

## **Paper Title**

Running of the Bulls, Motivating in Online Certificate Programs

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## **Paper Abstract**

Teachers are becoming aware of the power of geospatial technologies for the classroom. Making the most of teachers' schedule while meeting their flexible time needs creates unique challenges to online education. Creating an atmosphere where participants are excited about their community as well as their skills is critical in realizing the social nature of geospatial-based curriculum. Creating assignments that both challenge yet leave room for individual expression is an important part of the process. And how are objectives set that meet these diverse needs and still enable evaluation of their products. Join us for a healthy discussion of keeping in front of the charging pace and challenges of virtual community certificate programs.

## **Learning and Teaching GIS**

Despite enormous advances in the number and quality of textbooks, tutorials, and courses in Geographic Information Sciences over the past 30 years, learning the technology and applications remains a challenging enterprise. In part because GIS is simultaneously a discipline of study, a technological toolkit, and a series of methods and procedures, the learner must grasp all of these while applying them to his or her own needs. Yet, the benefits of using GIS in nearly every conceivable discipline to solve real-world problems has been so demonstrable that people from all walks of life have overcome these challenges and today number in the millions of those proficient in GIS.

Just as learning GIS has its challenges, teaching GIS requires an instructor to overcome the difficulties of mastering GIS as well as presenting the science and tools clearly for the intended audience. Sui (1995) identified two ways of thinking about instructional GIS—teaching *about* GIS, and teaching *with* GIS. Teaching *about* GIS emphasizes instruction with the goal of educating the audience about Geographic Information Science and Systems spatial theory, methods, and applications. Teaching *with* GIS emphasizes the application of theory and methods so that the intended audience learns about a specific or set of concepts or disciplines outside Geographic Information Systems (Kerski, *in press*). These concepts may include natural hazards, water chemistry, biomes and ecoregions, climate, population, biodiversity, crime, disease, and others, and are most often anchored in the disciplines of geography, environmental studies, mathematics, history, earth science, chemistry, biology, and physics. The goal of teaching with GIS is to foster the use of GIS as a toolkit and spatial thinking as a framework to understand the world and to solve real-world problems.

Educators seeking to teach *with* GIS have goals that are different from those teaching *about* GIS. Goals of teaching with GIS extend far beyond mastery of GIS software skills to the fostering of spatial thinking itself—analyzing the whys of where. Educators teaching with GIS are attracted to GIS because it makes use of real-world data, offers an inquiry-driven, problem-solving learning environment, is engaging to students, provides employment skills and opportunities, and is grounded in educational content standards that specify what students should know and be able to do at different grade levels.

We have been training educators to teach with GIS for nearly a decade (Kerski et al. 2005). We have accomplished this through the development of dozens of educational lessons and guidelines and courses ranging from half day to two-week institutes to full semester courses. Thousands of educators in the USA, Costa Rica, the United Kingdom, and in New Zealand have been trained through these resources. One of us served as co-author of the first two textbooks for educators seeking to teach with GIS—*Mapping Our World—GIS Lessons for Educators* (Malone, Palmer, and Voigt 2002) and *Community Geography—GIS in Action* (Malone, Palmer, and Voigt 2003), both from ESRI Press. The training and curricular resources we have developed are designed for formal primary, secondary, community college, and university educators, as well as those in informal education—museums, parks, after school programs, and for national educational programs such as National 4-H. These are all hands-on, tailored to the needs of the participants, include local and regional data and issues, and are anchored in state and national educational content standards in geography, technology, mathematics, history, science, and environmental studies. Despite the successful implementation of these courses and resources, demand for training remains higher than our ability to provide it.

### **Teaching with GIS in an Online Distance Learning Environment**

The online learning environment offers one solution to meet the demand that educators have for GIS training. Educators, especially those in schools, are available for training only for very limited time periods during the academic year. Most are not allowed to take professional development days that are not part of the school district's preapproved set of courses. If they are allowed to take time off from the classroom to attend a training event, they frequently have to find their own substitutes. To keep their certification, nearly all teachers must take courses during the academic year break. These competing professional development demands break further limit the time that teachers can attend a GIS-based training. Online courses offer the flexibility for educators to complete the work on their own time and schedule. Second, the online environment offers one of the chief advantages of face-to-face courses—the networking of professionals with similar needs and goals. Educators are oftentimes isolated when they teach with new tools and methods such as GIS. The online community of learners offers teachers the

technical and pedagogical support they need for the sustained use of spatial technologies and methods. This is critical with any new technology in the classroom, but especially with a complex technology such as GIS that is coupled with a different way of thinking about the world—in spatial terms.

In late 2004 and early 2005, we and other educators planned not only a new online course, but also a five-course GIS certificate program for educators. Advantages of a certificate program over a single course was to better cover the breadth and depth of the use of GIS for teaching and learning, and to offer educators a certificate in GIS in Education at the university level. Certificate applicants must have a bachelor's degree from an accredited institution and meet the graduate school non-degree student status requirement of Eastern Michigan University.

