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Utilizing geographic education research to increase learning in a seventh grade geography course

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Abstract

The purpose of this paper is to review the current condition of geography education, to examine current research in geographic education, and to create a plan to improve student learning in my classroom. It outlines the re-emergence of geography education in the secondary setting and considers the quality of the national geography standards. A descriptive narrative of current geographic education research is used to determine best instructional practice and is aligned with Colorado's Model Geography Standards to link the current research with curriculum. The results of the research are then used to evaluate and improve the curriculum, pedagogy, and assessment strategies that are part of a seventh grade geography course.

UTILIZING GEOGRAPHIC EDUCATION RESEARCH TO INCREASE LEARNING IN A SEVENTH GRADE GEOGRAPHY COURSE

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Chapter I

Introduction

The purpose of this paper is to review the current condition of geography education, to examine current research in geographic education, and to create a plan to improve student learning in my classroom. This paper defines geography as a unique discipline that has a unique perspective to offer students. It outlines the re-emergence of geography education in the secondary setting and considers the quality of the national geography standards. A descriptive narrative of current geographic education research is used to determine best instructional practice and is aligned with Colorado's Model Geography Standards to link the current research with curriculum. The results of the research are then used to evaluate and improve the curriculum, pedagogy, and assessment strategies that are part of a seventh grade geography course.

Statement of the Problem

Despite major advancements at the national level my students are not realizing the full potential of the discipline of geography. This paper will show that the best way to change geography education is to utilize research. What is needed is an opportunity to refocus my purpose as a geography teacher. This paper will serve a bridge to connect the practices and experiences of my classroom to the latest geographic education research. My research question is how can the findings of geographic education research be

implemented in a public school classroom? "Research indicates that teachers need time to analyze, discuss, and reflect on the curriculum they teach within the context of the academic discipline in which it is situated. It is through this process that teachers develop pedagogical content knowledge" (Bednarz, 2003, p. 108).

The paper will highlight the process that has strengthened geography as a discipline at the national level. One sign of the strength of geography is the popularity of the five themes of geography to organize geography instruction among social studies teachers. Unfortunately, many classrooms, including my own, have experienced little change. Gregg and Leinhardt suggest, "What is needed is a way of helping teachers acquire both the core epistemological themes and concepts of geography and knowledge about the problems that students face as learners. Without this kind of understanding of what geography is supposed to teach, the five themes are of limited use" (1994, p. 350). This paper then, attempts to be that connection. "It is difficult for teachers to rethink the nature of the disciplines they teach, but until geography educators do, implementation of the standards will only be superficial" (Bednarz, 2003, p. 108).

In *How We Learn*, the difficulty teachers face in regards to rethinking their subject matter is addressed. "Workshops for teachers often focus more on generic pedagogy (e.g. cooperative learning) than on the need to integrate pedagogy with the contents of the various standards" (Bransford, Brown, and Cocking, 1999, p. 182). Rethinking their subject challenges teachers fundamental beliefs about students and their purpose or role as educators.

> Learning involves making oneself vulnerable and taking risks, and this is often not how teachers often see their role...they are accustomed to being in control. When they encourage students to actively explore issues and generate questions, it is almost inevitable that they will encounter

> questions that they cannot answer-and this can be threatening. Helping them become comfortable with the role of the learner is very important. Providing them access to subject matter expertise is also extremely important (Bransford, Brown, and Cocking, 1999, p. 183).

In 1994 James Marran created a list of the components of "old geography" which often included a focus on specific places, recall, and fact-based assessment. It was teacher directed and textbook driven, considered the student as a segregated learner, featured little problem solving, had a regional emphasis, and included an ethnocentric and nationalistic bias. Despite my efforts and claims to the contrary, I think much of this list describes my class.

As the call for increasing the role of geography in secondary education took shape, leaders such as Marran evaluated where the discipline had been and charted a vision of where it should go.

> In addition, the pedagogy must compliment the fresh content emerging from the research and new cognitive models so that the delivery systems will be responsive to various learning styles and to collaborative teaching strategies. Only then will students be free from classrooms dominated by teacher-talk and fill in the blank workbooks so typical of the old geography (1994, p. 10).

Marran's vision of "new geography" includes an emphasis on spatial relationships, encourages problem solving, engages students in critical thinking, and replaces broad coverage with in-depth exploration of fewer topics. This classroom employs collaborative learning strategies, is researched based, includes technology and fieldwork, focuses on the relationship betweens humans and the environment, and is driven by the nation geography standards (1994). Maier updates this vision with her perspective on geography. "Geographic educators believe that geography is the content

that provides the knowledge and skills necessary to compete in the world's "global community" (Maier, 1999, p. 66).

It seems that at least portions of the vision of new geography codified in the national standards has been put forth before. Bednarz and Bednarz reviewed articles in the *Journal of Geography* and found that a circular pattern is evident that can be traced back to 1902 (1992, p. 149). In reference to the role of locational knowledge in geographic education the authors summarize the pattern as follows.

> First an alarm is sounded by a flurry of articles concerning geographical ignorance: these are followed by a few articles suggesting techniques to teach place names, which are usually recycled old activities; eventually the opposing viewpoint appears reminding the readership that geography is *more* than place names, that memorization is not an effective technique to teach anything of lasting worth, and in fact the goal of geography is...(The previous sentence is completed with the goal in vogue at the time.) After some period of time the cycle begins anew (1992, p. 149).

I think this pattern is typical of most of the reforms that have been enacted to improve student learning. Two additional conclusions are worth noting. Nothing in the articles that Bednarz and Bednarz reviewed was new and there was no consensus on what was effective (1992, p. 149). The authors suggested, "...Student ignorance has been verified again and again. Unfortunately, very little substantive, innovative, problem driven investigation concerning how students learn has been conducted. If we knew how students learn, maybe we could figure out better ways to teach. It would be a bright future, indeed, if we never had to read another headline that said: Americans don't know where..." (1992, p. 150).

