VISIT: Virtual Immersion in Science Inquiry for Teachers

Challenges and Lessons

Yichun Xie, Principal Investigator
Joanne Caniglia, Co-PI
Eastern Michigan University

Beverly Hunter, Co-PI
Piedmont Research Institute

Randy Raymond, National Advisor
St. Croix Valley Technologies, Inc.

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San Diego, CA
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Organization of the Panel Discussion

1. Presentations (45’) - Questions / comments are welcomed during the presentation!

   • Yichun Xie, Introduction of the VISIT project
   • Joanne Caniglia, Critical Issues of Professional Development
   • Beverly Hunter, Investigations / Investigators of the VISIT
   • Randy Raymond, Lessons and Challenges of the VISIT project

2. Discussions (45’)
What is the VISIT?

VISIT is an Online Collaboratory for secondary school science teachers to:

- participate in ongoing scientific investigations of contemporary problems in their localities
- through applying spatial analysis technologies.

VISIT is a three-year project supported by a grant from the National Science Foundation Teacher Enhancement program.
What is the VISIT?

VISIT provides teachers, scientists and students with tools and online environments for

- locating and using large scientific data bases,
- visualizing and analyzing data,
- collaborating with each other, and
- building scientific knowledge together.

The DGIS tools being composed support

- data mining,
- scientific investigation,
- knowledge base,
- curriculum integration,
- instruction management,
- learning assessment, and
- online participation.
Who are the VISIT team members?

1. the VISIT teachers
   - Teacher leaders (developers, reviewers, recruiters, online facilitators, technical supports)
   - Teacher investigators
   - Teacher explorers

2. the project staff team
   - Faculty and technical staff from Eastern Michigan U.
   - Online technology education specialists from Piedmont Research Institute
   - Independent evaluation specialist
   - Collaborators from government agencies

3. the National Advisory Board

4. where the team members are
   - Detroit and Michigan
   - Boston and Massachusetts
   - Denver and Colorado
   - Houston and Texas (developing)
   - Other metropolitans and states (discussing)
Teacher Enhancement Goals - Learn to:

- Conduct investigations that support process and content curriculum objectives in science and technology.
- Work with large and multiple scientific data sets
  - Locate, acquire, use relevant data to support student work
  - Use software tools to mine and analyze data, reason, solve problems
- Participate in, facilitate online community of peers, scientists.
- Access and apply scientific knowledge needed to interpret and understand findings
- Work with local community to manage projects relevant to community & student interests
- Develop and apply rubrics to assess learning and products.
VISIT Support for Teachers’ Investigations

Curriculum connections; School-based collaborations

Software tools

Local community scenarios

Assessment & Quality Assurance

Scientific reasoning, knowledge base

Scientific Data Sets

Collaborators: Peers & Scientists

Online Course & Community; Forums

Face-to-Face Activities

Tutorials & Hands-on Exercises
Sequence of VISIT Project Development
- 4 Phases

✓ **Phase 1.** (Spring/Summer 2000) **Core Team** works in prototype Collaboratory:
  ✓ to develop Investigations for other teachers
  ✓ while trying out and revising tools, interface, materials (some offline on CD).
  ✓ Core Team and staff add more tools, functions as we go along and the investigations require them.

✓ **Phase 2.** (Fall 2000) Core Team recruits and facilitates **pilot teacher investigators**
  ✓ in revised, operational Collaboratory environment using limited number of data sets and topics.
  ✓ teacher investigators from pilot schools provide feedback.

✓ **Phase 3.** (Winter 2001) Core Team and other teacher leaders facilitate and recruit VISIT **teacher explorers**
  ✓ in operational Collaboratory
  ✓ with broader range of topics, data.

