Building a Successful GIS Program in a Middle School

Barbaree Ash Duke
Educational Consultant and Teacher, Alexandria, VA, USA
baduke@mindspring.com

Abstract: This paper demonstrates how and why the use of GIS, Geographic Information Systems, in a middle school works. One of the most difficult aspects of a GIS program is getting started. Based on my experiences at LeRoy Martin GT Magnet Middle School in Raleigh, North Carolina, GIS offers students and teachers tools they need to succeed. Students get real world connections to the curriculum while teachers get a tool that encompasses their Standard Course of Study and hard-to-teach analytical skills. The Martin Middle School experience serves as a model for what works in a middle school GIS program.

GIS, Geographic Information Systems, is one of the fastest growing technologies in our world today. As this technology becomes more ubiquitous (Alibrandi 2003), educators need to consider this technology as a viable and essential tool in their techno-bag-of-tricks. Students need real world connections to the curriculum. Teachers need tools that will teach content and promote independent analysis of curricular material. This presentation will demonstrate how and why developing a successful GIS program in a Middle School makes sense for students today.

Why Listen to Me?
In 15 years as a public school teacher, I have taught kindergarten students to adult enrichment classes in four states. As a young educator, I found myself looking for new ways to make learning meaningful and interesting to my students. That zeal for innovation in education never left me. My students over the years have taught me several valuable lessons as I sought to meet their needs in the classroom. I learned then that students deeply care about what they did in class, wanted equal treatment along with the same intellectual challenges, regardless of their ability level. In addition, I learned that if I do not know how to do something, I should find someone that does. I also learned that we should never underestimate the power of student-directed, creative approaches to traditional curriculum to produce results. Moreover, I learned the real need for integrating of technology into the classroom curriculum opposed to teaching computer skills as a separate entity. We must meet the needs of the educational community to be successful. With my experience in the middle school and college classroom, one particular tool for integrating technology into the classroom actually changed how I looked at my curriculum, regardless of the subject: Geographic Information Systems.

The Martin Middle School Experience

I took the GIS in Education course at NC State in preparation for a technology endorsement where I created an ArcView GIS project (Fig. 1) to utilize with the second and third grade students studying their community. After my training in the GIS in Education course at North Carolina

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[1] "ArcView is full-featured GIS software for visualizing, managing, creating, and analyzing geographic data. Using ArcView, you can understand the geographic context of your data, allowing you to see relationships and identify patterns in new ways. ArcView helps tens of thousands of organizations make better decisions and solve problems faster."
State University in the spring of 2000, I took the GIS skills and creativity with me when I joined the LeRoy Martin GT Magnet Middle School in Raleigh, North Carolina that fall. Excited about teaching in middle school, I was eager to dive into cross-curricular projects with my team teachers. Isn’t that what middle school is all about? I was surprised to find that sort of thing just had not been happening for a variety of reasons. I moved forward with my one computer in my classroom and some free software to integrate GIS into my students’ study of Mark Twain. Students researched and examined the influence of Mark Twain’s travel on his novel *The Adventures of Tom Sawyer*. The “Road Trips in the USA” map (Fig. 2) is a view of the ArcView project that my students used in their study of Mark Twain and *The Adventures of Tom Sawyer*. It is not a fancy map, but it does a great job quickly showing students the intricate twists and turns of the Mississippi River and Twain’s journey down it. As a riverboat pilot, he really had to steer the boat along the river. It was not a straight ride from St. Louis to New Orleans. Using a GIS map to show this river journey instead of a paper map gives students the opportunity to zoom into the tiny details of the river and terrain to get a more true measurement of Twain’s experience.

The Curriculum Specialists and other team teachers expressed interest in utilizing the technology upon seeing my students use it. With the generous support of the AG Resource teachers and my teammates, I developed several cross-curricular units of study for all my students: *Take Me Out to the Ballgame, Mr. Twain Goes to Centerville, and CSI: Ebenezer Scrooge*, each one containing a GIS component for students. Additionally, I co-created cross-curricular studies with the Innovators Team teachers like *Water, Water Everywhere*. Partnerships developed with North Carolina State University and the Wake County GIS office. Other teachers sought grant money and donations while more teachers were exposed to the technology in staff development. As more teachers were trained to teach GIS at NC State, they returned to assist other Martin teachers with curriculum-based GIS enhancement lessons for students. Students got excited about the technology and were trained how to do GIS in elective classes, which gave birth to GIS Day events for entire grade levels. The picture shows our friends from the North Carolina Geodetic Survey demonstrating how they collect GPS data at GIS Day 2002 (Fig. 3). Those students wanted more classes in GIS so advanced GIS electives were created to train students in advanced problem solving. GIS was contagious!