Significance of the Problem

Developing a better understanding of how students acquire geographical knowledge can potentially yield tremendous benefits for practice. "The ultimate concern

of geography educators is ideally to exploit the strong base of educational theory with which to enhance teaching and learning geographic content" (Stoltman & DeChano, 2003, p. 120). While standards and educational policy mandates can offer some sense of direction, understanding what parts of the new geography have been shown to effectively increase student learning may have to come through research. In considering this question, Stoltman and DeChano observe, "Thus, a changing role for the geographic educator is to massage information and select that which is important in teaching and learning, and avoid overloading the educational capacity of students to manage and use information" (p. 124). A systematic examination of the relationship between the research and the standards may be able to inform educators concerning the areas that currently offer the most potential for change.

Organization of the Paper

This paper is organized into four chapters. Chapter I introduces the issue, states the problem and its significance. Chapter II will provide a rationale for teaching geography as a core discipline separate from social studies. Next, it examines the history of the development of geography education and the development of national geographic standards and the impact of those standards. Chapter III will identify the sources and content of geographic education research. Then it examines the research as it relates to the standards outlined by Colorado's model standards. Chapter IV highlights three guiding principles for how the research can be used as a foundation for fundamental change that will lead to more effective geography instruction in my classroom.

Chapter II

Introduction

This chapter addresses the historic changes in geography that have led to the creation of standards and the current emphasis on research in geography education. It begins by examining why students should study geography, and the reemergence of geography as a core subject in the past thirty years. That history served as the foundation for the creation of national standards in geography. The limitations of standards to effect change in the classroom will be discussed. In addition, the standards connection to high-stakes testing will be explored, as well as the questionable impact of high-stakes tests to improve student learning. This chapter will conclude by noting the increasing amount of research and its potential for effecting positive change.

Geography as a Discipline

In his commentary, "Geography: An Essential School Subject, Five Reasons Why," James Marran made the case that geography needs to be a stand-alone subject. He identified the special perspective offered by the study of geography as something that is uniquely applicable. "Of all the school subjects, geography is the most converging. It joins all the strands and threads of the arts and sciences to provide a coherent understanding of the causes, effects, and meanings of the physical and human events that occur across earth's surface" (2003, p. 43). Marran identified the spatial perspective, emphasis on problem solving, the exploration of the relationship between human beings and the environment they use and inhabit, the importance of location, and geography's multi-dimensional nature as evidence of its relevance and usefulness (2003).

In *Rediscovering Geography*, geography's unique perspectives are described as first "looking at the world through the lenses of place, space and scale." Second, geography brings together "environmental-societal dynamics relating human action to the physical environment, environmental dynamics linking physical systems, and human-societal dynamics linking economic, social, and political systems." Third is the perspective of representing the world using "visual, verbal, mathematical, digital, and cognitive approaches" (NRC, 1997, p. 29). In other words, geography asks what is happening, where is it happening and why is it happening there and then presents the findings in a visual form such as maps or charts.

In 1997, the National Research Council summed up the need for relevant geography education.

> It is clear that geography must be a part of any serious effort to meet the educational challenges...Students need to be exposed to ideas and perspectives that cut across the physical-human divide, that consider how developments in one place influence those in other places, that focus attention on the ways in which local circumstances affect understandings and activities, and that foster an appreciation for the diversity of peoples and landscapes that comprise the Earth's surface. Recent outcries over the lack of geography in school curricula reflect a growing recognition that an understanding of such matters is essential if the students of today are going to function effectively in the world of tomorrow (NRC, 1997, p. 27).

Gregg and Leinhardt outline three rationales for the study of geography. The rationale of geographic literacy,

> "Values geography as uniquely contributing to students' acquisition of the kind of background knowledge that will help them make sense of other information...The geographic perspective that results from describing, explaining, and predicting geographic phenomena and processed in terms of distribution, context, and scale is unavailable to students from any other approach to knowledge" (1994, p. 315).

Geography as synthesis "is a model for students to learn how to synthesize information from different subject matter areas...students of geography are constantly challenged to think and make decisions about the relative importance of various pieces of information or to recognize when more information is needed" (p. 315). The final rationale, global interdependence, supposes, "students may gradually come to understand how their own seemingly personal choices and activities affect other people as well as how others' decisions and actions affect them" (p. 316).

Finally, Charles Gritzner responds to the question of why geography is needed, in this way. "By better knowing the world about us, we come to better know ourselves-whether at home, or as members of the global community" (2003, p. 91). In considering Swiss students' attitudes toward Europe, Sibylle Reinfried responds to the question of why geography is needed in this way, "...Determined efforts have been undertaken to guarantee the peaceful understanding and productive coexistence of the different nationalities and cultures. Geography, in collaboration with other social sciences in upper secondary education, such as history, economics, and law can and indeed must make a considerable contribution to this endeavor" (Reinfried, 2000, p. 5).

History of Geography in Secondary Education

The illuminating and distinctive perspective of geography was dimmed in secondary education, if not extinguished, when it was combined with the other social sciences into social studies. "Many geographers fear that their discipline is being ignored altogether or that it occupies an inferior position in elementary social studies instruction" (Muessig, 1987). Gregg and Leinhardt summarized the disappearance of geography from the curriculum for these reasons.

> It is perceived as being a simple, informative subject which provided only a fragmented understanding of skills and themes, geography was phased out of the curriculum [because it was decided that] an integrated social studies curriculum would better meet the needs of American students, [and] because geography in the classroom had been reduced to location recitation and drill, its importance in the curriculum gradually diminished" (Gregg & Leinhardt, 1994, pp. 312-313).

"Geography became a study of the natural features of a certain place rather than a separate discipline. Bednarz contends, "Geography takes a secondary role in the standards of several states. Geography often exists to serve the purposes of history in the social studies curriculum. It is places and location, not a perspective or problem solving tool" (1998, p. 86). As such it often becomes subservient to a chronological perspective, taught by history majors, in the history classroom.

