STEM-Humanities Partnerships to Foster Responsible, Global Thinking

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Creating STEM-Humanities Partnerships

The practice and impacts of modern science always occur within a particular social context; science never exists within a vacuum. Understanding the intricacies of STEM within economic, political, and cultural contexts gives students the tools to gain a much more expansive understanding of the world, crucial in thinking responsibly and globally.

Dan Wilson and Nevart Tahmazian, Global Society and Chemistry faculty Montgomery College

- At Montgomery College (MC), STEM-Humanities efforts grew out of the Global Humanities Institute.
Three Models of Global Curriculum

- STEAM Tables
- STEM-Humanities Learning Communities
- Pop-up Learning Communities

Assessment of Global Learning Outcomes (GLOs)
STEAM Tables: Picking up STEAM

- Space for STEM and humanities faculty to explore global, interdisciplinary content and pedagogy
- A broad global theme
- 8 tables of 6-8 participants each
- Each table led by a faculty pair
  - (one STEM and one Humanities)
  - table topic of their choice
- 2:00-5:00 on a Friday afternoon
STEAMed Rice: Exploring the Intersection Between Global Humanities and STEM Through Food

Spring 2015
STEAMed Rice Table Topics

- Climate Change Bites: Feeding a Warming World (English and Physics/Engineering)
- Food for Thought: Choices, Habits and Responsibilities (English and Biology)
- 10,000+ Years of Domesticating and Replicating Food (Nutrition and History)
- Cheers: the History, Culture and Chemistry of Fermented Beverages (History, Geography and Chemistry)
- Food Irradiation and Adulteration (Chemistry and History)
What We Learned from STEAMed Rice

- Huge appetite for Humanities-STEM faculty collaboration on global issues
- “I never have a chance to talk to colleagues from STEM disciplines. This was incredibly valuable, helpful and motivating.”
- “I am very interested in exploring ways I can incorporate more real world, multi-faceted issues into my teaching.”
- Include students.
- “Please do this again.”
STEAM Cleaned:
Exploring the Intersection Between Global Humanities and STEM Through Clothing

Spring 2016
STEAM Cleaned Table Topics

- Made in China (Chemistry and Sociology)
- Clothing and Consumption: Environmental and Human Impact (Biology and History)
- Workers’ Rights (History and Nursing)
- Sustainable Clothing: Facts and Fictions (Chemistry and English)
- The Role of Clothing in Sexual Objectification and Gender Performance (Libraries and History/Women’s Studies)
Building on What We Learned

- Disseminated notes from whole group report-out
- Invited student participation
  - STEM Education Community Club
The MC STEM ED Community Club

Mission: to encourage STEM students to "discover the teacher" within themselves, share ideas across different disciplines to promote interdisciplinary collaboration, participate in volunteer-outreach activities, and become aware of educational opportunities within the community.
STEAMed: Global Perspectives on Water

Spring 2017
STEAMed: Global Perspectives on Water Table Topics

- **Water and Myth** (Biology and English)

- **Water Security** (History and Biology)

- **Hidden States of Water: Crystal, Quantum and Plasma** (Physics and Libraries)

- **Cultural and Traditional Uses** (Women’s and Gender Studies and Geography)

- **Protecting Water: History and Science of Water Policy** (History and Physics)

- **Climate Change: Telling Visual Stories to Effect Change** (Biology and Art)
Full STEAM Ahead

- Providing the space for faculty to think beyond their discipline
- Increasing student involvement
- Generating and sharing teaching ideas
- Making connections across the College
- Engaging in conversations about these big global issues:
  - SENCER
  - The Pulitzer Center
  - Northern Virginia Community College*
Creating STEM-Humanities Curriculum

Chemistry Course

Sociology Course

Environmental Humanities Learning Community
Learning Community
Essential questions

- How does culture shape perceptions of scientific knowledge and environmental practices?
- How are minority groups disproportionately impacted by environmental problems?
- Are free markets, economic growth, and environmental issues at odds with each other? Or can they work in harmony?
PROCEDURE
- Students read Ibsen’s play about the discovery of a town’s toxic water to highlight the drama that surrounds politics and science.
- Students assume the roles of characters in the play and engage in a fishbowl exercise.

STEM-HUMANITIES INTEGRATION
- This role play shows a conflict between science and politics that still occurs in today’s global water crises.
- It prepares students to see differing perspectives taken by politics, economics, media, and family in an environmental debate.

1. The Enemy of the People Role Play
PROCEDURE
• Small groups investigate:
  • main water pollutants in diverse areas of the world
  • challenges as economic, political, and cultural institutions create or prevent water pollution.
• Groups present research summaries for class discussion and peer evaluation.

