

## EDUCATION-COMMUNICATIONS EVENT REPORT AND RECOMMENDATIONS

Attendee's and Report Writer's Name:

**Joseph Kerski, Geographer:  
Education/GIS, Denver, Colorado.**

Event:  
**GIS Education and Evaluation Workshop**

Location: ESRI-Denver Regional Office,  
Broomfield, Colorado

Event Date: 7 December 2002

### **Summary**

The USGS, the Colorado Geographic Alliance, and ESRI co-sponsored a workshop and development session for a research project to evaluate the student impact of using GIS in a classroom setting.



Workshop organizers: L-to-R: Joseph Kerski, USGS, Esther Worker, ESRI, Sophia Linn, Colorado Geographic Alliance, Tosca Hoffmann, ESRI, Rick Gindele, Smoky Hill High School.



ESRI Denver—their new facilities in Broomfield, Colorado—was the site of our workshop. The workshop format of evaluation workshop and hands-on training was something we had never tried in quite the same way, but it proved to be a great success.



The ESRI facilities were the perfect location for the workshop—we used both training labs and the foyer of their building. Some of the teachers were present to fulfill their requirement as part of the COGA scholarship they received to attend a week-long GIS training in Boulder during June 2002. Other educators were present to contribute and facilitate our discussions and to receive GIS training.



Approximately 17 educators attended the workshop from the Colorado Front Range and Central Mountains of the state.

The things we wanted teachers to consider included:

- 1) what am I teaching—content or skills?
- 2) What are students learning—content or skills?
- 3) What subjects can be taught best using GIS?
- 4) Are students enthusiastic or engaged—by the technology, the content, or both (or neither?)
- 5) Are students more or less motivated to learn using this technology than with traditional means and media?
- 6) Does it increase students' confidence levels or their interest in school?
- 7) What are YOU as a teacher doing differently?
- 8) How do you use GIS? Open or closed units?
- 9) What are the benefits of unintended outcomes?



Sophia Linn of the Colorado Geographic Alliance led off the day's events. She also led a discussion on future GIS education events for 2003: 1) GeoTech at Mesa State College, 5 April 2003; 2) Technology in Education Conference, 22-27 June 2003 at Copper Mountain; 3) GIS Workshop for Educators and Colorado River Trip; Mesa State College, 2-6 August 2003.



Dr Colleen Fitzpatrick of the University of Colorado's Department of Sociology led our discussion on developing assessment tools for GIS in education. Sally Wither from the Orton Foundation was also there to lend us her expertise both that day and in the future. It is our intention that the assessment tools we develop will help in other projects, for example, the GIS4Colorado project, which seeks to obtain GIS site licenses and support for every K12 school in Colorado.



Attendees in the morning brainstorming session.

#### Morning Program:

Introductions, the purpose and power of assessment and evaluation, benefits and challenges of teaching with GIS, brainstorming student impact, measuring impact, and developing evaluation tools.

High school student and teacher presentations.

#### Afternoon Program:

Presentation of Colorado Standardized Assessment Program (CSAP) mapping project.

Hands-On GIS training.

Discussion of upcoming events of interest to educators using GIS.

We stressed the fact that we need help to coordinate the events in 2003, particularly the Technology in Education conference ([www.tie-online.org](http://www.tie-online.org)), where 1,500 teachers will gather. We plan to have 1 and one half days of GIS, GPS, and geocaching at TIE.



Phil Pendorf, Geography instructor from Arvada High School, explains why and how he uses GIS in his advanced geography courses.



Phil Pendorf and Arvada High School students receive ESRI shirts after their presentation at the workshop. One of the students attended our week-long GIS institute for educators during June 2002 in Boulder, Colorado.

