Curriculum Developed in the National Science Foundation ITEST and COSEE Education Programs

February 23, 2011

Innovative Technology Experiences for Students and Teachers (ITEST)

- Since 2003, the ITEST experience—including 176 projects across 40 states—helps young people and teachers build the skills and knowledge needed to succeed in a technologically rich society

- The National ITEST Learning Resource Center supports achievement of ITEST program goals through:
  - **Increased knowledge and capacity** among ITEST PIs and their teams to design, evaluate and refine their work to achieve individual project goals
  - **Synthesis, analysis and documentation** of the collective experience and results of ITEST projects
  - **Dissemination of the knowledge created in the ITEST program** to inform the field of STEM workforce development
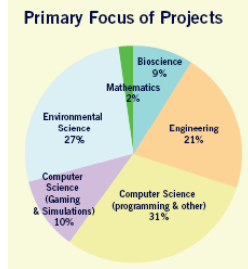
ITEST Portfolio

Computer Science: Gaming & Simulations

Primary Focus of Projects

- Bioscience 9%
- Mathematics 2%
- Environmental Science 27%
- Engineering 21%
- Computer Science (Gaming & Simulations) 10%
- Computer Science (programming & other) 31%

Computer Science includes programming; web development; multimedia – audio, video and animation; computer hardware

Bioscience includes bioinformatics, biotechnology, DNA analysis/sequencing, genetics, and biomedicine

Environmental Science includes GIS/GPS, remote sensing technology, climate modeling, and ecological research and analysis

Engineering includes aerospace, design, robotics and nanotechnology

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COSEE — CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE

Since 2002 the Centers for Ocean Sciences Education Excellence (COSEE) have worked to increase understanding of the ocean and its relevance to society.

The COSEE Network is comprised of 15 Centers located Throughout the United States and a Central Coordinating Office.

Each Center is a consortium of one or more ocean science research institutions, informal science education organizations, and formal education entities.

http://www.cosee.net

CoSEE
CENTERS FOR OCEAN SCIENCES
EDUCATION EXCELLENCE

- Center activities include:
    - Integration of ocean science research into high-quality educational materials
    - Establishment of pathways that enable ocean scientists to interact with educators and students

- Network-level efforts include:
    - Scientist-Educator Partnerships
      example: http://soundcitizen.org/
    - National promotion of Ocean Literacy
      example: www.coexploration.org/oceanliteracy/documents/OceanLitChart.pdf
    - Promotion of Ocean Careers
      example: www.oceancareers.com

Urban Ecology Institute
Technology-enhanced Urban Ecology Field Studies

- Audience(s): Middle and High School Students and Teachers and out-of-school environments
- Content areas covered: Urban Ecology
- Description: Our project engages students in the investigation of the health of their urban ecosystem through the use of advanced computer analysis and modeling technologies

Curriculum Modules

- Technology-Enhanced Field Studies
- Educatively Designed
  (Davis & Krajcik, 2006)
  - Materials have
    - Support materials for teachers
    - Misconceptions
    - Suggested teaching alternatives
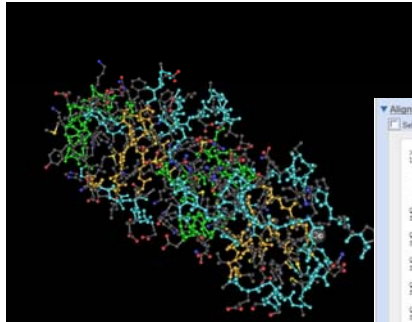   - Career Development and connections embedded
    - Pre-post assessment

http://www.urbanecologyscience.org
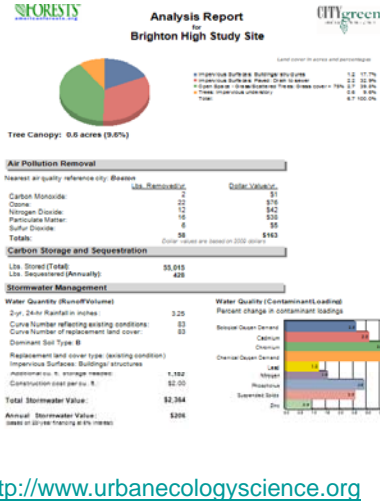
Bio-ITEST
New Frontiers in Bioinformatics and Computational Biology

- Audience(s): High school teachers and their students
- Content area covered: Bioinformatics
- Description: Two interactive units designed to make the concepts and tools of bioinformatics accessible to high school students, using themes of genetic testing and evolutionary relationships among organisms.