STEM-HUMANITIES INTEGRATION
• This assignment highlights the combined roles of the chemist and sociologist with respect to global water crises.
• Chemistry provides students with the necessary understanding of what water “is” and the chemicals that can make it harmful for living beings.
• Sociology teaches students the social mechanisms that create “dirty” water and the potential social barriers global communities face in fixing their water quality issues.

2. From Local to Global: Understanding Water Systems around the World
PROCEDURE
- Students tour the award-winning Resource Recovery Facility in Dickerson, MD and report on:
  - techniques used to minimize the emission of harmful chemicals into the air
  - how electricity is generated by burning waste

STEM-HUMANITIES INTEGRATION
- In sensitizing students to sustainable and clean processing of waste for energy production, this assignment is a precursor to the integrative global energy assignment.

3. Field Trip to the Incinerator
PROCEDURE
• Small groups research and present on 4 main sources of energy
  • generation of energy
  • major pollutants and waste
  • cost analysis
  • regulation around the globe
  • countries that lead in their use

STEM-HUMANITIES INTEGRATION
• This assignment requires a depth of scientific understanding of atmospheric pollution and remediation techniques and economic, political, and cultural impacts on energy use and development.

Future Considerations and Challenges

- introduce smaller integrative in-class projects throughout the semester
- incorporate service learning
- change student groups for projects and assignments
Pop-up learning communities

- Two courses that meet simultaneously
- Students engage in collaborative activity
- Short-term commitment (one or more meetings per semester)
- Face-to-face or virtual
- At one school or two
Global Learning Outcome: Perspective Taking

MC student: My perspective about life in El Salvador or the Salvadoran people changed as a result of this experience. Living in America hides you from the outside world. I always thought that Central America was poor and less developed.

UES student: Se ven afectados por la situación política en su país como en cualquier otra parte del mundo. The U.S. students are affected by the political situation in their country just like any other part of the world.
## AAC&U Global Learning VALUE Rubric

<table>
<thead>
<tr>
<th>Capstone</th>
<th>Milestones</th>
<th>Benchmark</th>
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<tbody>
<tr>
<td><strong>GLOBAL SELF-AWARENESS</strong></td>
<td><strong>MILESTONES</strong></td>
<td><strong>BENCHMARK</strong></td>
</tr>
<tr>
<td>Effectively addresses significant issues in the natural and human world based on articulating one's identity in a global context.</td>
<td>Evaluates the global impact of one's own and others' specific local actions on the natural and human world.</td>
<td>Identifies some connections between an individual's personal decision-making and certain local and global issues.</td>
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<tr>
<td><strong>PERSPECTIVE TAKING</strong></td>
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</tr>
<tr>
<td>Evaluates and applies diverse perspectives to complex subjects within natural and human systems in the face of multiple and even conflicting positions (i.e. cultural, disciplinary, and ethical.)</td>
<td>Synthesizes other perspectives (such as cultural, disciplinary, and ethical) when investigating subjects within natural and human systems.</td>
<td>Identifies and explains multiple perspectives (such as cultural, disciplinary, and ethical) when exploring subjects within natural and human systems.</td>
</tr>
<tr>
<td><strong>CULTURAL DIVERSITY</strong></td>
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</tr>
<tr>
<td>Adapts and applies a deep understanding of multiple worldviews, experiences, and power structures while initiating meaningful interaction with other cultures to address significant global problems.</td>
<td>Analyses substantial connections between the worldviews, power structures, and experiences of multiple cultures historically or in contemporary contexts, incorporating respectful interactions with other cultures.</td>
<td>Explains and connects two or more cultures historically or in contemporary contexts with some acknowledgement of power structures, demonstrating respectful interaction with varied cultures and worldviews.</td>
</tr>
<tr>
<td><strong>PERSONAL AND SOCIAL RESPONSIBILITY</strong></td>
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<tr>
<td>Takes informed and responsible action to address ethical, social, and environmental challenges in global systems and evaluates the local and broader consequences of individual and collective interventions.</td>
<td>Analyses the ethical, social, and environmental consequences of global systems and identifies a range of actions informed by one's sense of personal and civic responsibility.</td>
<td>Explains the ethical, social, and environmental consequences of local and national decisions on global systems.</td>
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<td><strong>UNDERSTANDING GLOBAL SYSTEMS</strong></td>
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<td>Uses deep knowledge of the historic and contemporary role and differential effects of human organizations and actions on global systems to develop and advocate for informed, appropriate action to solve complex problems in the human and natural worlds.</td>
<td>Analyses major elements of global systems, including their historic and contemporary interconnections and the differential effects of human organizations and actions, to pose elementary solutions to complex problems in the human and natural worlds.</td>
<td>Examines the historical and contemporary roles, interconnections, and differential effects of human organizations and actions on global systems within the human and the natural worlds.</td>
</tr>
<tr>
<td><strong>APPLYING KNOWLEDGE TO CONTEMPORARY GLOBAL CONTEXTS</strong></td>
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</tr>
<tr>
<td>Applies knowledge and skills to implement sophisticated, appropriate, and workable solutions to address complex global problems using interdisciplinary perspectives independently or with others.</td>
<td>Plans and evaluates more complex solutions to global challenges that are appropriate to their contexts using multiple disciplinary perspectives (such as cultural, historical, and scientific).</td>
<td>Formulates practical yet elementary solutions to global challenges that use at least two disciplinary perspectives (such as cultural, historical, and scientific).</td>
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<td></td>
<td></td>
<td><strong>FORMULATES PRACTICAL YET ELEMENTARY SOLUTIONS TO GLOBAL CHALLENGES THAT USE AT LEAST TWO DISCIPLINARY PERSPECTIVES (SUCH AS CULTURAL, HISTORICAL, AND SCIENTIFIC).</strong></td>
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**AAC&U Global Learning VALUE Rubric**