✓ **Phase 4.** (Fall 2001) Nationwide Implementation of the VISIT Model
Critical Issues in Professional Development of Project VISIT

Utilizing Loucks-Horsley’s Model for Professional Development of Mathematics and Science Education
Equity

- Is access to the professional development equitable?
- Does the design of the professional development invite full engagement and learning by participants?
Building a Professional Culture

- What can professional developers specifically do to build professional communities among teachers?
Building Capacity for Professional Learning

- Do you employ and develop people who can work with teachers to support their learning and teaching?
- Do you recognize, study and apply the knowledge base of professional development theory and practice?
- Do you work to create and influence policies, resources, and structures that make professional development a central rather than a marginal activity?
Scaling Up

- Is there clarity and a sound foundation for what is being scaled up?
- How do you provide professional development opportunities to large numbers of people?
- Does each teacher have sufficient support to change his or her practice?
- Is there a plan at each unit of implementation for ongoing use, support, and institutionalization?
Gaining Support

- How can professional developers build awareness of the importance of mathematics and science education reform and of effective professional development?
Supporting Standards and Frameworks

- How can standards guide selection of content for professional development?
- Can standards be the focus of professional development?
Evaluating Professional Development

- How do you acknowledge and then evaluate how a professional development initiative and its participants change over time?
Finding Time for Professional Development

- How do you find ways to make more effective use of time currently available within the school calendar?
Teacher Investigators in VISIT

- Panel for the ESRI Educational User Conference Sunday July 8, 2001
- Beverly Hunter
- http://www.emich.edu/visit
- This work is supported by the National Science Foundation Grant No. xxx to Eastern Michigan University
VISIT Professional Development

- Plan was to support teachers’ professional development through an online Collaboratory among teachers, scientists, technologists.
- Teacher-led teams would conduct investigations related to their community and their curricula -- e.g. in environmental issues, watershed, water or air quality, environmental hazards, etc.
Three Teachers

- All 3 were part of original team developing the VISIT project & proposal
- Nasreen Jalili, Chemistry teacher, Cody H.S. Detroit P.S.
  - Water chemistry investigations
- Robert Saxton, Environmental science teacher, Novi H.S. Michigan
  - Stream ecology & natural resource management
- Walter Paul, Technology teacher, Chelsea H.S. Massachusetts
  - HAZMAT Emergency planning & simulation
Teacher Investigators

- Their educational purposes & projects.
- Issues currently being addressed as we prepare materials based on their investigations, for other teachers’ use and learning.
Nasreen Jalili teaches chemistry at Cody High School in Detroit. Her first draft scenario, *Fish Kill at Silver Lake*, was designed to motivate her students’ beginning understandings of basic concepts by providing a real-world problem context involving water quality. Her scenario involved an imaginary "Silver Lake".

In this context, students would be learning such concepts as the effect of photosynthesis and respiration on dissolved oxygen in water; PH and its effect on water chemistry and aquatic ecosystem; conductivity of water and its relationship to chemical hazards in water; turbidity and its relationship to conductivity and chemical hazards in water; temperature and its effect on dissolved oxygen; light and its effect on dissolved oxygen.

In the VISIT Collaboratory, other teachers and scientists discussed this scenario. They determined that Newburgh Lake in Michigan’s Rouge River watershed had characteristics similar to her imaginary lake.
- Topics in Jalili lesson plans
- Fish Kill Scenario
- Dissolved Oxygen
- The Effect of Photosynthesis and Respiration on Dissolved Oxygen
- PH - Conductivity
- Temperature - Turbidity
- Climate Change - Erosion
- Solution - Gas Solubility
- Land Use Planning - Sediment Suspension
- Water Chemistry - Water Quality
- Sampling Design - Lake Stratification
Jalili - Issues

- How to get scientific and technical assistance and collaboration -- at the Teacher Leader, Investigator, or Explorer levels of participation.
- Locating and acquiring data (have been attempting for a year to get data on Newburgh Lake water chemistry parameters), from sources well known by PI
- Jalili recruited 10 teachers from her school to participate in VISIT but none will participate online; all require ftf consulting and workshops.
- Lack of student participation & exhibition results in lack of motivation for teachers.
Bob Saxton

- Working with Valley Segment Ecological Classification System (VSEC)
- Understanding factors affecting ecology of streams (catchment size, geology, elevation, hydrology, water chemistry, water temperature, channel character, fish assemblages).
- Applying ecological understanding to management of natural resources
Example: Au Sable River
Examples of VSEC map and table data for mainstem segments of the Au Sable River displayed in ArcView. The Au Sable River’s upper half drains a large, perched outwash (sand) plain that contains ice-contact(sand and gravel) hills. It then cuts sharply down across mixed-textured end moraines and flows across a sandy lake plain to Lake Huron. The river maintains extremely high baseflows throughout its length, with an additional influx of groundwater as it cuts the moraine.