#### ***Partnerships between USGS, COGA, and ESRI***

The partnerships that the USGS education program has had with both COGA and ESRI have been some of our longest running partnerships. They have also been among the most rewarding that I have been involved with and ones that, I believe, have brought much benefit to the educators in the USA and

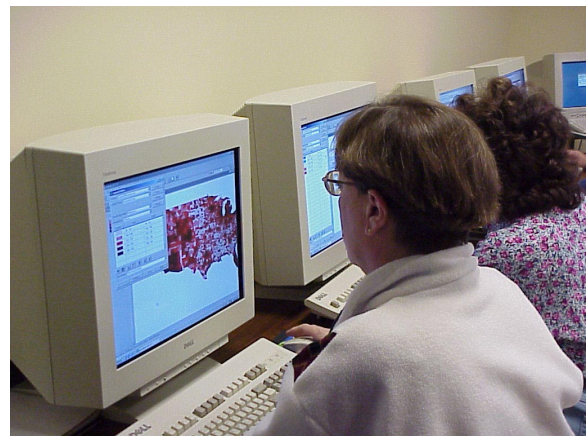
to each of our respective organizations.

The Colorado Geographic Alliance web site is <http://geography.unco.edu/COGA>. We have participated in all COGA conferences with both exhibits and workshops since 1995. The state geographic alliances are organizations established during the 1980s. They were originally supported by the National Geographic Society for the promotion and support of geographic education.

Colorado's alliance is one of the original groups begun in 1986 and includes over 6,000 teachers, professors, and others interested in geography education. We have also supported other state geographic alliances, such as with workshops that I have conducted in Iowa, Nebraska, Texas, Wyoming, Montana, and ones in Tennessee by Roger Barlow. Through the geography education list serve at the Association of American Geographers, I have worked online with other geography alliance members across the USA.

I have had the pleasure of working with Sophia Linn, COGA Program Manager, since 1996. Ms Linn conducted some of the first experiments to measure the effectiveness of geographic educational technology in her research at the University of Colorado. During 1999, we attended a summer GIS institute together at Southwest Texas State University. This institute brought together a group of educators interested in using GIS in the geography curriculum, most of whom are still considered the trailblazers in this effort. We have conducted GIS trainings for educators together over the years and have co-hosted two GeoTech conferences, in May 2001 and April 2002. We have presented together at NCGE conferences and plan to co-present our current research on developing GIS assessment tools and mapping the CSAP scores at the next Association of American geographers conference in March 2003.

I have worked with the ESRI staff since 1994 during, ironically, a Colorado Geographic Alliance conference. Since that time, we have conducted numerous training sessions together, share data, training strategies, and mutual publicity about each others' organizations. Esther Worker has been a constant support to the educational community throughout the country during all of those years. More recently, I became aware of Tosca Hoffmann's work with GIS in education while she operated successful environmental education programs in Wisconsin, and I most recently talked with her about this event during the 2002 GIS in the Rockies conference. She brings a great deal of technical knowledge about GIS software as well as an extensive educational background to her position at ESRI.



Teachers examine population change across the country during the past 100 years. The next step will be to follow up with these educators and to develop these assessment tools.

### ***Observations and Recommendations:***

By participating in the planning and operation of this event, we sought to:

- 1] Further our partnerships with ESRI , COGA, and the Orton Foundation to increase geography literacy on many levels.

2] Develop assessment tools that can help the promotion of spatial literacy.

3] Provide another opportunity for hands-on training for educators.

The USGS has a wealth of data sets, programs, and research efforts that this audience was interested in, particularly our digital data sets, training that we conduct, and projects with the educational community (such as with the Conserving Biodiversity project).

I recommend that the USGS pursue education as integral to its mission. Education shows our relevance to Congress and the general public. Education affects future generations of scientists who will support our agency and work for the USGS. Education serves the needs of diversity, recruitment, and retention. Education ties into all six major outreach audiences. Education forms partnerships that are far-reaching.

Working with the organizations and educators described here provide input to our own organization and contribute to the geographic and scientific literacy of the nation, helping individuals make sound decisions that affect the future of our society.

