

THE IMPACTS OF GEOGRAPHIC INFORMATION SYSTEM TECHNOLOGY ON MIDDLE GRADE SCIENCE STUDENTS

Background GIS are powerful computer applications for storing, processing, and displaying spatially referenced data. I see GIS technology as an opportunity for students to engage in inquiry learning opportunities while using authentic data to learn about topics such as plate tectonics that traditionally haven't supported this kind of learning approach. My students can use the computers to ask questions, make maps, and examine relationships between sets of geospatial data.

However, during the last two years of implementing lessons with the GIS technology, I was concerned about the learning and benefits that may come about by using this approach. It seemed that many students were struggling with completing the different elements of the assignment in a timely manner as well as struggling with mastering some of the curriculum learning concepts. I wanted to know more on the how GIS impacts my students' learning and how did it affect student attitudes to technology and science?

Focus Question

- What impact will using GIS technology in classes have on middle grade students?

Additional sub-questions to be addressed through my action research project include:

1. Does the incorporation of GIS impact middle school students' attitudes towards science and technology?
2. Does incorporation of GIS in instruction affect student learning and comprehension of plate tectonics concepts?
3. Does inclusion of GIS impact different groups (Gender/Ability) of students?

Literature Review

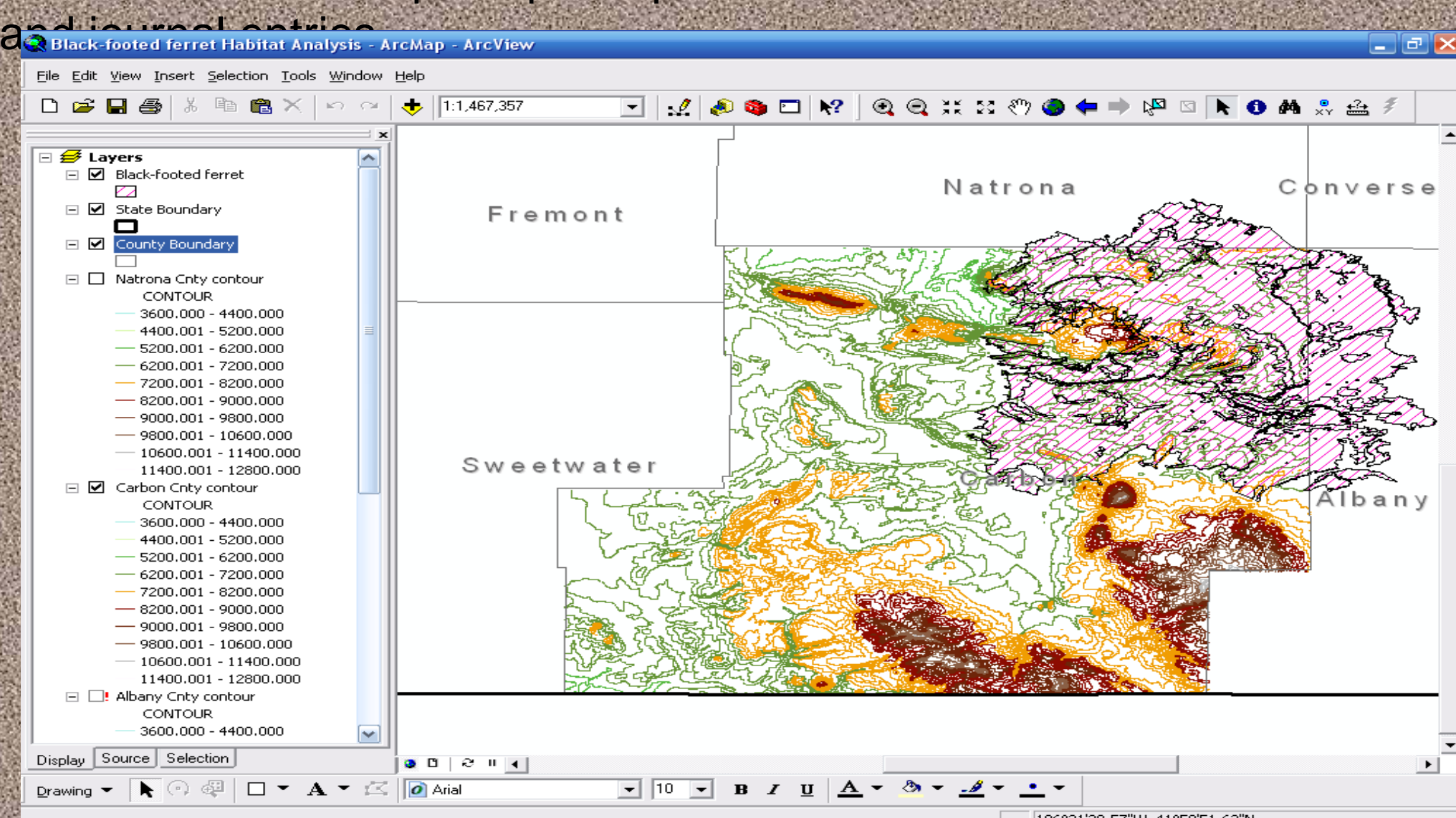
- Student use of GIS can provide significant improvement in attitudes toward technology, self-efficacy toward science, and modest, yet significant, improvements for geographic data analysis for students who used GIS (Baker and White, 2003).
- GIS fosters higher-order analytical and synthetic thinking, and increased student' knowledge of absolute and relative locations across the globe (Kersk, 2003).
- According to Barstow (1994) GIS is viewed as having the potential to "be a major educational tool, supporting more effective learning of science concepts and providing new tools for inquiry-based learning, as called for in the emerging National Science Education Standards" (p.14).

