

GIS Access—Active Learning Pedagogy: New Approaches for Introducing Technology into the Classroom

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Technology and education are two topics that have become increasingly intertwined. In the US community college educators in all disciplines are increasingly called upon to use the latest in advanced technology, as well as to introduce such technology to our academic students. Business, industry and government look to us to provide retraining or updating in advancing technologies for their current workforce. The community colleges in the United States occupy a unique position in higher education. Part of their task is to offer 2-year degrees in both the academic and vocational arenas. In addition, they provide retraining for the “non-traditional,” student who is returning to college to update skills required in their current job or to improve their employment status. Thus, the American community college stands as a bridge with one foot planted firmly in each of two worlds: (1) offering to high school graduates (recent as well as older) the necessary lower-division courses in preparation for transfer to the 4-year colleges and universities (a “junior college”), and (2) offering courses and certificates in job-related vocational programs (a “trade school”) in preparation for entry into/advancement in the workforce. With these goals in mind, educators are experimenting with how to use and introduce technology, as well as developing innovative teaching methods to more effectively teach students with varying needs and learning agendas.

Several problems have come to light. How can we as educators use the latest teaching methodologies and teach the latest technology when most of the technologies did not exist when we entered the teaching profession? Also, how do we determine the best methods and technologies to use when little study has been done on what does, and does not, work?

Geographic information systems (GIS) and related technologies of global positioning systems (GPS) and remote sensing have become increasingly important to the economies of the United States and the world. Educators from K-12 to university levels use GIS as a tool in the classroom to help students explore their world and meet these diverse objectives—that is, teach about and with the latest technology. Students are studying geography, geology, environmental science, resource management, biology and a host of other topics using GIS as a tool for “project-based” learning programs. Instructors using GIS find that their teaching style is also evolving from the traditional lecture/lab approach to a more student-oriented leaning approach. As a result, students are becoming more involved in the learning process and instructors are becoming less disseminators of facts and more facilitators or guides to help the students learn. This style has been coined as “Active Learning” pedagogy. These innovative programs and educators are reaching out to other educators to support their use of GIS and a project-based, active leaning pedagogy.

The GIS Access project is helping to provide some of the answers and highlight some of the problems in developing, using and implementing this new pedagogy and advanced technology in a wide variety of educational programs using GIS. The project was developed by Les Doak

at Cypress College, a community college in Southern California, and funded by a National Science Foundation Advanced Technology Education grant. The GIS Access program was modeled using techniques from Les Doak's classroom experience of using active-learning pedagogy to introduce students to geographic information systems technology. In his program, students create a GIS project in an area of interest to them.

The goal of GIS Access was to prepare educators from high school through university levels in the use of the SCANS approach (U.S. Department of Labor, 1991) for active learning, using GIS as the center of focus for advanced technology. Instructors from secondary schools through universities were to come together for intensive, two-week institutes at multiple sites around the US over each of two summers. Each site was to have two "Team Leaders" and 12 "Team Members," with the intent that there were no "teachers and students" but that they were all to learn from each other. The primary objectives were (1) to learn to use active learning pedagogy by having it modeled for them, (2) to learn fundamentals of GIS using ArcView (a GIS software), and (3) develop a GIS-based project for use in their classroom. Other goals of the program were to have instructors develop a GIS curriculum for their own institutions, continue networking during the year, and then return the following summer for a second, more advanced, institute.

The first 7 institutes were held in the summer of 1999 at 6 locations around the US. Fifty-one instructors gathered at these sites to be introduced to active learning and GIS. Evaluations and informal surveys from participants that completed the first institutes suggested that they felt that they had learned much about GIS, appreciated the opportunity to come together to focus on GIS, and had begun their own GIS-based projects. The majority of the participants surveyed did not feel that they had learned as much about active learning as they would have liked, nor did they have a clear understanding of what it really was or how they could implement it in their classrooms to teach GIS.

In December 1999, Les Doak stepped down from the project and Gail Hobbs and Ann Johnson became PI and Co-PI for the Grant. A meeting was held in February at Pierce College with instructors for the Summer 2000 institutes (a mix of some veteran team leaders from 1999 and some newcomers). The purpose of the meeting was to reorganize the institutes and build a tighter framework to include stronger emphasis on active learning methodologies as they pertain to GIS.

Essential to redesigning the institutes was developing a method to promote a clearer understanding of what active learning is and how best to convey it to other educators. Also, based on comments from participants in the first round of institutes, there was the need for more of a day-to-day framework of activities with clearly defined goals and objectives. Active learning may, at first glance, appear to be easier, i.e., less work, for the instructor—fewer formal lectures and more "participation" time by students. Active learning in practice is not easier, especially for the new practitioner or for one who is also learning GIS technology along with active learning methodology.

Other studies have demonstrated that most educators are reluctant to institute GIS programs until they have a firm understanding of all parts of teaching with and using GIS. This

includes the fundamental principals behind GIS as well as being comfortable in using the GIS software. To address this the institutes would use active learning methods to introduce and teach the basic concepts of GIS to participants and give them “hands-on” practice with the software as they work on their GIS projects. But fundamental to active and project-based learning methodologies, instructors have to be comfortable with the idea that they cannot know all things about GIS and are willing to learn along with their students. This also means not having all of the answers or firmly defined outcomes for projects. Instructors must be able to let the students more freely experiment along the way to learning GIS. This does not mean that teachers do not have clearly defined learning objectives and a framework for class activities. Students (especially those from the work place who are retraining or upgrading skills) must have a firm understanding of the important underlying principles, but in this methodology these principles must be interwoven throughout the curriculum as they advance toward working on a project.

Discussions with government, industry and business professionals have suggested that there are three areas they look for in hiring GIS workers. The three are:

- (1) A clear understand of principles behind GIS, including among others such things as cartography, datum, projections, data accuracy, data collection, database development, spatial analysis, and presentation of analysis
- (2) Proficiency in use of GIS software and related hardware.
- (3) Thinking and interpersonal skills such as problem-solving abilities and team working skills.

Thus, educators using project-based, active learning must be able to address the above learning objectives as students explore and use GIS. To this end, the institutes will be presenting various learning modules that introduce these basic principles using a more active learning approach. Participants will observe and use teaching techniques that develop team work. They will still learn GIS and develop a project during the institute, but they will also come together to observe, critique and develop the “basic concepts” modules for use in their own classrooms. Dissemination of the modules and participant projects will be via web sites at Pierce College and ESRI (Environmental Systems Research Institute), and through presentations at various local, state, national, and international conferences.

Participants (this year totaling approximately 110, including those from the 1999 workshops as well as first-time participants) will evaluate the program at the end of each institute. It is hoped that by the time of the conference in September 2000, the grant PIs will be able to make a preliminary assessment of the outcomes from modifications made in the second summer’s institutes. From previous experience in evaluating GIS workshops, it has been found most educators need more than one year, and often up to 4 years, to begin to institute GIS in their course work, partly dependent on availability of hardware and software, as well as institutional support. Thus, measurement of success of the GIS Access project will have to be a long-term process. It is hoped that educators will be able to institute some type of GIS technology soon after completing the institutes, but for the overall success or short comings, the PIs will continue to monitor participants over the next several years.