**Acknowledgements:**

I would like to thank the following individuals:

Sophia Linn of COGA and Esther Worker of ESRI for their excellence during the past 4 months in organizing and planning this event.

Sally Wither and Colleen Fitzpatrick for their assessment expertise for this event.

Esther Worker and Tosca Hoffmann of ESRI for hosting this event at their facility in Broomfield and for supporting education over the years.

Phil Pendorf and his students for presenting during the day. It should not be understated that four high school students gave up a Saturday to present about GIS!

Rick Gindele for presenting the project "Mapping the CSAP Scores."

The teachers who attended; they made the event all worthwhile.



One group of teachers analyzed Colorado DOT accident data, earthquake and watershed data, and population data. The other group worked through some of the modules from the ESRI Press book *Mapping Our World*. I had the great privilege to serve as one of the reviewers for this excellent resource.

Notes from our "Evaluating The Student Impact of Using GIS in Classroom Settings" workshop:

Colleen Fitzpatrick led the group in a discussion of how to think about developing assessment tools that evaluate the student impact of using GIS in the curriculum. Given the state assessment and standards, does what the students are learning mesh with what the state says students should know and be able to do? Is technology a good vehicle? It is speaking their language. Give validity.

1. It is important to use GIS for a number of reasons.
  2. Develop an evaluation mechanism.
- Content-skills-self esteem.

It is not just content!

#### I. Working from Objectives To Particulars and Back Again

Describe and quantify GIS in the classroom:  
Students

#### II. Moving Up and Down the Ladder of Abstraction

- A: Concretizing the abstract
- B: Abstracting the concrete

#### III. Thinking out loud: A Process of building a model of our collective thoughts

a) Wrapping our heads around the objectives

Need objectives and outcomes. But first, what are your expectations? Why do we need to measure this?

b) Why are we doing this?

i) Grant requirements

ii) Meets state needs. Justify to board of education.

iii) Useful to the rest

iv) What else

#### IV. The essential nature of usefulness

- a) an agent of change
- b) improves something
- c) not cumbersome
- d) makes reaching overall fundamental

objectives:

1. more effective
2. more efficient
3. without producing extra work

Is it IMPORTANT, NECESSARY, AND WORTH THE TIME?

How is it USEFUL?

If you determine usefulness, then you can meet all the other requirements. Things are useful if they induce some kind of change. Therefore,

- 1) What do we want to change?
- 2) Improve what?
- 3) We don't want it to become cumbersome. We want it to make us more effective. Efficiency → Effectiveness.

Change.

Responses:

- 1) GIS Made the classroom more student-centered.
- 2) Open ended questions that students can investigate. Fast Food Nation exercise. Higher Order Thinking. Predict Future events. Real world.
- 3) Solution oriented
- 4) Think inferentially.
- 5) Investigate topics more like a scientist would. Back it up with real data.
- 6) Don't just accept the news, test it with their own data. Verifiable. Scientific thinking, self –research.

Question: Would the students do all of this otherwise? Perhaps not. GIS puts data at their fingertips. Makes it more efficient than paper maps.

7) If you don't use technology, there is more pressure on the teacher to inferentially think.

- 8) Can find data more easily.
- 9) Interpretation of diagrams better and make their own;
- 10) not just look at what others have done. Analytical thinking. Interpreting data.
- 11) Seeing patterns and relationships.
- 12) Holistic approach: people, culture, environment.
- 13) Specific to global... move through levels of abstraction more fluidly.

How do you know they have done all this? Tough.

Eg—GIS has enabled them to look at real data, not with paper. You give assignments to students to examine real data. This is measurable. What about scientific thinking? Eg—MOWGLE Europe vs Africa, predict the future.

1. student inquiry, questions
2. capture the data
3. interpret the data and analyze
4. draw conclusions
5. presenting results.

Measure by: Attendance.

