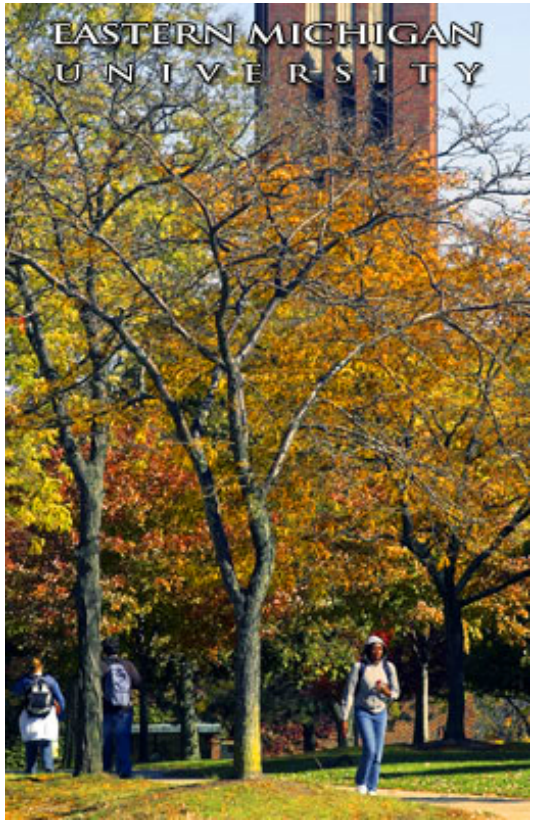
GIS/T Resources & Applications for Career Education (GRACE)



Presentation at Statewide GIS User Group Meeting

Yichun (EMU/IGRE)

Andrew Hartwick (MiCAMP)

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Presentation Topics

1. What is GRACE
2. How does GRACE train students for internship
3. Role of Geo-Mentors
4. Role of Michigan Communities
5. Connection with GIS Educational Communities

I. WHAT is the GRACE Project?

The GRACE (**GIS Resources and Applications for Career Education)** Project, a four year project sponsored by the National Science Foundation, was developed by Eastern Michigan University and partners as a strategy for expanding and disseminating technology-based education for STEM careers in K12, and in the workplace by aligning the resources from multiple educational and community organizations.

Educational Team Partners

- Eastern Michigan University (**EMU**)
- Michigan Virtual University (**MVU**)
- Michigan Mathematics and Science Centers Network (**MMSCN**)
- Michigan Earth Science Teachers Association (**MESTA**)

Community Team Partner

- Michigan Communities Association of Mapping Professionals (**MiCAMP**)

GRACE Intellectual Merit

The GRACE team is positioned to:

- Demonstrate how to team-up GIS/T organizations and professional volunteers (geomentors) with schools, students and teachers for integrating authentic GIS/T applications in curricula and for providing a "foreseeable" career incentive for students to enthusiastically participate in STEM learning at schools;
- Study motivations and hindrances of integrating GIS/T into science and social studies classrooms; and
- Develop an effective delivery model - the use of online and blended learning – to transform the speed, replicability, and consistency of delivering instruction that is personalized and customized to increase motivation and achievement for students.

The project findings and lessons learned will be published in peer-reviewed journals and presented at professional meetings for organizations such as:

Michigan **S**cience **T**eachers **A**ssociation
National **S**cience **T**eachers **A**ssociation
National **A**ssociation for **R**esearch in **S**cience **T**eaching

Why use GIS in K-12 Education ?

MICHIGAN DEPARTMENT OF EDUCATION

Michigan eLibrary

http://more.mel.org/index.php?P=BrowseResources&FieldId=34&myParentId=3584#

The Michigan Standards Recommend It !

G1.2 Geographical Inquiry and Analysis

6 – G1.2.1 - Locate the major landforms, rivers (Amazon, Mississippi, Missouri, Colorado), and climate regions of the Western Hemisphere. (237)

6 – G1.2.2 - Explain why maps of the sa[illegible] rth and new knowledge based on science and mode[illegible]

6 – G1.2.3 - Use data to create thematic [illegible] terrain, rainfall, and vegetation, analyze the patt[illegible] on and density of the population. (63)

6 – G1.2.4 - Use observations from air photos, photographs (print and CD), films (VCR and DVD) as the basis for answering geographic questions about the human and physical characteristics of places and regions. (47)

6 – G1.2.5 - Use information from modern technology such as Geographic Positioning System (GPS), Geographic Information System (GIS), and satellite remote sensing to locate information and process maps and data to analyze spatial patterns of the Western Hemisphere to answer geographic questions. (21)

