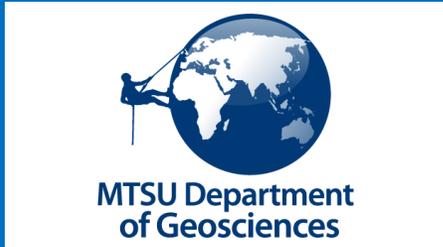


# Implementing “Interdisciplinary Teaching About Earth for a Sustainable Future” (InTeGrate) Undergraduate Education Modules at Middle Tennessee State University



*Mark Abolins, Department of Geosciences,  
Judith Iriarte-Gross, Department of Chemistry,  
and*

*Lisa Langenbach, Department of Political Science and International Relations*



Middle Tennessee State University,  
Murfreesboro, TN 37132



# Organization



- What is InTeGrate?
- What is this talk about?
- What were some outcomes?
  - *Five courses*
  - *Focus on three courses*
    - *General studies Introduction to Earth Science course*
    - *Honors Physical Science course*
    - *Junior-level American Public Policy Political Science course*

# What is InTeGrate?



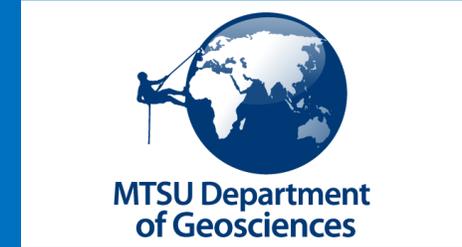
- InTeGrate is funded by a multi-million dollar 5-year (2012-2016) STEP Center grant from the National Science Foundation.
- The program supports the teaching of geoscience in the context of societal issues both within geoscience courses and across the undergraduate curriculum.
- ***Overarching goal:*** to develop a citizenry and workforce that can address environmental and resource issues facing our society. The program is lead by a team of 15 people based at institutions scattered across the country.
- ***Goal 1.*** The first goal of the InTeGrate project is to develop curricula that will dramatically increase Earth literacy of all undergraduate students.
- ***Goal 2.*** The second major goal is to increase the number of majors in the geosciences and related fields who are able to work with other scientists, social scientists, business people, and policy makers to develop viable solutions to current and future environmental and resource challenges.

# What is InTeGrate?



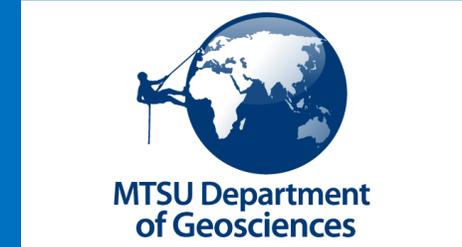
*InTeGrate Photo*

# What is this talk about?



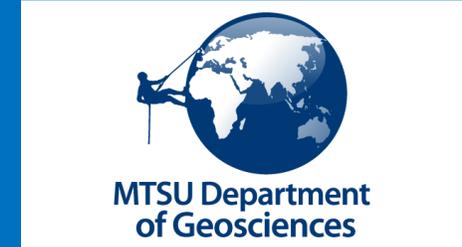
- This talk is about the InTeGrate *implementation project* at Middle Tennessee State University. InTeGrate supports a series of implementation projects to incorporate geoscience into programs designed to reach a diverse array of students, including those from groups underrepresented in the geosciences and students whose dominant interest or field of study lies outside the geosciences. These implementation projects are working to:
  - develop a new vision for how geoscience is positioned in higher education,
  - infuse geoscience throughout the curriculum,
  - leverage existing geoscience, environmental science, and engineering programs to address solutions for societal problems,
  - and engage younger students in the geosciences as a mechanism for increasing geoscience enrollment.

# What is this talk about?



- The MTSU Implementation project is working to:
  - **develop a new vision for how geoscience is positioned in higher education,**
  - **infuse geoscience throughout the curriculum.**

# What is this talk about?

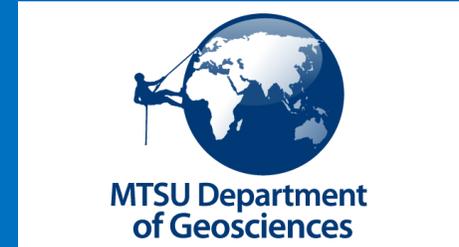


MTSU Implementation Project

## *“Using InTeGrate to Enhance Civic Engagement in the Geosciences- Middle Tennessee State University”*

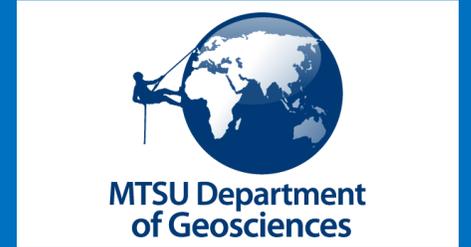
- **PI:** Dr. Mark Abolins, Department of Geosciences, MTSU
- **Co-PI:** Dr. Judith Iriarte-Gross, Department of Chemistry and Women in STEM Center, MTSU
- A little under \$50K (mostly to faculty)
- One-year