Trout associations dominate the upper, coldwater half of the system, but increasing size drives the downstream segments towards cool, stable temperatures and Burbot and Walleye associations. (From Seelbach et al).
Part of “Darcy” (hydrology)
Saxton: VISIT Objectives

- Create and Package learning materials for teacher explorers, based on Saxton’s investigations
- Saxton as facilitator of online course using these materials
Saxton: Technical Issues

- How to find technical assistance.
- Projecting VSECs, elevations, surficial geology, Darcy’s together
  (needed for understanding of the VSEC classifications)
- Projecting VSECs with towns & roads for geographic orientation.
- Obtaining some of the digital data -- e.g. elevations, roads.
- Darcy’s is an image. How to interpret.
Saxton Pedagogical Issues

- Teachers/students reconstructing the process vs using the products.
- What/how much to package for teachers.
- Produce hard copy colored maps for teachers to use?
Walter Paul

- Working with Chelsea community: police, fire, hospital, businesses & industry
- Year-long HAZMAT curriculum for Chelsea H.S. students
- Uses MARPLOT, CAMEO, ALOHA from EPA
- Project culminates in a half-day live simulation
- (see chapter in GIS in Schools book)
Previous slide shows an Aloha simulation plume of hazardous material heptane, superimposed on MARPLOT map of Chelsea showing schools, streets, etc. Students will determine where to evacuate, appropriate evacuation routes, etc. as part of the hazmat simulation.
Paul: Pedagogical & Curricular Issues

- Chelsea simulation is in a technology curriculum. Connections in science and social studies are apparent, but we have not succeeded yet in engaging a science teacher in this effort.

- Chicken-and-egg problem: little teacher demand for this, versus lack of teacher materials and p.r. that would generate the demand, versus lack of resources to support development of teacher materials, versus lack of teacher demand....
Paul: Technical Issues

- MARPLOT, CAMEO, and ALOHA are tricky to install and the processes involved in linking to desired data are still murky after a year of VISIT effort to do so.
- Lack of technical assistance available, except through for-fee workshops.
- ENVIROMAPPER and ENVIROFACTS provide some useful tools and information for related studies, but we have not yet found a teacher able/willing to dig deeper into the resource and make the strong connections to curriculum.
Summary

- Individual teachers have developed exciting investigations using GIS and connected to THEIR curriculum.
- VISIT wants to package their knowhow and materials for benefit of other teachers’ learning.
- Main obstacles are lack of technical and scientific collaborators (even with $400,000 per year in NSF funding).
- It has not been possible to regularize collaboration and support online.
Challenges to the VISIT Project

1. Challenges from Teacher Goals and Expectations

- Have diversified needs for professional development
- Want clear priorities in science and content objectives
- Have direct impacts on student learning
- Request close links to classroom activities
- Prefer seeing learning materials or science investigations in the format of lesson plans / modules - “ready-to-use short (45 minutes) GIS based science investigations / lesson plans”
- Have support from school administration
- Have extremely limited availability in time
- Hope to have quick and effective “approaches and apparatuses” helping them to achieve these goals
2. Challenges to the VISIT Online Collaboratory Communities

- The VISIT Project is built on multifaceted collaborations in curricula, data exploration, and spatial technology
- Culture using online collaboratory - Reluctance of using open forum for sharing ideas for material development
- Obstacles using online collaboratory
  i. Limited contents in the developing phase
  ii. Extra efforts accessing collaboratory
- HCI: human computer interface – the virtual world needs warmly support of human affection
- Accessible and dependable assistance to teachers
- Synchronizing schedules and cooperation between teachers, supporting agencies, and project staff
- Often hard for supporting agencies and staff to imagine the stress that teachers are facing
- One falling nail can sink the boat!
3. Technology Challenges to the VISIT Project