One of the first steps to reviving geography as a discipline was the High School Geography Project (HSGP). In 1970 a group of classroom teachers published materials for a tenth grade geography course called *Geography in an Urban Age.* It promoted the use of the inquiry method, focused on depth, problem solving, and on student interest. It was limited because it did not fit into the curriculum of most American high schools, teachers needed more training, and it did not tie into the issues of the day (Hardwick and Holtgrieve, 1990). Gregg and Leinhardt credit the failure of the HSGP in part, to a lack of geography specific subject matter knowledge on the part of social studies teachers. "The amount and coherence of a teacher's epistemological knowledge clearly influences the quality of both lesson planning and on-line instruction" (1994, p. 351).

In 1984, the Joint Committee on Geographic Education published, *Guidelines for Geographic Education*, which created the five themes of geography: location, place, relationships within places, movement, and regions ((Hardwick and Holtgrieve, 1990). "The five themes were simple, jargon-free, and they proceeded from more basic concepts

to complicated issues-driven geography that offered problem-solving avenues for interested students" (Boehm, 1997, p. 2).

The use of these themes was promoted and supported by alliances for geographic education that were created in all fifty states during the 1980s. These groups created an informed and active group of educators that influenced the development of curriculum in their districts and states (R. S. Bednarz, 2002). Wilbanks credits their activity as having influenced the inclusion of geography as a core subject at the national level.

In 1989 at the Governors' Education Summit in Charlottesville it was recommended that geography be a core subject, along with English, history, science, and math. This became public policy as part of *America 2000.* "Their sense was that geography might be the best umbrella for issues-oriented social studies and environmental education...They were looking for results in terms of useful outcomes in what students know and can do in their lives, related to real social and economic needs" (Wilbanks, 1994, p. 116).

Next, the five themes were incorporated into the document, *Geography Framework for the 1994 assessment of Educational Progress* and eventually into the document, *Geography for life: The National Geography Standards* in 1994 (Hardwick and Holtgrieve, 1990). Along with eighteen standards, this document pushed for student exposure to new mapping technologies, less memorization and more analysis and problem solving, viewing the world from a spatial perspective, and finally making geography a part of everyday living (Boehm, 1997).

Praise for the Standards

The national geography standards appear to compare favorably to other disciplines and in some cases have received high praise from commentators. Chester Finn, Jr. of the Thomas B. Fordham Foundation described the standards in this way, "And-in marked contrast to what happened in history, English, and several other subjects-this endeavor turned out reasonably well. *Geography for Life* is a solid (if over-long, over ambitious, and awkwardly structured) guide to what the leaders of the field believe young people should learn about it" (Finn, 1998, p. vi).

In *The State of the State Standards in Geography* Susan Munroe and the Casados Group analyzed standards from 45 states and the District of Columbia. Iowa does not have state standards, however it is informative to investigate what impact the national standards had on the other states. The standards were evaluated on general characteristics such as clarity, balance, benchmarks, and guidance for teachers. The second aspect of the report examines the quality of knowledge and skills required of students. Munroe concluded that it was evident that material from the national geography standards was incorporated into the state standards. This suggests that it is being used as a model and resource at the state level. She also found evidence that states had "taken pains to capture geography's spatial perspective" and "a decreased emphasis on social studies and more on actual geography" (Munroe, 2002, p. 18).

Colorado received a perfect score in both of Munroe's studies. "Its standards present geography as an important and compellingly interesting field of study, are rigorous and comprehensive and nicely presented" (1998, p. vii). Thus, it makes sense to

use it as a resource for considering what geography can be in my classroom. To begin with, in the introduction geography is described in the following way.

> Everything exists in space. Geography's concern is space. Geography uses a spatial perspective to study the location, arrangement, and interaction of people, places, and environments over Earth's space. By understanding and using the spatial perspective geography offers, students can study issues and ideas in depth.
>
> People everywhere have a need to know about the nature of their world, beginning with themselves. Therefore, geography has to do with both asking questions and solving problems, as well as memorization of facts. Geography is composed of three interrelated and inseparable components, knowledge, skills, and perspectives (Colorado Department of Education, 1995, p. 2).

The document continues with six standards that start at the basic knowledge level and progress to synthesis and application of knowledge.

Impact of Standards

Although the standards in geography appear to be well conceived, it is uncertain whether they have had a substantive impact on classroom instruction. "Conventional wisdom holds that education reform initiatives like subject-specific standards, assessments, and curricula influence pedagogy and student achievement" (Bednarz, 2003, p. 99). As the states have gone through the political process of adopting geography standards there have been successes and failures. "The resulting state standards are very uneven in quality and in their connection to *Geography for Life"* (Bednarz, 1998, p. 85). Besides the problem of being mixed with history, there is inconsistency in which topics are emphasized or ignored, few states include geography courses in high school, and location knowledge still comprises the public's definition of geography (Bednarz, 1998).

> The new proposals (such as *Geography for Life*) envision much more thoughtful, adventurous, and demanding instruction. But most instructional practice in the United States is quite traditional: teachers and

> students spend most of their time with lectures, formal recitations, and worksheets. Intellectual demands are modest and a great deal of the work is dull. Only a modest fraction of public school teachers have a deep knowledge of any academic subject. Hence, even if state and local agencies accumulated the infrastructure and influence required to steer teaching and learning, could they be steered so sharply away from long-established practice? (Cohen & Spillane, 1992, p. 4).

Even in the best of circumstances, "research and experience both show that past efforts to fundamentally change teaching have had modest effects at best. Most often they have resulted in fragmentary adoption of new practices, translation of new practices into old, or both" (Cohen & Spillane, 1992, p. 37). With all of the progress made on the national level in regards to geographic education in the 1990s interest seems to have waned. "There is come an urgency in this because opportunity to improve geography education through implementation of the standards may be disappearing. The document is aging as is professional interest in it" (Bednarz, 2003, p. 107). This paper can benefit from the time that has passed. There has been time to accumulate a body of research regarding the best way to approach teaching geography.

Limits of Testing and Standards

There are two possible explanations to explain the limited impact of standards. First, they are very broad and offer little in the way of specific remedies for classroom teachers. Second, they have been tied to high stakes testing, for which there is little evidence to show an impact on educational practice. This may be yet another indication that the historical autonomy which teachers and students have enjoyed in their classrooms has been difficult to penetrate.