[aacu.org](http://aacu.org)
In planning and assessing:

- STEAM tables events
- Global learning communities and stand-alone courses
- New courses: Global Humanities 101 and Global Studies at Work in Washington, D.C.
- Public events, such as Humanities Days
- Memoranda of Understanding with overseas partner institutions.
- Faculty scholarly travel through the GHI

GHI uses of Global Learning VALUE Rubric
Using outcomes to assess global learning

- Identify global issue
- Develop integrative GLOs
- Design learning experiences
- Assess integrative GLOs

Source: Adapted from *Understanding by Design*, by Grant Wiggins and Jay McTighe
### PERSPECTIVE TAKING
 Evaluates and applies diverse perspectives to complex subjects within natural and human systems in the face of multiple and even conflicting positions (i.e. cultural, disciplinary, and ethical.)

Synthesizes other perspectives (such as cultural, disciplinary, and ethical) when investigating subjects within natural and human systems.

Identifies and explains multiple perspectives (such as cultural, disciplinary, and ethical) when exploring subjects within natural and human systems.

Identifies multiple perspectives while maintaining a value preference for own positioning (such as cultural, disciplinary, and ethical).

- **LC GLO:** Students will explain diverse perspectives on issues of global environmental inequality.

### GLOBAL SELF-AWARENESS
 Effectively addresses significant issues in the natural and human world based on articulating one's identity in a global context.

Evaluates the global impact of one's own and others’ specific local actions on the natural and human world.

Analyses ways that human influence the natural and human world.

Identifies some connections between an individual's personal decision-making and certain local and global issues.

- **LC GLO:** Students will recommend individual actions that produce meaningful and positive environmental outcomes on local and global levels.

### UNDERSTANDING GLOBAL SYSTEMS
 Uses deep knowledge of the historic and contemporary role and differential effects of human organizations and actions on global systems to develop and advocate for informed, appropriate action to solve complex problems in the human and natural worlds.

Analyzes major elements of global systems, including their historic and contemporary interconnections and the differential effects of human organizations and actions, to pose elementary solutions to complex problems in the human and natural worlds.

Examines the historical and contemporary roles, interconnections, and differential effects of human organizations and actions on global systems within the human and the natural worlds.

Identifies the basic role of some global and local institutions, ideas, and processes in the human and natural worlds.

- **LC GLO:** Students will analyze the impact of social practices and patterns on protecting the environment at local and global levels.
Using outcomes to assess global learning

1. Identify global issue
2. Develop integrative GLOs
3. Design learning experiences
4. Assess integrative GLOs

Source: Adapted from *Understanding by Design*, by Grant Wiggins and Jay McTighe
Assignment outcomes developing **Understanding of Global Systems:**

- Identify the role of social, political, and economic institutions in addressing waterborne epidemics.
- Compare and contrast approaches to waterborne epidemics used by social institutions in different countries.
Using outcomes to assess global learning

Identify global issue

Develop integrative GLOs

Design learning experiences

Assess integrative GLOs

Source: Adapted from *Understanding by Design*, by Grant Wiggins and Jay McTighe
Class averages on integrative projects

- Global Chemistry and Society:
  - Water Project: 82%
  - Energy Project: 95%

- Preserving the Blue Marble: Environmental Sustainability through Chemistry and Writing:
  - Causal analysis of a global air pollution problem: 81%
  - Oral presentation: 84%
  - Essay defending a position on a global sustainability controversy: 93%

Using grades to assess GLOs
Water Privatization in the Democratic Republic of Congo

“...Determining the most efficient method of governance or control of water can result in debates over which method of ownership functions best in a sector. This essay will discuss the potential benefits and drawbacks of the privatization, or transfer from public ownership to private ownership, of public water systems as a means of reform.”

Discourse analysis of student writing

Student interviews

Assessing GLOs: Looking ahead
CHEM class averages, Fall 2016
CHEM class averages, Fall 2016 & Spring 2017
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