

Exploring the intersection between SENCER and the National Science Foundation's Interdisciplinary Teaching about Earth for a Sustainable Future Project



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InTeGrate Photo

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Why SENCER and InTeGrate?

- SENCER and InTeGrate have overlapping goals revolving around science and society.
- The authors encourage SENCER faculty to consider incorporating InTeGrate modules into their courses.

What is InTeGrate?



InTeGrate program:



InTeGrate is funded by a 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. The overarching goal is 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.

- The first goal of the InTeGrate project is to develop curricula that will dramatically increase Earth literacy of all undergraduate students.
- 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.

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

What is this poster about?

This poster 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.

This implementation project:



Abstract

During 2015-2016, Middle Tennessee State University (MTSU) faculty and students explored the intersection between SENCER and the National Science Foundation's Interdisciplinary Teaching about Earth for a Sustainable Future (InTeGrate) project. A prominent outcome of combining SENCER with InTeGrate was the addition of service learning to an introductory Earth Science course. Other prominent project outcomes are not directly attributable to SENCER, but are consistent with the goals of both SENCER and InTeGrate. For example, the InTeGrate "Map Your Hazards" education module stimulated so much interest in natural hazard education that two of the 17 undergraduates in Iriarte-Gross' class are going to make related presentations at the Tennessee Academy of Sciences meeting in November 2016. Also, use of the InTeGrate "Humans' Dependence on Earth's Mineral Resources" module added Earth Science knowledge to the exploration of mining policy, and this constituted the first use of a two-week natural science module in a non-geography MTSU social science class.

Service Learning



- Used in general studies introductory Earth science course.
- Partnership with MTSU Stormwater Program.
- 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.)



MTSU Stormwater Photo

Natural Science in the Social Science Classroom



- 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.

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, benefiting, transporting, trading, using, and disposing of natural resources.

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

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.

Communication



- Used in a 17-student Honors Physical Science course.
- Two of the seventeen students will make a related presentation at the Tennessee Academy of Sciences meeting in November, 2016.
- These two chose high school students as their stakeholders.

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.

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.

Middle Tennessee State University Implementation Project

- One year (2016)
- PI: Mark Abolins (had been using InTeGrate modules)
- Co-PI: Judith Iriarte-Gross (had been involved in SENCER)
- Mostly pays faculty extra compensation to use InTeGrate modules in their 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

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