> The classroom doors behind which teachers labor are no thicker here than elsewhere, but teachers in the U.S. received fewer strong and consistent messages about content and pedagogy. They and their students found it

> relatively easy to pursue their own preferences once the doors close behind them (Cohen & Spillane, 1992, p. 23).

This leads to a question asked by Cohen and Spillane, "Could state or national agencies actually mobilize the influence required to steer teaching and learning in thousands, or hundreds of thousands of classrooms?" (p. 4). It seems that standards can only do so much to produce change at the classroom level.

In the years since the standards were created, the federal government has made an effort to effect change in math and reading. Standards based education has been tied to high-stakes testing. In a controversial study Amrein and Berliner examined the impact of high-stakes testing on learning by looking at the results of standardized tests such as the ACT, SAT, NAEP, and AP. They concluded, "At the present time, there is no compelling evidence from a set of states with high-stakes testing policies that those policies result in transfer to the broader domains of knowledge and skills for which high-stakes test scores must be indicators...Moreover, ...data from high-stakes testing programs too often appear distorted and corrupted" (2002, March).

The Amrein and Berliner research touches on three important points. First, it is difficult prove conclusively that action taken on a state or national level has improved student learning. Data can be manipulated and may be likely to be manipulated when the government uses its power to produce change. In their review, Cohen and Spillane concluded that, "efforts to make teaching more ambitious produced change at the margins, but little else" (1992, p. 29). Bednarz concluded, "those aspects of innovations that are closest to current practice and most easy for teachers to understand may be adopted, while difficult, complex, or unfamiliar practices may be ignored" (2003, p. 99).

Second, it is difficult to legislate or mandate a scheme that increases student learning. "Most schemes for fundamental change present a paradox. They offer appealing visions of a new order but therefore also contain a devastating critique of existing realities" (Cohen & Spillane, 1992, p. 35). When the call for change comes from the federal level, the idea has to go through so many layers of control that it lessens the impact of the change itself. In the end it seems, "it would be much more difficult and costly to replace the present cluttered and fragmented accumulation of instructional guidance with a system that was simpler, more focused and more powerful" (p. 41).

Third, Amrein and Berliner looked at math and reading test data. As educators in those disciplines are up in arms about federal and state interference into their activities, I wonder if geographers should be concerned about lack of interest in their field. Will more resources and time be diverted from our discipline to meet federal and national mandates in math, reading, and eventually science? Just as national interest in geography sparked an interest in geography, a lack of it may put out the fire. Bednarz contended that factors such as authority, power, prescriptiveness, and consistency play an important role in the success of any attempt at educational reform. "Without the support of those in authority and other decision-makers, including textbook authors and editors, there are very few extrinsic rewards or sanctions to institutionalize the [geography] standards" (p. 101).

The Role of Research

The role of research in producing change was highlighted as recently as the January/February 2005 edition of *Journal of Geography*. Gerald Zam and David Howard

discuss the addition of Geography for Educators class at the University of Toledo. Their class addressed the need to train preservice teachers.

> The idea for a specialized course in geography emerged as a result of several converging factors: (1) a reprise of research that focused on several glaring deficiencies in American education; (2) the inevitable march towards the implementation of a plethora of standards and assessments in K-12 education; (3) the unfolding of a sincere desire on the part of the [Department of Geography and Planning and the Department of Curriculum and Instruction] to forge a mutual understanding and implementation of both geographic knowledge and educational standards, and concomitant conversion into meaningful, practical instruction in K-12 classrooms (p. 28).

These factors support the argument put forth in this paper; there is a need for excellent geography instruction that is based on the best practice supported by current geographic education research. Indeed, this project represents my effort to analyze my class and propose changes that are supported by the current research in geographic education.

In 1994, Roger Downs came out with this position on geographic education research. "I wish, therefore, to make a claim about the current state of knowledge regarding geography education and then present four needs that, if satisfied, might reshape the future of geographic education. The four needs are:

(1) A new attitude and approach to research in geographic education;
(2) A series of baseline studies of the current process of geographic education;
(3) An agenda to shape a systematic program of research in geographic education;
(4) A support system to ensure that the program of research in geography education is carried out and the results disseminated (1994, p. 128).

The amount of research in geographic education has been multiplying in the years since the creation of the standards, as indicated by the increasing number of journals. What journals focus on geographic education research? Jones (2001) identified eleven English language journals that focus on geographic education. Of these many shared

lesson plans or had a focus on physical geography. Twenty-four percent of the articles reviewed from the *Journal of Geography,* the main publication of the National Council for Geographic Education, were focused on research of geographic learning. The focus of *Research in Geographic Education* and *International Research in Geographical and Environmental Education* are dedicated to research on geographical learning and attempt to fill a gap in the array of scholarly geography publications.

Rutherford (2002) expands on this research to determine the focus of the empirical studies being conducted in geographic education. His pilot study suggests the topics of spatial cognition, curriculum, technology in geographic education, teaching methods, and map learning are most frequently represented. Gender issues, learning theory, cross-cultural education, teacher training, visualization, and environmental education receive some attention. The topics that generated few articles are assessment and environmental psychology.

Chapter III

Introduction

Chapter 3 is a literature review that includes research on how students learn and what instructional practices are most effective. Although the standards have not transformed classroom practice, they do encompass many facets of a well-rounded geography education. As such, model standards, such as those from Colorado provide an ideal framework for organizing the latest geographic education research. In turn the research provides the practical data needed to realize the goals set forth in the standards. This review of the literature points to the potential of geographic education research to bring meaning to the National Geographic Standards. For the first standard, the research on map instruction is examined to find out what should be taught, how students learn to read maps, and how map construction can be used to teach students to read maps. The merits of mental mapping are investigated as part of standard one, as well as the way learners make decisions about the spatial organization of the world's cities. A method of introducing the many perspectives associated with place location knowledge and the cultural biases students may have is connected to the second standard. The third standard is illustrated by a discussion of the evolution of teaching about population growth. To explore standard five an examination of the role of geography courses to promote environmentalism is included. Finally, research into how technology can be used to apply a spatial perspective to solve problems provides an example as to how to bring life to the sixth standard.