- Hardware: New and old PC and MAC computers coexisting and no guaranteed access to computers
- Internet Connection: Many relying on dial-up though phone lines
- GIS Technology: GIS is an evolving technology, encompassing concepts, critical thinking, and skills from multiple disciplines. It is extremely challenging for anyone in short time to master basic software operation skills as well as spatial reasoning and application for problem solving. Overdoing GIS dilutes the curriculum/content objective, but overlook hinders progress in advancing skills in spatial reasoning and science investigation
- It is imperative to have face-to-face hands-on training as initial steps of learning GIS
- Applying GIS in science inquiries demands comprehensive/systematic understanding of GIS, in addition to broad knowledge in subject areas and data
- Sustained technical support is extremely important, but often difficult to deliver through online
4. Challenges in Data Exploration and Requisition

We propose to conduct science inquiry based on large and multiple scientific data sets. This is a sound assumption technically and politically. However there are many unexpected challenges. DataView ScientificDatabase.htm

- Science data sets are rarely compiled systematically though digital data of geography and natural features are readily available and accessible
- Science data sets are often short in time sequence – observations across limited time sequences are not meaningful in science inquiry
- Observations of science data are seldom synchronized in time at different sites or years
- Observations of science data of selected parameters are seldom consistent at different sites or years
- Agencies responsible for collecting science data are usually short of personnel to provide adequate technical support
- The requisition of science data is often done by consulting firms though funded by public agencies, and thus there may exist no adequate data publishing / sharing mechanism
The Newburgh Lake Wayne County Triathlon will be centered around Newburgh Pointe which is located on the shores of Newburgh Lake. This 152-acre lake was restored in 1998 through the Rouge River National Wet Weather Demonstration Project, and stocked with bluegill, bass and other pan fish. The lake was originally constructed as a mill pond around 1819. In 1935, the old mill was demolished by Henry Ford and replaced with a new “Village Industry Plant.” A new dam was also built by the Wayne County Road Commission as a cooperative venture.

The historic comfort station offers a paddle boat concession and fishing docks during the summer. In the winter the lake is swept for ice skating. Newburgh Pointe is a beautiful area with two finger piers for fishing and a small boat launch. You can stroll around the lake on a hiking trail or ride your bike on the Hines Bike Path that crosses the site and connects to the I-275 bike trail.

The 2000 triathlon, sponsored by Ford Motor Company, was a wonderful success. Despite the rain which canceled the swimming portion of the triathlon, the duathlon had 118 participants. This year, because so many athletes enjoyed the duathlon, both a duathlon and triathlon will be offered. The male overall winner was Matthew Kowalski and the female overall winner was Janet Chappell.
Inset 1. An Email Communication

Water Investigation Matrix

> I am providing several screen shots in this email to explain what types of
> data we hope to get for supporting scientific investigations (for the
> purpose of education). Station D2003581 is near to the Newburgh Lake.
>
> 1. The time series (sequences) are too short. For instance in Tables Lab 98
> and Lab 99, the CD only provides data for two time observations. If
> feasible we'd like to receive a much longer time series, for instance, a
> month by days, or a day by hours (or 15 minutes).
>
> 2. The time series are not synchronized at different years as you pointed
> out in your email.
>
> 3. The parameters tested at different times or years are not consistent.
Parameters (11) at Station D2003581 on 6/23/1999

PARAMETER

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PHOS_T
pH
TSS
TDS
CBOD
COND
HARD
NH3
Cl
BOD5
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The **Adopt-A-Stream Program** enables adults, friends, families, and interested kids to monitor the quality and become stewards of study sites on the river and its streams. The Program provides educational experiences about the structure and sensitivity of streams, and about actions needed to protect and improve the quality of the river system.