# Two lower-level courses



UNDERGRADUATE LEVEL	COURSE	INSTRUCTOR	InTeGrate MODULES	NUMBER OF MODULE ACTIVITIES
Lower	Introduction to Earth Science	Mark Abolins	Humans' Dependence on Earth's Mineral Resources	All
			Hurricanes	All
			Climate of Change	2 activities
			Living on the Edge	2 activities
			A Growing Concern	1 activity
			Environmental Justice and Freshwater Resources	1 activity
	Honors Physical Science	Judith Iriarte-Gross	Map Your Hazards	All

# Three upper-level courses



UNDERGRADUATE LEVEL	COURSE	INSTRUCTOR	InTeGrate MODULES	NUMBER OF MODULE ACTIVITIES
Upper	American Public Policy	Lisa Langenbach	Humans' Dependence on Earth's Mineral Resources	All
	<del>Cartography</del>	<del>Patricia Boda</del>	<del>Map Your Hazards</del>	<del>All</del>
	Environmental Issues	Patricia Boda	Interactions Between Water, Earth's Surface, and Human Activity	All
	International Agriculture	Tony Johnston	A Growing Concern	All

# Introduction to Earth Science

**MIDDLE  
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STATE UNIVERSITY



MTSU Department  
of Geosciences

## Environmental Justice and Freshwater Resources

100 200 300 400  
▲  
Intro Level

|----- 2-3 Weeks -----|  
● ● ● ● ● ●  
6 Units

Adriana Perez (Dona Ana Community College)

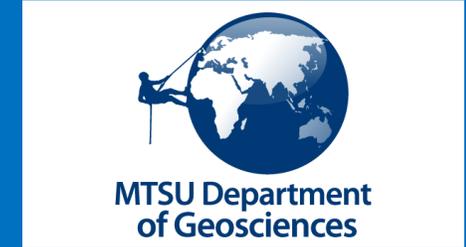
Jill S. Schneiderman (Vassar College)

Meg Stewart (Independent instructional technologist)

Joshua Villalobos (El Paso Community College)

Editor: David McConnell (North Carolina State University)

# Introduction to Earth Science



- Used in general studies introductory Earth science course.
- Partnership with MTSU Stormwater Program.
- During Spring 2016, the Stormwater Program hosted two 50-minute campus clean ups for 72 introductory Earth Science undergraduates and a few students from Iriarte-Gross's Honors Physical Science class and Langenbach's American Public Policy class.
- The clean ups led to a class discussion about health, personal freedom, regulation, and management of non-compliance because the most commonly-collected items were tobacco-related (mostly cigarette butts) even though MTSU is a tobacco-free campus.
- After completing the clean ups and a rock weathering exercise at a nearby cemetery, the introductory Earth Science students were asked to either write (a) a 2-page mock sustainability grant proposal or (b) a 2-page mock undergraduate rock weathering research proposal, and 71 of 75 chose sustainability.
- The responses of 54 undergraduates to a clicker survey indicated that 76% thought the campus clean ups should continue and only 13% thought they should not. (The rest abstained.)

# Introduction to Earth Science

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*MTSU Stormwater Photo*

# Introduction to Earth Science

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of Geosciences

## Humans' Dependence on Earth's Mineral Resources

100 200 300 400

Intro Level

2-3 Weeks



6 Units

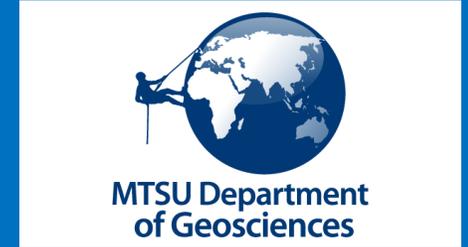
Prajukti (juk) Bhattacharyya (University of Wisconsin, Whitewater)

Joy Branlund (Southwestern Illinois College)

Leah Joseph (Ursinus College)

Editor: David McConnell (North Carolina State University)

# American Public Policy



- Used in upper-level American Public Policy course.
- First use at MTSU of a two-week natural science module in a non-geography social science class.

# American Public Policy

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## Summary

Despite humans' heavy reliance on Earth's mineral resources, few think about where the products they use come from and what it took to produce them. This module addresses that disconnect by combining learning about rocks and minerals (and how these become the products students use), methods of mineral resource discovery and extraction, and the impact of mineral resource use. This module allows important geoscience concepts to be taught in the context of important and immediate societal issues while also asking students to confront human issues such as environmental justice, economics, personal choice, and politics that may arise due to obtaining, beneficiating, transporting, trading, using, and disposing of natural resources.