Standards and Research

Marran's vision of "new geography" states that geographic education should be driven by standards. In the absence of Iowa standards, this paper will use Colorado's Model Standards, which are based on *Geography for Life's* essential elements to organize our examination of geographic research. "Geography educators must have a firm grip on alignment of the curriculum in order to monitor the role of geography within education" (Stoltman & DeChano, 2003, p. 123).

Standard 1: Map Instruction

The first standard states students know how to use and construct maps, globes, and other geographic tools to locate and derive information about people, places, and environments (Colorado Department of Education, 1995). The first element of this standard, that students know how to use maps, globes and other geographic tools to acquire, process, and report information from a spatial perspective, includes a middle school benchmark that expects students to be able to explain the characteristics, purposes, and differences among maps, globes, aerial photographs, geographic models and satellite images. What is the best way to organize map instruction to facilitate student learning? "If we want children to use maps as tools for thinking, analysis, and argument, they will need to know what map types best solve what problems and how to design them" (Castner, 1999, p. 38).

A taxonomy of maps can be used to create a logical sequence for instruction. It incorporates the categories of kingdom, phylum, class, order, family, genus, and species to make distinctions about the types of problems the maps can help solve. The map taxonomy can be used to sequence instruction, and should be aligned with the perceptual

and motor skills of children. This type of taxonomy could also serve to encourage geography instructors to use maps in different ways. "Unless children are given opportunities to produce a variety of maps as tools, not just inventory or reference maps, they might get a one sided view of what maps might look like and what they can do" (pp. 40-41).

Castner's taxonomy starts with the family of maps. He divides maps into genera based on their task. Inventory maps show what is there and are divided into species based on scale. Navigation & wayfinding maps show how to get there. Navigation tasks are divided into species based on the mode of transportation. Maps used for measurement are divided into distance, angles and directions, area, and elevation. The final genus of maps is for analysis tasks. They are divided by the type of questions they attempt to answer, either questions of magnitude or quantity or questions of relative location or quality. These would be divided into species by method of depiction.

I have included this idea of taxonomy because it creates a framework for purposeful mapping. It encourages instructors to increase the difficulty and variety of maps students work with as the students' map skills develop. Castner put forth this argument,

> It may be useful to develop classroom activities that integrate some of these functions and sequences and so provide both hindsight (what lessons and concepts it builds upon) and foresight (what lessons and concepts it anticipates). With this, elementary and middle school teachers can better come to know and understand how the particular step(s) fit together and why they may wish to engage in them. These decisions will ultimately be moderated by teachers with the knowledge of their students' skills and past experiences and the curriculum goals they wish to pursue. It is my contention that most of these steps and sequences are missing from our geographic and cartographic curricula and thus their logic and conceptual bases are also missing (p. 59).

Castner concluded with these recommendations: continue to use inventory maps to introduce mapping to children; focus on large-scale maps to introduce mapping to help students ease into using maps with out having to deal with the problems created by distortion; use walking maps to introduce wayfinding to students; start with relative location and qualitative questions before addressing questions of magnitude; begin with maps with built-in structural control and that use unclassified or unaggrigated data.

Castner's taxonomy also ties into the third element of the first standard that calls on students to be able to analyze the dynamic spatial organization of people, places, and environments (Colorado Geography Standards, 1995). "I would argue that the need for analysis skills are just as valuable and much more accessible [than] navigation and wayfinding skills because of the difficult nature of abstract concepts about scale, distortion and map projections (Castner, p. 42). In my experience, sometimes I spend so much energy trying to help my students with the problems Castner identifies that I neglect the more accessible and possibly more rewarding analytical tasks.

Castner's taxonomy is devised so that it increases in difficulty as the students' map skills develop. Joan Maier's research attempted to understand the cognitive processes involved in map reading. Thus, it could be dovetailed with Castner's taxonomy to improve map reading instruction. Maier contends, "without substantial prior knowledge to build on, the comprehension of and learning from maps is likely to be superficial, fragmented, difficult to apply and quickly forgotten" (1999, p. 68). Maier wondered if schema theory could explain map reading and if it could be identified and characterized.

What is schema theory? "It assumes that learning is a cognitive process of giving personal meaning to public information. Second, it is assumed that every individual constructs a somewhat idiosyncratic meaning for information. Third, the knowledge and conceptions (and misconceptions) the learner brings to the learning task have substantial influence on learning...Fourth, the process of acquiring meaning from text, oral discourse, or the social world and of remembering information is related to knowledge structures called schema" (p. 67). If schema theory applies to map reading, then map-reading instruction should emphasize, "map reading for understanding instead of simply map skills" (p. 68). The traditional uses of maps as a product of geographic inquiry, analytic tools, and objects of study lend themselves to the comprehension process described by schema theorists in reading education.

The study employed a qualitative research design on 24 seventh grade subjects. The students were asked to view a map with familiar content (the United States) and one with unfamiliar content (South Asia) and then asked for both voluntary and probed responses of each subject.

> Data from this study supports the interpretation of schema theory applied in this study, in that, the process by which written discourse is comprehended is analogous to the process by which maps are comprehended...The role of prior knowledge structures as applied to comprehension of written discourse was operative during map reading because map content familiarity accounted for differences in map comprehension...These findings suggest map reading is a content specific activity; that is, when the content of map materials changes different knowledge structures and processing could emerge (p. 72, p. 75).

By classifying the responses to the questions during the map reading interviews, Maier identified six domain specific knowledge structures.

1. Spatial configuration and location knowledge
   A. Initial configuration

B. Existence on Earth
    1. Name recall
    2. Visual recognition
    3. Direct experience
C. Relative location

2. Place Knowledge
    A. Cultural features
    B. Physical Features
3. Map Structure Knowledge
    A. Symbolic representation of place
        1. Linguistic
        2. Graphic
4. Map Elements-scale, title, legend, and directional indicators
5. Map Functions
6. Personal Perspective Knowledge (p. 78)

Obviously the scope of this list goes far beyond traditional map skills such as the skills needed to use symbols, skills for measuring distance, skills for noting directions, and skills for using scale. Instead these skills are integrated into the entire process of understanding a map. "That is, defining map reading as "map skills" alone does not provide a comprehensive explanation of the information, skills, and processes needed to comprehend, learn, and remember information represented on maps" (p. 78). "Preliminary results from this study suggest that differences in comprehension may be related to the differences in the quality and extent of prior knowledge structures and process strategies map readers activated and employed" (pp. 78-79).