Analyzing BRCA1 mutations using Cn3D and BLAST

http://www.nwabr.org/education/itest.html

CoastLines

- Audience: grades 6-12, teachers and students
- Content areas covered: Environmental Science, Marine Science, Earth Science, and Geography
- Description: The project uses geographic information systems (GIS) and global positioning systems (GPS) to conduct scientific studies of coastal ecosystems in the NSF's Long-Term Ecological Research (LTER) network. Classroom-ready activities and data sets available for use with MyWorld GIS.
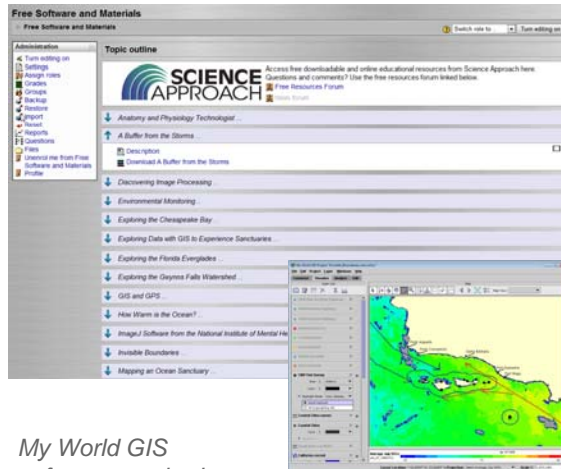
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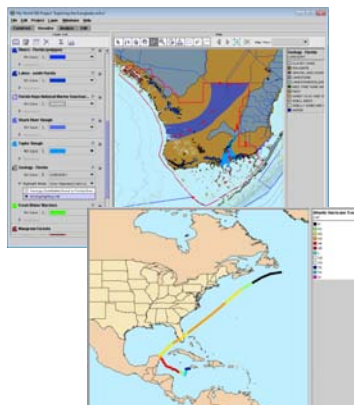
Curriculum & GIS Data

1. Log on to Science Approach website: www.science-approach.com
2. Register. (Free!)
3. Choose Materials & Subscriptions.
4. Choose Free Software & Materials.
5. Descriptions available on-line; activity PDF, data, and project file can be downloaded.

My World GIS software required.

CoastLines

- **Florida Coastal Everglades**
  - ➤ Exploring the Everglades (Overview)
  - ➤ Buffer from the Storm (Hurricanes)
  - ➤ Matter of Inches (Ecosystems)
- **Chesapeake Bay Watershed**
  - ➤ Exploring Chesapeake Bay Watershed
  - ➤ Exploring the Gwynn Falls Watershed (Baltimore)
- **Santa Barbara Coastal Region**
  - ➤ Invisible Boundaries (SST/Fish distribution)
  - ➤ Storm Water Pollution (runoff /land use)
  - ➤ Environmental Monitoring (how to...water quality)
  - ➤ LiMPETs (sand crab monitoring)

COOL Classroom

- Audience(s): middle and high school students
- Content areas covered: biology, marine ecology, earth science, technology, and career exploration
- Description: An online learning environment that provides guided inquiry-based lessons on ocean and environmental themes while linking to core science topics such as density, watershed ecology, buoyancy, spatial literacy skills, etc.   Students focus on generating iterative models to express their understanding of science problems.

Sample/Link

http://new.coolclassroom.org/adventures

Fresh and Salt

- Audience(s): Grades 5-10
- Content areas covered: Great Lakes and ocean science topics
- Description: *Fresh and Salt* is a collection of activities connecting Great Lakes and ocean science topics to enhance teacher capabilities for accessing science information in Great Lakes/ocean sciences.

Going with the Flow

A Classroom Activity for *Ducks In The Flow - Where Did They Go?*

Summary:
Students use a simple model to discover that air moving over water causes the surface of the water to move horizontally. In writing and in a discussion, students relate this concept to surface currents in the ocean and the Great Lakes.

Student Learning Outcomes:
Students will be able to
- Relate the motion of surface currents (cause) to the motion of objects floating in the ocean and Great Lakes (effect)
- Relate the transfer of energy from wind moving across water (cause) to the horizontal movement of water (effect)
- Use the term "surface current" to explain horizontal movement of surface water caused by wind
- Explain that surface currents affect surface water, not deep water

Standards:
Ocean Literacy Essential Principles and Fundamental Concepts
- The Earth has one big ocean with many features.
National Science Education Standards
- (K-4) Position and motion of objects
- (5-8) Structure of the earth system
- (5-8) Motions and forces
- (5-8) Abilities necessary to do scientific inquiry

Grade Level: 3-5

Materials: (teams of 2-3 students)
- 5-6 quart clear plastic shoebox (1 per team)
- Water (to fill shoeboxes approximately ¾ full)
- Black construction paper (I per team)
- Bendable straws (1 per student)
- Paper towels (for clean up)
- Newspaper (to cover table/desk)
- *Going with the Flow Data Sheets 1-3* – (1 per student)
- For *Activity 1: Aluminum foil* (Each team crumples 20 one-inch squares into 10 loose balls that will float and 10 tight balls that will sink.)
- For *Activity 2: Rheoscopic fluid* (Dilute 150 ml of rheoscopic fluid in 3 L of water per team; the diluted fluid can be reused.)

Purchase Note: You can purchase rheoscopic (convection) fluid from many online vendors for approximately $10/L:
- Arbor Scientific - www.arborsco.com (# P8-5000)
- Carolina Biological - www.carolina.com (# GEO8450)
- Educational Innovations - www.teachersource.com (# RH-100)
- Fisher Scientific - www.fishersci.com (# S4520 or S4521)

Time: 1-2 class periods (45 minutes each)

http://coseegreatlakes.net/curriculum/toward

Ocean Gazing

- Audience(s): middle and high school students and teachers
- Content areas covered: ocean sciences, technology, research, career exploration in ocean sciences and engineering
- Description: A forum for scientists for telling their stories about ocean observing science. OG integrates interviews, ambient sounds gathered in the field/lab, and music.   Also included are high school curriculum companion pieces for selected podcasts.

Sample/Link

http://coseenow.net/podcast/
http://coseenow.net/podcast/oglessonplans/

SENSE IT

- Audience(s): middle and high school teachers and students
- Content areas covered: science, technology, pre-engineering and math
- Description: SENSE IT participants are challenged to design, build, deploy and interpret data from their own water quality sensors.

Sample/Link

http://senseit.org

Discussion and Questions

More curricula and resources:

- ITEST: http://itestlrc.edc.org

- COSEE: http://www.cosee.net