A CASE FOR SPATIAL LITERACY AND GEOSPATIAL TECHNOLOGIES IN THE CORE K-12 SOCIAL STUDIES CURRICULUM

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Historically, Iowa schools have been known for excellence in terms of student test scores, teacher innovation and local control. As Iowa moves toward a core curriculum for social studies, math and science, Iowa is perfectly positioned to impact students' spatial literacy skills by incorporating GST within many areas of the core curriculum creating previously unseen relevance for Iowa students.

Introduction

The themes of place and location are core to social studies. These cornerstones of the social sciences allow for the study of human activity over time and give rise to the context of people's existence. Place and location have played a significant role in human patterns on earth which can't be ignored and certainly never undervalued in the study of human activities. The choice of activities by humans is largely based on location, climate and availability of resources. As an example the pioneers of northwest Iowa in the 1800's used their resources to meet their needs.

> In northwest Iowa, where there were almost no trees, pioneers used the earth itself, or the sod, to make homes. They cut it up in careful strips, cutting the strips into pieces about twelve inches long. Then they placed the strips of sod to form the outline of a house. Once the outline was in place, the settlers laid strip upon strip to build up the walls. (Schwieder, Morain and Nielsen, 2002, p. 60)

This passage contains a clear reference to the impact of location, climate and availability of resources that shaped the decision making of these pioneers.

Studying patterns of human existence relative to place and location in school is an essential building block in the foundation of problem solvers in the 21st century. Today, new emerging technologies have impacted life in large part due to the advent of technologies such as wireless access to the

internet, email, cell phones, text messaging, iPods, and a plethora of more or less advanced technologies. Students are living in an age where technology is common-place and the knowledge-skills of how and when to use technologies to determine place and location has become core to this generation's existence. Geospatial Technologies (GST) is a rapidly expanding technology rooted in problem solving using place, time, location and human patterns.

Geospatial Technologies

GST is, "an information technology field of practice that acquires, manages, interprets, integrates, displays, analyzes, or otherwise uses data focusing on the graphic, temporal, and spatial context" (National Research Council, 2006, p. 112). GST includes three distinct branches. They are Geographic Information Systems (GIS), Global Positioning Systems (GPS) and Remote Sensing (RS). Each of these technologies has its own unique role in the field of geospatial study.

GIS takes location data and through software creates map layers of the data revealing connections between and among each layer. A city might use geographic location data of speeding tickets and accidents to create map layers that indicate certain areas of the town which are more susceptible to traffic problems.

GPS is found in many automobiles, the agricultural industry and business in general. A GPS unit remotely connects with at least three satellites to locate a point on the earth's surface. With this information GPS can connect several points to create a route on the surface of the earth.

RS receives data from sensors on the earth's surface without actually being at that location. An oceanographer gathering ocean water temperatures remotely is an example of RS. These three components of GST are prevalent in society today, yet K-12 students have not been exposed to these technologies commensurate with societal interest.

Geospatial technologies are impacting society through the job market. On October 6, 2005 and January 27, 2006 the United States Department of Labor (DOL) facilitated the President's High Growth Job Training Initiative. The DOL in conjunction with Geospatial Information and Technology Associations and the Association of American Geographers held two round table discussions. These discussions were focused on how the DOL should define and communicate the geospatial workforce need. As it recognized the importance of geospatial technologies the "Overall Program Objectives" of the initiative makes it clear that the DOL believes educational institutions

play an important role in the development of a workforce that can meet the industry demand for various geospatial tasks. Their goal; "To pilot and demonstrate a specific application of these new outreach materials and geospatial intelligence information tools and methodology in a particular geographic area to better align educational, employment, and economic development programs with employers' labor needs." (United States Department of Labor, 2006, p.2)

In addition to the Department of Labor's focus on Geospatial Technologies, the National Research Council states in Learning to Think Spatially,

> Workforce demands are changing; those demands can be met only if the K-12 education system produces graduates with the requisite skills and knowledge, with a commitment to lifelong learning, and with flexibility to adapt to change. Central to changing workforce needs are knowledge workers for the rapidly growing IT sector. Central to the IT sector and many other sectors is spatial thinking. To what extent does the K-12 educational system generate graduates with these spatial thinking skills? (National Research Council, 2006, p. 113)

The National Research Council brings up a point worth examining. In support of this statement the United States Department of Labor Statistics reveals telling predictions for the growth of geospatial technologies by the year 2014. In their Occupational Outlook Handbook they foreshadow a growth rate of slightly more than fifty percent from the years 2004 to 2014 in the Network Systems and Data Communication Analysts category. (Occupational Outlook Handbook, 2008) This growth rate prediction when coupled with a 600% market increase, from five to thirty billion dollars, over the years 2002 to 2005 give quite an opportunistic outlook for jobs in the field of geospatial technologies.