Maier sets forth three pedagogical implications for geographic education. First, teaching map reading requires large amount of time for map reading. This will give students the "opportunity to manage the knowledge, skills, and processing strategies that

are important to comprehend, learn, and remember map information...The more time spent reading may be largely attributable to the knowledge base that grows through map comprehension" (p. 79).

Second, teaching map reading for understanding requires "learning experiences to facilitate the activation and construction of knowledge structures used to comprehend maps" (p. 79). Maier recommends that when using a map, the instructor consider the following questions. "(1) What prior knowledge and experiences will the students need in order to comprehend this map? (2) What information on the map, that is not explicitly presented, will the students need in order to comprehend this map? (3) What learning experiences will activate or construct the students' prior knowledge to comprehend this map?" (p. 80).

Third, just as students need to talk about what they read, they need to talk about what they read on a map. "When students engage in meaningful discussions about their comprehension of a map, they should have an opportunity to: use literal to critical and evaluative questions and responses; clarify the basic meaning of the map; and use the opinions of others to help clarify their thinking about a map" (p. 80). In *Handbook on Geographic Education* the author outlines an equally supportive but broader vision of student discourse. "Geography based discourse among students prepares them for their role as responsible citizens outside the classroom...Discourse provides students with experience in continuing to think about questions and issues when they leave the classroom and school and engage in public policy discussions in the community" (Stoltman & DeChano, 2003, p. 129).

This potential of a schematic approach to teaching map-reading skills to increase geographic literacy may have a profound impact on geographic education. Providing students with more appropriate and effective instruction on map reading may unleash the power of maps to increase the students' understanding of other geographic concepts.

The first element of the Colorado Model Standards also includes a benchmark that requires students to be able to interpret and construct maps, globes, models, charts, and geographic databases.

> Maps are the notational, symbolic system of geography...For students to learn how to reason with maps, they must learn an entirely new representational system-a system that is nonlinear, multilayered, geometric, and iconic. These aspects of the representational system of maps are different from several of the traditional representational systems taught early in students' educational development, such as alphabetic and numeric principles. The mapping system has conventions: north is "up" on most popular maps, although it does not have to be: water is usually colored blue, but it may or may not have shadings that have special meanings; some lines represent real observable entities (rivers), some represent social entities (geopolitical boundaries), while some represent theoretical constructs (longitude and latitude). The notational system of maps permits a complex array of choices concerning projections, scale and topic of interest. Maps are complicated, powerful, and interesting conveyors of information about our world. Learning about maps requires much more that the trivia naming of locations on a line master; true understanding requires knowledge of a unique notational system and the ability to use displays within that system to make subtle and sophisticated inferences (Leinhardt, Stainton, & Bausmith, 1998, p. 19).

From this eloquent description of maps we see the rationale for a study on constructing maps. The researchers targeted the "notational elements of maps that are used to model the physical world...symbols, longitude and latitude, and scale" (p.20). The lesson started with a didactic style focused on one aspect of their maps. During the work time half of the subjects worked on their maps alone and

the other half worked in collaborative groups of four. All of the students created a final map on their own.

The researchers concluded through significant differences between pre-and posttest "[the process of enlarging a map] helps the student form a deeper appreciation of the actual content of a map and the decisions that are present in any map" (p. 29). Stoltman and DeChano offered this rationale for having students engage in map-making activities. "Cartography, or map-making is a useful tool because the end result, the map, requires the students to collect data and decide how to present it" (2003, pp. 131-132).

Students in the group condition showed an even more impressive gain when they created the final map on their own. Before conducting the experiment, the authors identified these critical features of the group as important for the success of the activity: a truly complex, ill structured or open ended task; different roles; sustained engagement; controlled attention; scaffolding-external memory system; and forced explicit justification. The authors summed up the success of the group condition in this way. "We think that making maps in groups works especially well because it forces students to make their own thinking explicit and public, and occasionally requires them to justify and support their thinking. The group situation places more cognitive demands on each individual, but at the same time it provides a comfortable and supportive environment for revisiting and correcting [their map]" (Leinhardt, Stainton, & Bausmith, 1998, p. 29).

Leinhardt, Stainton, and Bausmith suggest the strategy could be improved if it included time for the groups to plan their work, time to develop and discuss techniques to solve the problems that arise in groups, and time to discuss progress as a class during each work time so that students can share what has worked for their group. The research

seems to support their observations. In her review of the research on collaborative groups Elizabeth Cohen recognized the importance of collaboration to make a small group productive. "Many developers of cooperative learning models have observed that groups quite frequently fail to show behaviors that one might call cooperative: in fact close examination of some groups reveals negative and insensitive behavior as well as refusal to assist one another in any meaningful way" (Cohen, 1994, p. 26).

Cohen cites a study conducted by Lew, Mesch, Johnson, and Johnson that educated students on four collaborative skills: sharing ideas and information, staying on task, positive support of group members, and checking for understanding. Then the instructor awarded bonus points if all group members were observed to demonstrate three out of four cooperative skills. "The addition of training in cooperative skills plus the reward contingency for cooperative behavior, was necessary before cooperative groups produced superior achievement results to individual study" (p. 26).

Standard 1: Mental Maps

This standard also contains the element that students develop knowledge of Earth to locate people, places, and environments. More specifically a benchmark states that to satisfy this standard students should be able to draw an accurate map from memory and to answer questions about the location of human features (Colorado Department of Education, 1995). Research in geographic education suggests that these sketch maps do not need to be merely an outcome; rather they can be used as a tool to understand the students' mental map of the world or by extension of a particular region of the world.

There is a wealth of research on the use of sketch maps. How accurately do they measure a person's knowledge of the location of physical and human features? Is the

quality of the data on the sketch map dependent on the subject's ability to draw? Kosslyn's study concluded, "that drawings are not a "royal road" to the child's internal representations" (1977, Kosslyn, Heldmeyer, & Locklear, p. 211). Many of the subjects complained about the drawings of objects or described what they thought they should look like.