6 – G1.2.6 - Apply the skills of geographic inquiry (asking geographic questions, acquiring geographic information, organizing geographic information, analyzing geographic information, and answering geographic questions) to analyze a problem or issue of importance to a region of the Western Hemisphere. (95)

THE K-12 GIS TOOLS HELP PRESENT MATERIALS USING A NEW FORMAT "MODERN TECHNOLOGY"

Choose Grade:

- All Grades
- Kindergarten
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Grade 6
- Grade 7
- Grade 8
- Grade 9-12

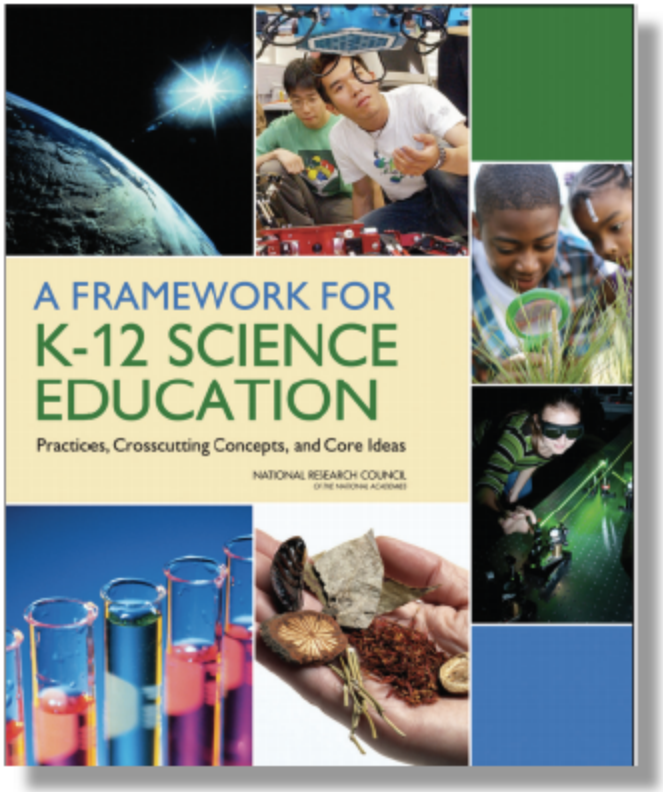
- The ***Next Generation Science Standards*** (NGSS) advocates that science education integrates the science and engineering practices, disciplinary core ideas (DCIs), and crosscutting concepts of science and engineering in a three-dimensional fashion across the K-12 years.

- The integration of GIS/T tools in STEM education provides a perfect environment for creating and implementing the three-dimensional learning opportunities. Instructionally, GIS/T has long been recognized as an interdisciplinary educational technology, supporting high-level thinking and spatial reasoning.

- Additionally, spatial reasoning and visualization have been demonstrated to be foundational to science, engineering and mathematics (NRC, 2006).

A Framework for K-12 Science Education

NGSS@NSTA
STEM STARTS HERE



Three-Dimensions:

- **Scientific and Engineering Practices**
- **Crosscutting Concepts**
- **Disciplinary Core Ideas**

Scientific and Engineering Practices

NGSS@NSTA STEM STARTS HERE

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

For example:

- GIS/T serving as data mining analytical and visual aids supports asking questions (for science) and defining problems (for engineering) – **P1**;
- GIS's integrating data from multiple sources into large data sets supports analyzing and interpreting data – **P4**;
- GIS's coupling data, analytical models and human interpretations into participatory decision support systems supports developing and using models – **P2**, planning and carrying out investigations – **P3**, and engaging in argument from evidence – **P7**;
- GIS's coupling with statistical software packages and customizing for complex computations supports using mathematics and computational thinking – **P5**;
- GIS/T as a computerized mapping system and an integrated multimedia organizer supports constructing explanations (for science) and designing solutions (for engineering) – **P6**, and obtaining, evaluating, and communicating information – **P8**.