Methodology

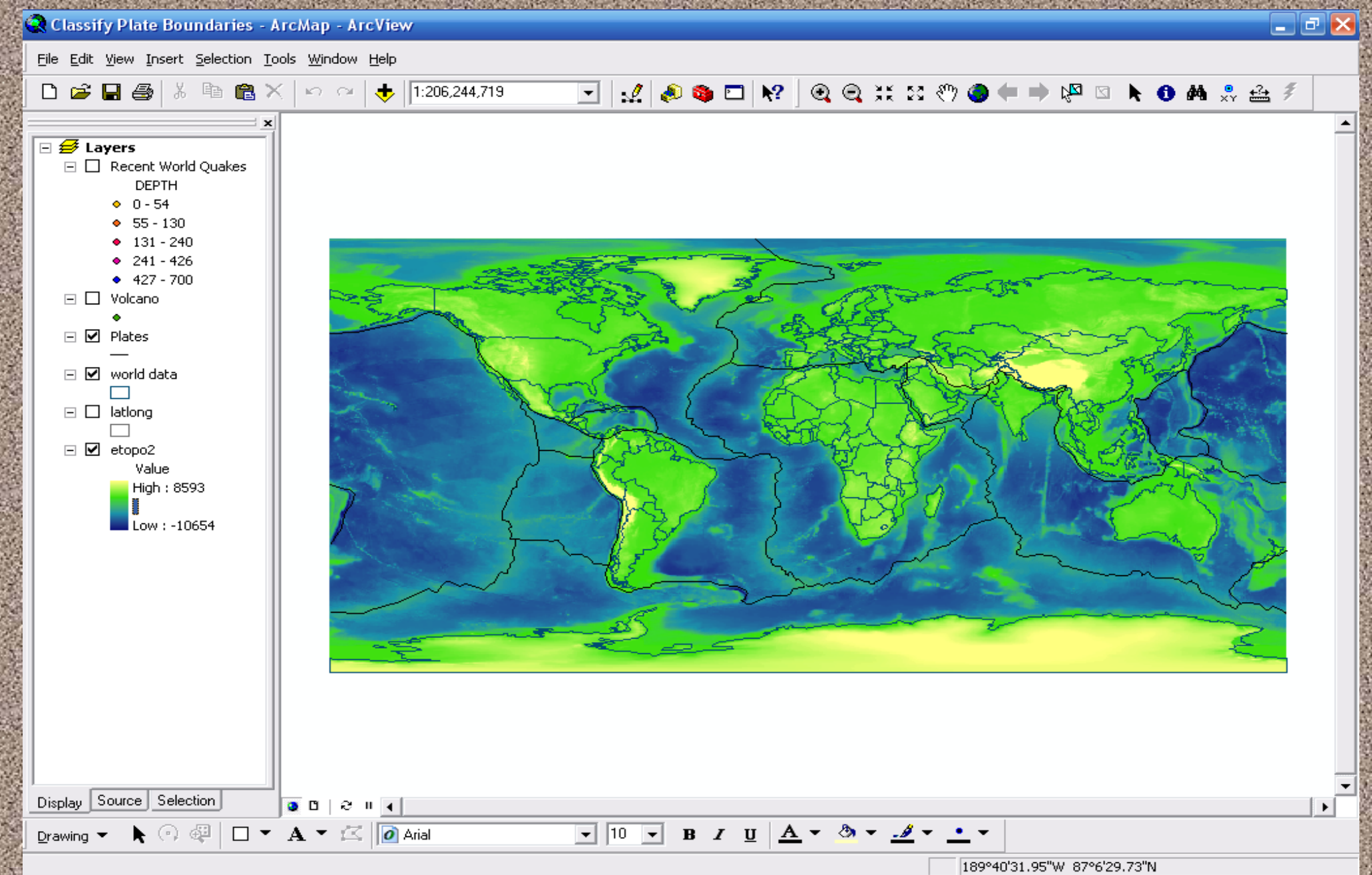
To investigate the impact of GIS on middle school science students, I had students in three of my classes work in pairs with Environmental Systems Research Institute's ArcGIS to examine geospatial data on volcanoes, earthquakes, and topography in a constructivist lesson based on Sawyer's *Discovering Plate Boundaries* (2005) (Appendix D). This lesson guided students in determining the locations of plate boundaries based on volcano and earthquake locations. Following this work, students then used the GIS software to create categories of types of boundaries based on that same data. For the past two years I have found that it takes students six class periods of 50 minutes to complete the assigned tasks.