**Figure 2**

### Cornerstones for Building a GIS Program

Any school can build a GIS program, as long as some essential cornerstones are in place to make the program strong. These key building blocks are one skilled and interested teacher, an interested Curriculum Specialist, Partnerships with Agencies or Universities, Administrative and Technical Support, Funding, Training, Events and ESRI Resources. My partners at North Carolina State University were instrumental in offering support, guest speakers and lessons that enriched my classroom as well as other teachers with no experience in GIS. They maintain a site of information and resources at [http://www.ncsu.edu/gisined](http://www.ncsu.edu/gisined) as well as offer their services to the education community in the Triangle area. ESRI, Environmental Systems Research Institute, in Redlands, California is instrumental in creating attainable software and resources for teachers. They offer software at better than reasonable rates for schools and maintain online lesson plans and activities related to curriculum and GIS objectives. Their support to the GIS in Education initiative is essential. Activities and puzzles are available at [http://www.esri.com/industries/k-12/education/lessons.html](http://www.esri.com/industries/k-12/education/lessons.html). My students particularly enjoyed the puzzles like “The Great Chocolate Caper” and “The Case of the Missing Ship.” Lessons and puzzles like these are ready to use in the classroom.
What happens if all of the cornerstones aren’t available? I would recommend keeping in mind the old adage, “Rome wasn’t built in a day.” A set of four or five of these building blocks are enough to construct a workable program. With a trained teacher, administrative support, ESRI resources, and a supportive Curriculum Specialist or Technician, a GIS initiative can be moving along in your school.

The Importance of GIS in Middle School

Why is creating a GIS program in middle school important? Two arenas merit discussion: Curriculum Perspectives and Benefits for Teachers and Students. Curriculum carries a heavier burden in our classrooms and in statistics than in the past. GIS expands the curriculum out of the textbook and into the real world, as the examples of outstanding GIS efforts in schools illustrate (Audet and Ludwig 2000). In short, GIS is transforming learning. It allows children to think differently, “out of the box.” GIS pushes students up Bloom’s Taxonomy (Dalton 1986) into evaluation, without the groans and fights that often accompany higher thinking activities. Many curricular approaches to core curriculum content include Bloom’s model (Huit 2004), but finding activities that meet all the needs and maintain student interest is difficult. GIS related activities easily connect to all areas of the curriculum for one simple reason: all things are mappable.

Students are learning technology that will be in their work world (Alibrandi 2003). Students begin to ask the questions of each other and the GIS maps without searching for answers to teacher-directed questions. In short, students are thinking! Isn’t that what we really want? Even our high-stakes testing questions ask students to apply multiple levels of content understanding and connect it to a given example. Worksheets do not give students the opportunity to think through these types of questions. Utilizing GIS as a thinking tool, in contrast, give students practice thinking without knowing that they’re thinking! Moreover, this technology satisfies the middle school student’s desire to explore and find his or her own place in the world (Alibrandi 2003). Students see the connections between curriculum and real-life so that they can answer for themselves that popular question, “Why do we have to learn this?” As Dr. Marsha Alibrandi says in GIS in the Classroom (2003), “Through the joint problem solving so evident in all of theses schools, students are learning what they need to be responsible adults who can make decisions not simply based on ‘what is given,’ but from developed skills and habits of looking at what is behind the data. These are the types of skills and habits of mind we need to develop in our students in order to feel confident in their abilities to create a world of sustainable communities.”

Students are not the only beneficiaries. Teachers need technology that will meet many requirements in their high-stakes testing world. GIS addresses all learning styles. It offers Type 2 and 3 Renzulli activities (Renzulli 2004) and targets other special needs students. The use of GIS in the classroom gives the teacher more freedom to assist student deficiencies than typical lectured instruction affords. This technology integrates easily into all four major curriculum areas while giving authentic, real world/real time connections to the Standard Course of Study and supports research analysis and discrimination of relevant data and information. For example, my students enjoyed bringing to life Mark Twain’s personal journeys around the globe. Seeing Twain’s itinerary on the map as it related to their travel experiences and research about Twain gave new understanding to “a boring dead writer.” After the students and teachers are enjoying the fruits of curricular experiences with GIS, students want to learn more about how it works. Students will be ready to explore their own issues and problems with maps and data they create as solutions to community, regional, national and international problems.

Quenching Student Enthusiasm

One natural result of a viable program is additional GIS elective classes. For example, Rita Hagevik and Ann Thompson created a GIS I elective for Wake County Public Schools in 1998. In this course, students learn how
to use ArcVoyager and ArcView but also learn to apply the principles of research and analysis to their favorite topics. Students chose a myriad of topics. Twenty-one students chose 21 different topics ranging from dog rescue shelters and Wal-mart locations to Ancient Architecture in Europe and Haunted Castles in the UK (Fig. 4 and 5).