Crosscutting Concepts

NGSS@NSTA
STEM STARTS HERE

1. Patterns
2. Cause and effect: Mechanism and explanation
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter: Flows, cycles, and conservation
6. Structure and function
7. Stability and change

Disciplinary Core Ideas

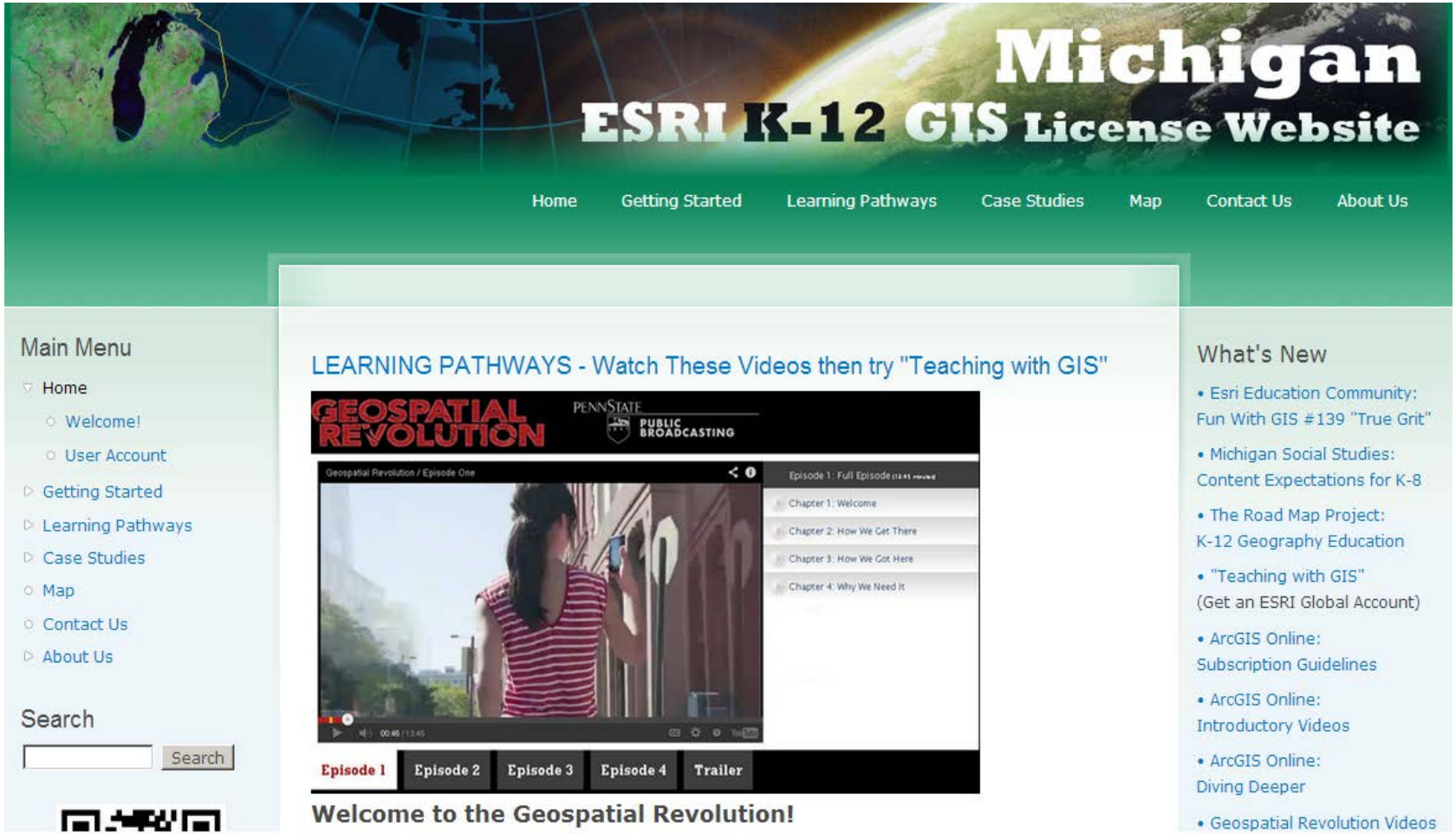
NGSS@NSTA
STEM STARTS HERE

Life Science	Physical Science
LS1: From Molecules to Organisms: Structures and Processes	PS1: Matter and Its Interactions
LS2: Ecosystems: Interactions, Energy, and Dynamics	PS2: Motion and Stability: Forces and Interactions
LS3: Heredity: Inheritance and Variation of	PS3: Energy
	PS4: Waves and Their Applications in

Michigan's K-12 GIS LICENSE GATEWAY

Your Portal to the Geospatial Revolution

http://esrik-12gis.emich.edu/k12/



http://www.youtube.com/watch?v=poMGRbfgp38#t=20

“Without geography you're nowhere.”— Jimmy Buffett