An additional activity using GIS technology was used later in the spring of the school year. For this lesson students use GIS technology to analyze the habitats of Wyoming animals and then look for areas in Missoula County that match the habitat needs for that organism (Appendix E). Students again worked in pairs on this assignment over three class periods.

Data collection strategies for this action research project included: pre/post treatment student surveys, student focus group interviews, pre/post test on plate tectonics understandings, pre/post treatment student made concept maps on plate tectonics, and teacher field notes



Mike Plautz
Hellgate Middle School
Missoula, MT



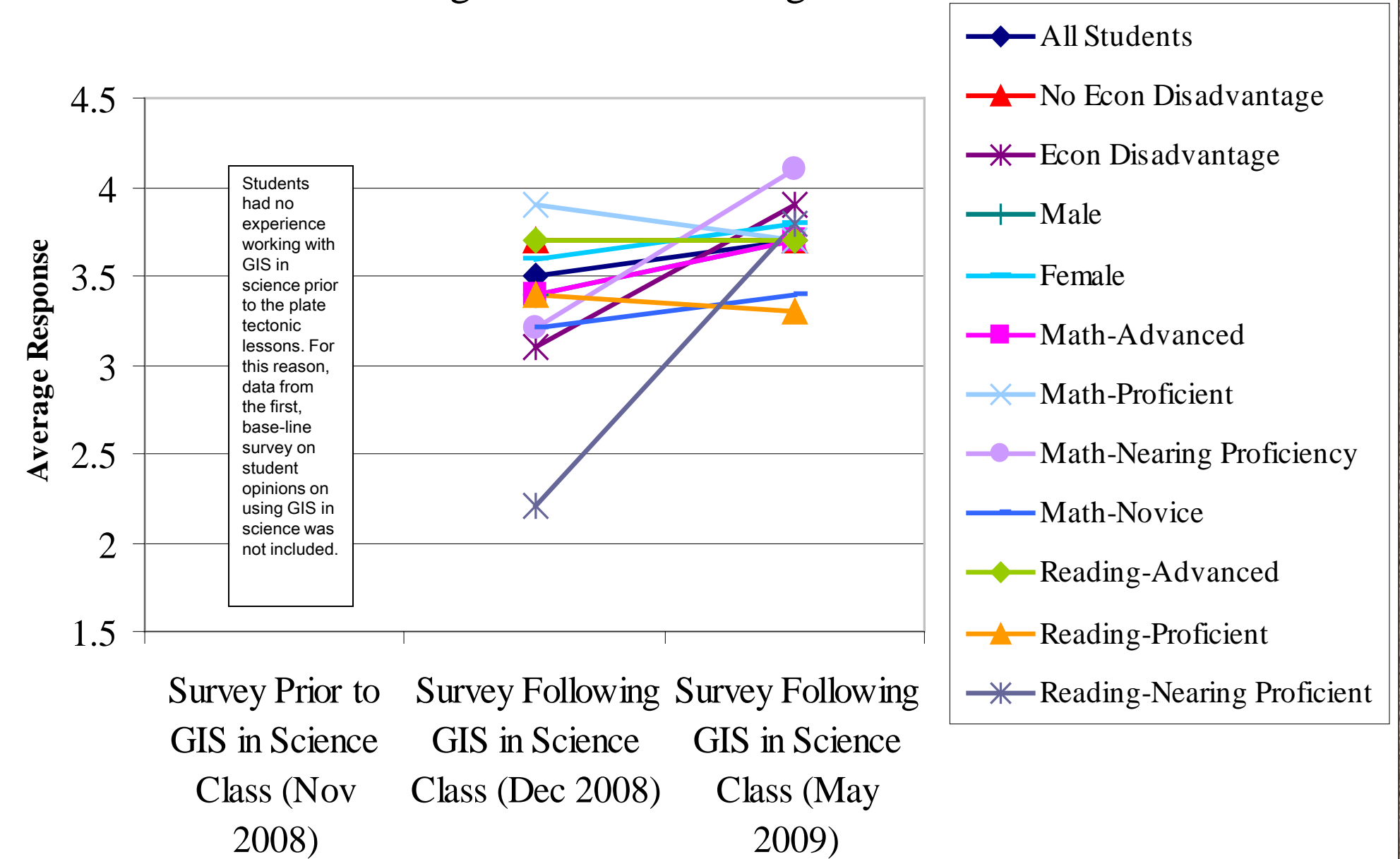
Data Analysis

Students enjoy working with computers with 72.44% of students replying positively and also feel comfortable working with them, demonstrated by almost 82 % of the students responding with "agree" or "strongly agree."

While students enjoyed using computers in school and felt comfortable using them, they did not look at them as positively when asked about learning with them or they way they use them on assignments. Roughly half (48%) of the students viewed computers positively as a learning tool and the same percentage of students agreed that they work hard on assignments using computers.

Students felt comfortable working with computer, however, not all felt confident in using GIS. A larger percentage of students (42.52 %) disagreed or strongly disagreed with the question on using GIS to explain something. A similar percentage resulted on students' view of GIS encouraging them to seek out their own answers. These numbers support comments that I heard from students as they were taking the survey.

16. I like working on science investigations that involve GIS.



Response to the Student Survey on Attitudes Towards Science and Technology from November 2008 to May 2009. The survey was scored on a scale of 1 for strongly agree to 5 for strongly disagree.

References

- Barstow, D. (Ed.). (1994). Conference Report from: National Conference on the Educational Applications of Geographic Information Systems (EdGIS). Cambridge, MA: TERC Communications.
- Baker, T. R. and White, S. H. (2003) 'The Effects of G.I.S. on Students' Attitudes, Self-efficacy, and Achievement in Middle School Science Classrooms. *Journal of Geography*, 102(6), 243 – 254
- Kerski, J. J. (2003). The implementation and effectiveness of GIS technology and methods in secondary education. *Journal of Geography*, 102(3), 128-137.
- Sawyer, D.S. (2005). *Discovering Plate Boundaries*. Retrieved on April 1, 2008 from <http://terra.rice.edu/plateboundary/intro.html>