Referring to this research Saarinen concedes "the observation that sketch maps test drawing ability rather than knowledge is probably true for certain populations, such as children below a certain age of maturity than allows them to externalize their mental map knowledge" (Saarinen, 2001, p. 36). However, he still contends, "sketch maps provide a rich data source to investigate size, shape, and locational relationships" (p. 35). Kitchin supports this notion with his summary of the uses of cognitive mapping, "there are persuasive reasons for undertaking cognitive mapping research, not the least the need to understand how and why we behave in space as we do. Other applications relate to the planning and creating of environments that are easy to remember, and to educational issues concerning improvement of wayfinding, orientation skills and general geographic skills such as map reading" and he includes map sketches as a "technique to try to gain information concerning cognitive map knowledge" (1996, p. 57).

The research Saarinen conducted compared sketch maps to the results of outline maps that students had to fill in. Subjects were asked to complete a questionnaire and some were selected for extended interviews. The study also includes analysis of selected maps. Saarinen suggested, "the findings indicate that the general pattern of known places is based on geographic knowledge, which can be elicited by means of either the map sketching or filling in names" (p. 36). But the additional analysis on the selected maps

offers insights into the thinking of the subject. First, all 3,568 maps included distortions, were over-generalized, and under represented the scale of the ocean. However they were still recognizable as maps.

Second, knowledge or lack of it was why they drew what they did. The study used the questionnaire to determine if sketch maps reflect drawing ability rather than geographic knowledge. "The study asked which are the best parts of your map? And Why? Which are the worst parts of your map? And Why? ...The most common answers to why the selected portions were best were comments such as "greater knowledge," "most familiar," "know best," my country," "my continent," inferring knowledge and familiarity. The next largest frequency of responses... was they had studied the area in school. This suggests the power of a geography class to impact place location knowledge that is so often cited as a deficit of our students. The third most common type of reply was "easy to draw." (p. 38). This third reply was investigated further was it easy to draw because it was a simple shape or was it easy to draw because it was familiar.

Third, often the area closest to the subject's home included the most accurate detail and information. The data indicated "the home country or continent tends to be considered among the best portions of the map regardless of the continent of origin. Thus, geographic knowledge provides the best explanation of why certain parts were drawn better than others. This conclusion is supported by the answers to the questions of why certain parts were better" (p. 40).

Fourth, even though the test group represented 52 countries and all of the inhabited continents, "Asia and Europe were ranked as worst portions of their world

sketch maps. Nonetheless, in spite of the difficulty of drawing Europe, the students' knowledge of it enabled them to represent it effectively" (p. 49). Saarinen's closing comments are insightful into the potential power of sketch maps as an ongoing assessment of student's understanding of the content of my course and of their view of the world. "Because sketch maps so clearly express knowledge, or lack of it, they remain a fascinating method that is useful for research or teaching" (p. 49).

Standard 1: Spatial Organization

Another benchmark calls on students to locate places using latitude and longitude. The third element associated with using geographic tools expects students to know how to analyze the dynamic spatial organization of people, places, and environments (Colorado Department of Education, 1995). So often non-geographers dismiss this skill as an unnecessary navigational use of maps that students are not likely to encounter. But the usefulness of longitude and latitude to analyze the earth cannot be overstated. There is a direct relationship between longitude and time and a relationship between climate and weather and latitude that can help students recognize the patterns of interaction between people and their environments.

Four experiments by Brown and Friedman present another way to use longitude and latitude to understand the geography of the Earth. "It is possible to use absolute location judgments, locational profiles, and seeding effects to investigate the nature and accuracy of people's geographic knowledge" (1999, p. 11). If sketch maps are a way to represent a subject or students knowledge, estimating the latitude or longitude of a city are a way to have people make geographic judgments based on that information.

The results of these experiments make it possible to explore the biases of the test subject and they suggest that the biases can be influenced by accurate information. The biases that the researchers referred to in this study are the idea that the United States' east coast cities are located to the east of cities on the west coast of South America called the Miami-Lima illusion, and the Chicago-Rome illusion which refers to the tendency to place some European and African cities far to the south of their actual location. Actually, Miami is 3degrees west of Lima and Chicago and Rome are at 42° North latitude. Freidman and Brown referred to this as the alignment hypothesis, the subject's representation of the world is straightened out. It has not been proven that all inaccurate beliefs about location are due to normalization mechanisms, that continents are represented in the human memory as a single unit, and that there is a direct relationship between errors in the location of continents and cities.

In an additional, extended article on the same experiments, the authors expanded their analysis. Here they presented an argument of different ways to think about how people remember where things are. "We conclude that the mental map metaphor is a misleading analogy for the representation of geographical knowledge and that the plausible-reasoning framework can account for much of the data in the subjective geography literature" (Friedman & Brown, 2000, p. 193). When subjects lack the specific geographic information they are looking for they rely on plausible inferences based on what they do know. "We assume that many factors contribute to a geographical knowledge and that any or all of them may contribute to a geographical judgment. Consequently, a range of estimation strategies [is] possible. We assumed that relatively

few of these involve reading or computing locations directly from mental maps or other perceptually based representations" (Friedman & Brown, 2000, pp. 196-197).

The subjects, sixty Canadian university students were given a set of cities and asked to estimate the longitude or latitude of the cities. The resulting correspondence between actual latitudes and estimated latitudes indicated that participants had some knowledge of the relative locations of the test cities in both hemispheres. For most cities estimated latitude fell below the actual latitude, this indicated these Canadian subjects tended to believe that most test cities lie south of their actual locations" (1999, p. 3).

"The data demonstrate partial support for a kind of alignment bias, in that there was a tendency for the Old and New Worlds to be laid out on roughly the same scale. However, where a particular city was specifically located depended on how the continents were subdivided. In particular, there was evidence for psychologically distinct subregions in both the Old and New Worlds. Subregional biases can have their basis in a variety of sources, including similarities of climate, politics, and beliefs about the location of mid-level superordinates (e. g. states or provinces in North America, countries in Europe)" (Friedman & Brown, 2000, p. 200). So the data suggested that subjects were using regional knowledge to estimate the location of the cities instead of referring to a map-like representation. These findings provide balance to the findings related to mental maps. We must remember that geographic knowledge has many layers and it is likely that it is much more than a static mental image.