# American Public Policy



Instructor Stories: How this module was adapted for use at several institutions »

## Table of Contents

Instructor Materials: Overview of the Mineral Resources Module

**Unit 1** People, Products, and Minerals

**Unit 2** Boom and Bust: How Econ 101 Relates to Rocks

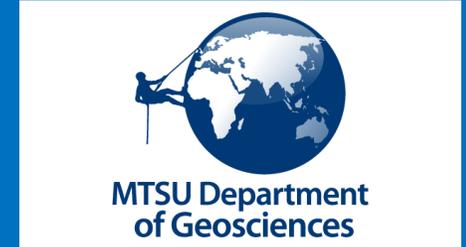
**Unit 3** Mining and Mining Impacts

**Unit 4** Mineral Resources Created by Sedimentary Processes

**Unit 5** Resources Created by Igneous and Metamorphic Processes

**Unit 6** Mining, Society, and Decision Making

# American Public Policy



## **Sample Assessment Question:**

Sphalerite is a sulfide mineral ( $ZnS$ ). Zinc is extracted from sphalerite. Several zinc mines exist in Tennessee. Most of the zinc mines in Tennessee are underground mines as opposed to open pit mines. Imagine you are the project manager of a mining company that might be interested in establishing an underground zinc mine in Tennessee. Describe at least **two geologic, one socioeconomic, and two environmental factors OTHER THAN ACID MINE DRAINAGE** that you need to consider for locating a suitable mine site in Tennessee. Explain why each of those factors is important for establishing the mine.

# Honors Physical Science

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MTSU Department  
of Geosciences

## Map Your Hazards! – Assessing Hazards, Vulnerability and Risk

100 200 300 400

Intro-Intermediate Level

3 Weeks



3 Units

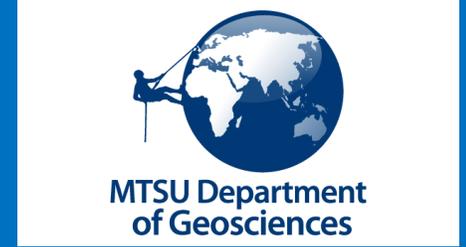
Brittany Brand (Boise State University)

Pamela McMullin-Messier (Central Washington University)

Melissa Schlegel (College of Western Idaho)

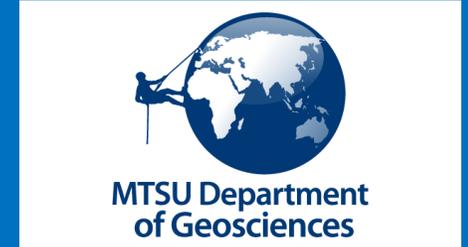
Editor: David Gosselin (University of Nebraska - Lincoln)

# Honors Physical Science



- Used in a 17-student Honors Physical Science course.
- Two of the seventeen students are making a related presentation at this meeting.
- These two chose high school students as their stakeholders.

# Honors Physical Science



## Sample Assessment: Translating the Message

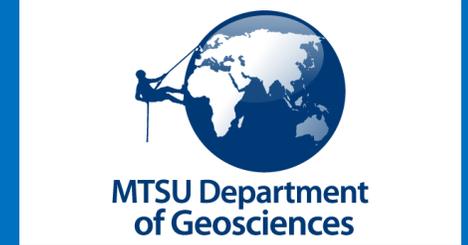
**Learning Goal 3: In your groups, you will synthesize and evaluate data sets from Units 1 and 2 for a particular stakeholder and generate recommendations for preparedness, resource allocation and city planning to promote building a more prepared community.**

Your entire presentation will be geared toward your stakeholder (chosen with guidance from your instructor). Your audience may include invited guests that are professionals in the field of natural hazard mitigation and representatives of your stakeholder, as well as classmates. ***Any recommendations should be made in a professional manner.***

Presentation must include:

- Risk map
- Assigned hypothesis (from group packet) and conclusions with supporting graphs
- Group hypothesis and conclusions with supporting graphs
- Suggestions for additional useful data
- Citations for hazard maps and any other resources
- *Professional and reasonable* suggestions for future natural hazard mitigation strategies.

# Honors Physical Science



## Tennessee Academy of Sciences Abstract

Addressing Civic Issues of Unpreparedness for Natural Hazards in Tennessee. ***Marilyn A. Kelley, Samuel M. Musili, Mark Abolins, Judith Iriarte-Gross*** Middle Tennessee State University, Murfreesboro, Tennessee. In the fall 2015 semester, the Honors Contemporary Issues in Science class, in collaboration with the National Science Foundation's Interdisciplinary Teaching about Earth for a Sustainable Future (InTeGrate) researched natural hazards in Tennessee. Using the module, Map Your Hazards, students identified natural hazards risk zones. The purpose of this research project was to equip stakeholders such as high schools, with knowledge on natural hazards and their vulnerability to these hazards. A survey was administered to locals of Murfreesboro, TN and MTSU students to obtain current statistics on public knowledge of natural hazards such as tornadoes, floods, and earthquakes. With this knowledge, the authors hypothesized methods to educate high school students, faculty and their families with useful knowledge in the event of a natural hazard occurrence. This research project concluded with recommendations for preparedness and resource allocation for a safer and more prepared community.



*Opinions expressed in this talk are those of the authors and do not necessarily reflect the views of the National Science Foundation.*