<i>Translation</i>
Disciplinary Grounding	You can only combine knowledge if you know enough from each field
Interdisciplinary Reasoning (there are sub-stages to this)	Explain something by combining knowledge and approaches from all fields
Pragmatic Solution	You need that when you want to solve an interdisciplinary problem



# Interdisciplinary Rubric

Modified Thinking-Writing Rubric, combined with Boix-Mansilla and 6 $\sigma$ :

Interdisciplinary project rubric	Proficient (4)	Acceptable (3)	Developing (2)	Deficient (1)
<b>Disciplinary Grounding</b>				
<b>Clarity: Explanation of disciplinary insights, methods, findings, mode of thinking is free from confusion and ambiguity.</b>	All disciplinary explanations are clear in purpose and organization.	All but one disciplinary explanations are clear in purpose and organization; or several miss either purpose or organization	Only one disciplinary explanation is clear in purpose and organization; or all miss either purpose or organization	None of the disciplinary arguments are clear
<b>Logical: Each disciplinary argument fits together well, conclusions follow from reasoning and evidence; well-reasoned; plausible, consistent, coherent.</b>	All disciplinary arguments are logical, coherent, and based on evidence	All but one disciplinary arguments are logical, coherent, and based on evidence	Only one disciplinary argument is logical, coherent, and based on evidence	None of the disciplinary arguments are logical, coherent, and based on evidence
<b>Complete: Includes all disciplinary information needed; lacking none of its parts or aspects thorough, whole.</b>	All disciplinary information needed is presented.	Most of the disciplinary information needed is presented.	Only some of the disciplinary information needed is presented.	None of the disciplinary information needed is presented.

# Interdisciplinary Rubric

Modified Thinking-Writing Rubric, combined with Boix-Mansilla and 6 $\sigma$ :

Interdisciplinary project rubric	Proficient (4)	Acceptable (3)	Developing (2)	Deficient (1)
<b>Interdisciplinary Reasoning</b>				
<b>Integrative Summary: All disciplinary arguments are distilled into a coherent summary with an overall meaning or result.</b>	All disciplinary information has been included in the summary in a logical manner.	2 disciplines are favored over the 3 <sup>rd</sup> .	1 discipline is favored over all other disciplines.	No integrative summary is attempted.
<b>Conceptual Bridging: A particular concept, instrument, skill is used in a variety of concepts resulting in a deeper understanding of the tool itself.</b>	The topic is investigated from the viewpoint of all disciplines, leading to deeper understanding of the topic.	2 disciplines are favored over the 3 <sup>rd</sup> .	1 discipline is favored over all other disciplines.	No deeper understanding has been achieved.
<b>Complex Explanation: The interdisciplinary argument is developed to a higher level of abstraction</b>	Coherent whole is synthesized to a higher level of abstraction	Several parts of the bridged concepts are developed to a higher level of abstraction	A few parts of the bridged concepts are developed to a higher level of abstraction	Abstraction has not been attempted

# Interdisciplinary Rubric

Modified Thinking-Writing Rubric, combined with Boix-Mansilla and 6σ:

Interdisciplinary project rubric	Proficient (4)	Acceptable (3)	Developing (2)	Deficient (1)
<b>For final seminar project only: Pragmatic solution</b>				
<b>Pragmatic Solution: A practical problem is solved by the inclusion of all disciplinary perspectives</b>	The pragmatic solution plan is interdisciplinary and includes all processes of 6σ: define, measure, analyze, improve, and control	The pragmatic solution plan is interdisciplinary includes at least 4 of the processes of 6σ: define, measure, analyze, improve, and control	The pragmatic solution plan only includes only 2 out or fields or only 3 of the processes of 6σ: define, measure, analyze, improve, and control	The problem was not solved in an interdisciplinary manner or did not include 6σ processes.

# Increased Interdisciplinary Thinking

- Interdisciplinary group project, split into:  
problem statement, concept map, pitch, SCREE presentation
- For determining if there was an increase in interdisciplinary learning we compared % available points for concept map and SCREE presentation based on rubric
- The student groups' performance on interdisciplinary learning:  
Concept map: 40.1% of possible points (StDev: 22.0%)  
Final Project (SRCEE poster): 71.6% of possible points (StDev: 11.8%)

All groups but one experienced a large improvement in performance on interdisciplinary rubric.

Remaining group was the highest performing group, doing very well on both assignments.

# Student Comments

*"I didn't realize how serious the water issue is in the US and globally. Hopefully more people take action to help slow down water depletion."*

–Anonymous student

*"It is troubling that the cost of even dirty water is so high in some areas, and until everyone has access to clean, affordable water global equality will not be possible."*

–Anonymous student

*"I think its important for different fields to come together and develop a solution to the increasingly urgent water crisis."*

Anonymous student

*"I am much more curious about water issues! I want to know more. I don't like what I know and I want to help!"*

–Anonymous student

*"I wanted to have an impact on how water was recognized or viewed and be on the right side of change. "*

– student Sam Strahl, quoted in CM-Life,

# Conclusions

- Besides teaching anthropological, biological, and chemical facts about water, there were two overarching goals for course:
  - 1) developing interdisciplinary thinking
  - 2) encouraging students to engage in actively solving current, real-world problems in an interdisciplinary way.
- Interdisciplinary understanding:
  - was measured by rubric for group projects
  - assessed three steps of interdisciplinary learning: disciplinary grounding, interdisciplinary bridging, interdisciplinary problem solving.
  - Students became proficient in the disciplinary information early
  - It took most of the semester for them to become proficient in interdisciplinary bridging and problem solving.
  - At the end we were able to show a significant increase in interdisciplinary learning.

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- CMU Deans: Pamela Gates (College of Humanities and Social and Behavioral Sciences), Dean Ian Davison (College of Science and Technology)

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