## I. Quantitative

To sum: A rubric helps us to meet our evaluation objective. A rubric matrix.

Quasi-experimental design. Look at regression discontinuity design at At Risk Poudre School District. Compare at risk group to mainstream group.

Joseph: I compared lesson A with GIS, lesson A without GIS, lesson B with GIS, lesson B without GIS, etc. for 3 schools, 3 teachers. Time consuming but worthwhile.

Encouraged teachers to find a non-GIS

using teacher teaching the same content for comparison purposes. Look at their grade sheets.

Gindele: Prepackaged lesson vs students really doing their own investigations. There is a difference.

Gaffri: Switch from collect for 80% of project and analyze for 20% of project to the point where collecting is only 20% but analyzing is 80%.

Transferability: Eg—taking The Hill lesson in Boulder to other cities.

What takes longer—learning GIS vs making paper maps?

1 state standard: To use the same technology that scientists use in the workplace.

Teaching content vs skills or both?

Joseph: I mentioned that it takes the college students 1 hour to download and format the same data from the USGS earthquake site in GIS; the middle school students can do it in 20 minutes. Don't be afraid of the tech; the students can do it.

Teachers' comfort level with GIS?

Nichols: With GIS, the students don't give her answers copied from someone else; they are engaged – level of engagement is higher. "I hear things that tells me they are learning. They are teaching themselves. The students are driving the class. The A-Ha! And the questions that they ask – the depth of the questions. Self-motivating, self-teaching. Student sees the relationships that the instructor has not even thought of! These are the best students; those who are self taught.

## II. Qualitative Measures.

Anecdotal—write down sentences you hear  
Interest survey  
Teacher interviews  
Journal of reflections from students  
Track choices – do the students choose GIS vs PPT or XLS? A Systematic approach.

Joseph: when no menu choice or button, can the students detect patterns and ask geographic questions?

Pretest interest level survey

Accuracy; On paper they can misplot earthquakes. Not so with GIS? GIS still is error inherent. But: Be critical of the data is paramount. Students asking and challenging the teacher: Where is the data to back up your statements?

Observe something in a different way—triangulation

Demonstrate achievement with GIS.  
Q: Is GIS worth it? What are the students doing?

## V. The Process

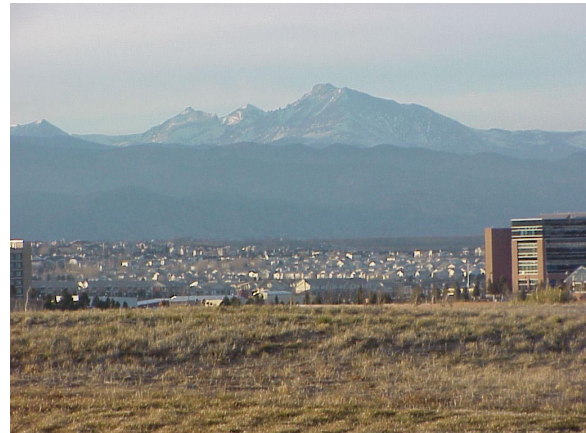
- a) take a look at the terminal objectives and interpret what they mean
- b) working in concepts
- c) define and operationalize
- d) measuring, categorizing, and describing what we interpret
- e) analyzing what we measure
- f) putting into words our findings

- i) fitting the pieces together to make a whole
- ii) relate back to the stated objectives
- iii) make unexpected or serendipitous observations
- iv) fit new observations into the whole
- v) relate back to the stated objectives

Kent: The more we can use GIS, we free up funds that were allotted to textbook

purchases!

Arvada HS presentations: Were you surprised at the data for your school? A competition for the best PPT. It is exciting; we “get mad at friends if they don’t do their work.”



Colorado Front Range and Longs Peak from ESRI Denver Office, 430pm, 7 December 2002.

\*\*\* End of GIS Evaluation – Training December 2002 report \*\*\*