Education and Geospatial Technologies

The current role of education in the field of GST is problematic at best. Schools are far behind what is happening in the public and private sectors with GST and spatial literacy. Kerski (2003) in his article "The Implementation and Effectiveness of Geographic Information Systems Technology and Education in Secondary Education" states, "To put it another way, the state of the art is far beyond the state of practice. Only three percent of schools in the U.S. are effectively integrating technology into all aspects of their educational programs." (p. 129) GST instruction, incorporated into the current K-12 curriculums would enrich student's school experiences and add

relevance to more closely represent their daily lives. Students are already far ahead of schools, and in many cases teachers, in technological intuition. Letting students use their natural abilities to advance their learning would seem to be a logical step in terms of spatial literacy and technology advancement. The National Research Council (2006) goes on to state, "The educational challenge is to teach students strategies for spatial thinking; to teach how, where, and when to use them; and to convey a critical awareness of the strengths and limitations of each strategy" (p. 19). Building an awareness of what, when and how to apply spatial reasoning skills or strategies is the foundation of how GST can significantly impact education.

Relatively few schools in the United States are teaching courses that focus on geospatial technologies and then move to the application of it. Many lessons from various science, social studies, business, and math courses use geospatial technologies at points in singular lessons. In fact Kerski (2003) points out that "Only twenty percent of teachers using GIS use it in more than one lesson in more than one class" (p. 129). A primary reason for this could be the emphasis on the state mandated curriculums.

Other places in North America are offering their students basic GST learning in their secondary school experience. As an example in the Canadian province of Ontario a course profile for Geomatics: Geotechnologies in Action created by school boards and subject associates for the Ontario Catholic Schools states, "Students will receive a systematic introduction to the four pillars of geomatics – surveying, remote sensing, cartography, and geographic information systems (GIS) – and will learn how to apply their knowledge and skills to a variety of real-world situations relating to physical and human geography" (p.1) While this particular course is not required for all students it is an example of what is being done with GST in other places outside of the United States to make GST relevant to student's lives.

Iowa and Geospatial Technologies

With Iowa moving to more rigorous and relevant curriculums it would seem to be a logical extension to include GST in the K-12 curriculums of Iowa schools. On July 11, 2007 the Iowa State Board of Regents and the State of Iowa convened science and math educators in Iowa on the campus of the University of Northern Iowa to "discuss challenges and opportunities facing the state in mathematics and science education" (Math and Science, 2007). The first goal of this collaborative initiative is, "To improve math and science performance of Iowa students (pre-K-12)". In a list of top challenges identified under this goal was "Use of technology (access and preparation)

to match student strengths" (Math and Science, 2007). This is the point... to make school more relevant to the lives of the students.

Historically, Iowa schools have been known for excellence in terms of student test scores, teacher innovation and local control. As Iowa moves toward a core curriculum for social studies, math and science, Iowa is perfectly positioned to impact student's spatial literacy skills by incorporating GST within many areas of the core curriculum creating previously unseen relevance for Iowa students. Natural fits for GST exist in social studies, science and math courses but also in business courses and many other relevant areas of study. Not only can GST be used within each course but it can also bring each of these courses together to blur the lines of the curriculum and knock down the silos that separate one subject area from another. With a focused effort to incorporate and build student's spatial literacy skill and GST technical skills Iowa can be on the cutting edge of technology innovation allowing schools to more aptly mirror student's lives and meet the societal workforce demands.

Just as the pioneers of the 1800's used their location, place and resources to sustain their lives, today's educators have the responsibility to teach their students in relevant ways how to interact in the society which they reside. Essential to this relevant learning must be the use of technology as a problem solving tool. Core to this relevance is the incorporation of Geospatial Technologies in the K-12 curriculums of Iowa.

(Note: A common barrier to any technological advancement in the schools is funding. GST can be infused in many ways with the current internet connections and technologies in the schools. Environmental Systems Research Institute (ESRI) has FREE geospatial software that can be downloaded to any computer. To download the software go to http://www.esri.com and search "AEJEE". You will also find examples and tutorials of GST applications within the ESRI site.)

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