**Questions and Answers about the Adopt-A-Stream Program**  
**Events of the Adopt-A-Stream Program**  
**Winter 2001 Stonefly Search Recap**  
**April 2000 River RoundUp Recap**  
**Report on Analysis of Results for Adopt-A-Stream monitoring from inception through 1998**

**WINTER 2001 STONEFLY RESULTS**
Wow! Thanks to the 107 volunteers who participated in the search, we were able to monitor almost all of our study sites in a single day! The day was a lot of fun and a huge success.

**BACKGROUND INFORMATION**
The remarkable winter stoneflies are useful indicators of river conditions, playing a role like the one that canaries used to play for miners. All stoneflies require a rich supply of dissolved oxygen, which is plentiful in winter streams. Winter stoneflies are dormant during most of the year when we look for problems caused by stormwater runoff, warm water, or excessive plant growth. Winter Stoneflies are active in January when conditions provide an opportunity to look for signs of toxic pollutants in the absence of these other problems.
Inset 2. Another Email Communication

We have two teachers from Community High School (Cathe Hetter and Liz Stern) to conduct an investigation of Benthic at Traver Creek. They have collected 6 years of field data and are applying GIS (geographic information system) tools for scientific visualization of Benthic data and exploring the relationships between Benthic and landuse changes. At this moment, their data is just about one section of the creek. I hope that we can link their data with the entire Creek or the Huron River. Recommended by Washtenaw County Department of Environmental Infrastructure and Services (Rebecca Head and Rich Badics), I am writing to you for the data support. Also I have read your "Adopt a Stream" program Webpage and was very impressed by what you have done.

I'd appreciate it very much if you could find Benthic data in Traver Creek, other creeks, or the Huron River so that we can make comparisons. Also I strongly believe the data you used in the report, "Current Conditions, Recent Changes, and Major Threats to the Huron River: A Report on Eight Years of an Ongoing Study"

will be very useful. We can link the data in this report with the data collected by Liz and Kathe to make meaningful analysis.
Dr Xie,

I just spoke with Joan Martin. She was a bit confused by your email and wasn't quite sure what we wanted from her. It seems that they are willing to provide any data that they have but will definitely not be able to provide any support etc. as they are very under-staffed. All we need to do is provide her with a list of the specific layers that we are interested in. I wasn't sure exactly what Kathe and Liz had in mind - do you know or should I write to them? Thanks, Anne
Lessons from the VISIT Project

1. Strategies for Serving Teachers

• Recruiting more Teacher Leaders writing lessons, reviewing lessons, recruiting teachers, providing technical assistance, and facilitating online collaboration
• Providing face-to-face workshops to train teachers how to learn basic GIS software operations, to use Internet and WebCT, and to augment the online experiences
• Developing a sequence of structured online courses to teach some of the prerequisite skills and knowledge in a way that prepare teachers, scientists and faculty to work in an online collaboratory environment – Intro to VISIT, Intro to GIS, Developing Investigations
2. A Series of VISIT Curriculum Materials

- Comprehensive VISIT Investigations (Water Quality, HazMat, Radon, Watershed Management, River Eco-Studies, Benthic) Investigation
- Short GIS Science Lesson Modules (ready-to-use GIS-based science lesson plans for classrooms, including adaptation of ESRI K-12 GIS Lessons) List of GIS Short Lessons
- Adaptation of the Work/Site Alliance Training Manuals and Cases Studies
- Adaptation of LATE (Look At Environment) GIS Lessons
- Adaptation of MFteach Lessons
Important URLs used by VISIT Core Team

- VISIT Webpage http://www.emich.edu/visit/
- CEITA Webpage http://ceita.acad.emich.edu
- VISIT FTP site ftp://visit@geodata.acad.emich.edu
  (the userid and the passwd: visit)
- Rockman Core Team Survey http://survey.rockman.com/visit.htm
- Water on the Web http://wow.nrri.umn.edu/wow/index.html
- ESRI Virtual Campus http://campus.esri.com/index.cfm
  (click Courses and then Free Modules)