Supporting the effort were Dr Yichun Xie and Dr Chris Mayda at Eastern Michigan University. Dr. Xie has been a longtime supporter of GIS in education, evident through such projects at the NSF-funded Virtual Immersion in Science Inquiry for Teachers (VISIT), which made heavy use of GIS in an online environment. The only other program specifically tailored to teachers that we are aware of is that from the University of Montana originally supported by NASA's Earth Observing System program. The courses in the Eastern Michigan University certificate program include:

Geography 520: GIS Introduction for Educators  
Geography 522: Internet GIS Resources for Educators  
Geography 524: GIS As an Instructional Tool in Classrooms  
Geography 667: School GIS Projects  
Geography 669: GIS Lesson Plan Development

Each course lasted for 7 ½ weeks so that two courses could be taken in each semester, allowing for the entire program to be completed in one year. The online software and system used was eCollege, which provides for discussion boards, drop-boxes for work turned in, feedback from the instructors, syllabi, grading, resource listings, and everything else that one needs to teach online content.

Geography 520 is intended as an introductory GIS course for educators with some computer experience, but no GIS experience, and is designed to open up the world of GIS to professional educators. We used the *GIS In Schools* book from ESRI Press (Audet and Ludwig 2000) for readings, supplemented with additional articles, and asked students to explore web-mapping services. Toward the latter part of the course, we asked students to complete several exercises in ESRI's Arc Explorer Java Edition for Education (AEJEE).

Geography 522 focused on the availability of Internet-based GIS tools and data sources and their applicability to the development of K-16 curriculum materials. We used the *Mapping Our World* book as our core text and ArcGIS or ArcView 3 for our core GIS software.

Geography 524 further expanded students' GIS skills but kept the focus on its educational applications. Students explored strategies for integrating GIS in a variety of formal and nonformal instructional environments. In addition, students developed introductory instructional materials intended to introduce their *own* students in the use of GIS as a tool for data display and analysis.

Geography 667's focus on school GIS projects emphasized the mastery of GIS concepts and techniques in education. Students chose their own topics to explore and develop lessons around. These projects were selected and designed to enable students to engage in using GIS in problem solving and to think spatially about the world.

The last course, Geography 669, focused on using state and national benchmark standards to plan, research, and develop GIS-based lessons in education. The course could be fulfilled in part by attending one of our summer intensive GIS institutes.

The first course began in the fall semester of 2005 with about a dozen students. These students included university professors, primary and secondary educators, nonformal educators from parks and museums, and graduate and undergraduate students with an interest in geography and GIS. Thus, as was our goal, most students were actually educators themselves, and ranged from those training to be teachers, those new in their teaching careers, and veteran educators. One of our first students was a professor who conducted teacher professional development of her own.

The online learning environment offers challenges and benefits (Sherron and Boettcher 1997). For GIS in education, we found the online distance learning environment rewarding and stimulating to us and to the students, but not without its challenges.

Student reactions were generally positive. Those who kept up with the work on a regular basis, not surprisingly, accomplished the most and had the most favorable reactions to the courses.

My expectations have been surpassed. First of all, I was extremely impressed by the level of expertise, availability and responsiveness of the instructors. I have rarely encountered such teachers in an actual face to face classroom.

I know for sure I thought about these "GIS for Educators" courses from a "how to use the technology" viewpoint. I really never considered the approach you guys started with. Considering HOW to teach WITH the technology didn't enter my mind. I've been too conditioned to shoulder much of the burden of teaching my courses in geography (that is, with the students in a passive learning mode). So this class has actually taught me to be a better overall instructor, not just from the standpoint of GIS.

For us as instructors, the greatest reward was knowing that we were meeting real needs of the students from a wide variety of backgrounds, disciplines, and teaching experience. One of the challenges was, as others have observed, the time commitment required in the online environment. As we endeavored to be online each day, the students rapidly came to expect near real-time responses to their comments and questions. The three of us spent about 300 hours collectively to teach each 7.5-week course. Another challenge was to deliver technical assistance, as some students were running MacOS while others were on Windows OS, and some were running ArcView 3 while others were using ArcGIS 9. A final challenge was to adjust the course to meet the needs of the students as we went along, but still remain true to the original program framework and goals. A particular challenge was to accomplish what we felt needed to be done after the course titles were already established. We have a long history of working together as a team, however, and although time consuming, we accomplished this to our mutual satisfaction and also, we feel, to the satisfaction of the students. By the end of four courses, teachers also began to take ownership of how to implement this into their classrooms. The following quotes also show their growing appreciation to continue developing their own skills as teachers and lifelong learners.

The process that we used to create our lesson plans for 669 have been very valuable to me, as I stated earlier, I was not one to create a lesson from start to finish and then use it in class; that has changed... Frustrating at times...Yes, worth it, yes: The last 4 classes have put me back into the thinking mode, and I wouldn't trade that for anything.

My first vision is to have my fully integrated GIS class as permanent part of the WGHS curriculum. I know that next year I will have one section. I want to stimulate the students' critical thinking skills by having them investigate spatial data.

I have been very concerned about how I will not only hone my GIS skills but even maintain those I have already learned. I believe that once I begin my Geospatial Technologies for Educators class that the wonderful perk of teaching will occur—cementing of content knowledge and skills...for the teacher! It has always been amazing to me how teaching is the best way of learning. Until that course begins, I feel I must work independently to strengthen both the depth and breadth of my ArcGIS skills.

As far as keeping my skills up, I would like to see our district high schools form a GIS user group to help encourage all of us to share lessons and assist others with new lesson plans.

The online distance learning environment is not without its challenges, but is an excellent means of providing GIS training to those who seek to use it in their educational curricula. For some, it may not fully meet the same needs that face-to-face training provides. However, given rising transportation costs, difficulty for educators to pay for and attend face-to-face professional development opportunities, and our own limited time and availability to provide all of the training in demand, electronic distance learning meets real needs.

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