After teaching this course in 2002, I had several students who wanted further study in GIS, so I wrote the course GIS II: Solving Problems with Maps. In this course, students get involved with local, state and national issues that GIS can solve. This second level course focuses on community issues as students analyze what their “community” is. Students explore the multiple facets of their community utilizing Community Geography: GIS in Action (Zanelli 2002). Each module in the text covers GIS Skills along with an “on your own” project that allows flexibility for student ArcView projects. My design for this course was to encourage students to explore viable solutions to world, national, state and local problems. After working through the book modules, students move into project creation for issues that affect them personally (like the ESRI Community Atlas Project), research on their own problem/solution, or create ArcView solutions for Teacher/Curriculum driven problems. Students discovered more about their community. With the generous assistance of Shannon White from at North Carolina State University, my students focused on juvenile crime in Cary and Raleigh (Fig. 6).

As students completed the second level course, we saw the need for an additional elective: GIS III/Independent Study. This course offers students the freedom to explore personal GIS projects as well as create GIS lessons for teachers that do not feel comfortable with the technology but want their students to experience GIS as a curricular enhancement. One student created multiple ArcView projects and then he helped teach the lessons.

All of these students were involved with events like GIS Day (http://www.gisday.com), sponsored by ESRI. With the entrance circle, hallways, Media Center and computer lab transformed into GIS showcases, 650 Martin Middle School students participated in a GIS scavenger hunt and tour of presentations by local and state GIS experts. Some of those experts were their own fellow students and Martin staff. In addition to the student-run centers, experts from the North Carolina Geodetic Survey demonstrated GIS in the circle in the front of the building. Students passed through a map gallery, saw Wake County GIS demonstrate aerial photography, topographic, environmental and parcel data, witnessed first-hand Raleigh City GIS crime mapping strategies, and were “put on the county map” by the North Carolina State University GIS in Education team. GIS elective students displayed their projects and helped conduct lab experiences for students on GIS Day along side of local professionals demonstrating the use of GIS in the community. GIS brings the classroom and the community together.

Conclusion

Our mission in educating and preparing future teachers should be to equip every pre-service teacher with the tools they need to be successful, creative and empowered. I believe the inclusion of GIS in teacher education programs should fall under the umbrella of cross-curricular and technology integration. This technology is an

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[2] “ArcVoyager was created by ESRI’s Schools and Libraries team to go along with ArcView. It is a 50-mb package of carefully selected data, ArcView projects, and help files, in a tiered format. Elementary teachers, middle school students, high schoolers, librarians, college instructors, museum professionals, or parents are using ArcVoyager effectively.”
excellent tool to navigate curricular boundaries while exposing them to a technology that is already saturating the world business community.

Unfortunately, there is very little research done in this field. “There are a number of unanswered questions about GIS; many of the issues related to implementing GIS in US classrooms have scarcely been considered, including pre-service teacher education, spatial cognition, affect, content (declarative) knowledge acquisition, process skills, assessment, instructional models, standardized curriculum packages, special needs students and minority and gender concerns” (Baker and Bednarz 2003). Pre-service teachers need many tools to improve long-term teacher efficacy. One of the best tools they can employ is their creative integration of meaningful and enlightening content that enriches the curricular experience. Empowered teachers are integrating technology (Internet, GIS, and software applications), video, text, audio and the arts. Seeing curriculum and course work in the big picture gives wings to creativity. Getting results is inevitable as students become involved with content and analysis across the curriculum. If students can engage in meaningful classroom activities, it will make classroom management easier. The more students understand the purpose and need for the curricular content; teachers can accomplish more in the classroom. I propose that GIS is one such tool that will hook students on the goals and content that teachers want and need them to grasp. Since community and finding our place in the world is human nature. Teachers and students love seeing themselves “on the map.” GIS brings the map not only into the curriculum but also across it. Although an educator has many tools in his or her bag-of-tricks, GIS is one cool tool that will change how you and your students see the world.

References


**Acknowledgements**

My deep gratitude extends to the many professionals and willing students that made and continue to make GIS possible in education. A special thanks to Dr. Marsha Alibrandi at North Carolina State University for introducing me to GIS, an event that changed my perspective of the globe forever. Her efforts with Shannon White have changed the face of GIS in Education. Thanks for letting me tag along. Special thanks go out to my Innovators Team teammates: Angela Slate, Kris Thomasson and Sahar El Shafie who believed in trying a crazy new idea. Thank you to Karen Wagoner and Glenda Cox, the AG Resource Teachers, who saw the potential in GIS without personal experience. GIS continues at Martin Middle because of the continued efforts of faculty and staff bitten by the GIS bug and do not want an antidote. I am most thankful to John and my family for their unending prayers, support and enthusiasm for my creative ventures.