In a variation of the experiment, subjects were given the actual location of a seed city to see if their estimates of the other cities improved. "Importantly, these pre-seeding profiles reveal the extent and nature of pre-existing biases in geographical knowledge.

This difference between pre-seeding and post-seeding profiles can be examined to determine how representations of global geography are updated when people learn new location information and individual cities" (1999, pp. 1-2). "We should note that these studies have demonstrated that seeding facts can improve the accuracy of latitude judgments, that seeding effects propagate to unseeded regions only when changes are required to maintain a coherent set of geographical beliefs, and that seeding per se does not guarantee improved performance. Depending on the particular seed facts, post-seeding estimates can be more accurate, less accurate than or identical to pre-seeding" (p. 11).

I think these activities can be used to engage students in using their geographic knowledge to make decisions about locations. The idea of providing seed locations as clues can help the students think about the relative location of the cities. The authors also mentioned the role of regional prototypes to fill to the gaps the students may have in their specific knowledge, but students may also have biases and illusions that are influenced by regional knowledge. Thus, it is important to challenge students' regional knowledge and probe for those misconceptions.

Standard 2: Knowledge of Place

Birdsall's explanation of the variety of ways to view a landscape fits into the second standard; students know the physical and human characteristics of places, and use this knowledge to define and study regions and their patterns of change (Colorado Department of Education, 1995). The sub-standard that students know the physical and human characteristics of places includes the benchmarks of being able to describe human

and physical characteristics of places; and explaining how places change due to human activity (p. 10).

Birdsall's recommendation for teaching a variety of perspectives on how to view or interpret physical and cultural landscapes is backed by anecdotal evidence from his teaching experience. "Geography offers a way to help students value more than one answer to the question: How can I understand the world? Geography can help students better learn that a perspective on a given topic is an alternative rather than a proto-truth" (Birdsall, 2003, p. 29). 'Students can learn to be intellectually flexible enough to appreciate the practical difference between one's own conclusions about the world and those held by others" (p. 29).

In his course Birdsall has his students view the same city block from ten different viewpoints. Birdsall outlines Meninig's ten perspectives from *The Beholding Eye: Ten versions of the same scene*, landscape as nature (perfect until humans corrupt it); landscape as habitat (nature and humans co-exist); landscape as artifact (inventory of need convenience); landscape as façade (it covers up the many underlying interacting processes); landscape as a problem (ills of society or bad plans or design); landscape as wealth (everything has a monetary value), landscape as ideology (extensions of prevailing belief systems or philosophies); landscape as history (record of nature and humanity); landscape as place (unique onto itself); and landscape as aesthetic (a backdrop to events). Students are assigned a viewpoint and then must try to view the area from that particular lense. They write their observations and then share them with the rest of the class. Not only do they open themselves up to a variety of methods of understanding the world, they also have an opportunity to discover which lenses they tend to view the world

from. Birdsall concludes that the approach is "...an effective rubric for introductory students to learn that compelling perspectives-whether called ideologies, organizing frameworks, or theories, are alternatives, not truths" (p. 33).

Standard 2: Perceptions and Misconceptions

Another element of standard two expects students to know how culture and experience influence people's perception of places (Colorado Department of Education, 1995). Tom Saarinen's research on sketch maps seems relevant here for two reasons. Looking at the data on how students perceive the world informs us of what they understand and what they misunderstand or what is missing altogether. Also, the students could conduct these experiments on their own classes' maps to see how their individual perception compares to the group and if they have access to the data presented in the article, to the maps created by people from throughout the world. Then they could discuss why the maps from their class are different from the maps from other regions of the world.

The study is an analysis of world sketch maps drawn by first year geography students from around the world. "The task, though interesting, is difficult. The map sketcher likely relies on memories of the type of world map most readily recalled, which would probably be the ones most commonly seen and used in the map sketcher's society. How the sketch maps were centered in this broad international sample reveals something about how the world political map is presented in different parts of the world and gives insight as to how one's society is viewed in relation to the rest of the world" (Saarinen, 1999, p. 137).

Four types of centering were recorded. Eurocentric maps had the Americans on the left and were found on 79% of the maps (p. 141). The author traces this back to the first International Meridian Conference of 1884 that designated the Greenwich Meridian as the Prime Meridian. Sinocentric maps accounted for 11 percent of the sample. This puts the Americas on the right side of the map. Americentric maps, that places the Americas in the center and splits the Eurasian landmass, represented seven percent of the total. The remaining four percent of the maps only included the homeland, were polar or hemispheric, or incomplete. "Clearly the predominant factor explaining deviations from the norm of the conventional Eurocentric map of the world is longitude...It is in countries that appear on the edge of conventional Eurocentric maps of the world that dissatisfaction develops" (p. 156).

The next test he conducted on a subset of the maps was to compare the relative size of the continents. "Exaggeration at the center and diminishment on the peripheries are related to the mapmaker's level of knowledge and the area's perceived importance. So the home area is drawn in great detail, while less space is devoted to the more distant and less-known areas beyond" (p. 156). He selected landmass as units. Then the units were encoded by tracing the perimeter. Real measurements were converted to a percentage of the whole to allow for comparison between maps. Saarinen also traced the unit sizes as represented on a published map and converted them to percentages to provide for the basis for the estimation of deviations from the real world areas (p. 159). "I am not focusing on idiosyncratic differences, rather I am trying to see if there are general tendencies, which become apparent when all the maps from one place are grouped...group images from different images from different places will reflect the

likelihood that any continent will be diminished or exaggerated in the mental maps from a particular place" (p. 164). "I equate size with amount of knowledge, one continent is by far the best known: Europe. The least known again by a wide margin, is Africa." (p. 166). "The mental maps indicate that we live in a Eurocentric world" (p. 167).

Saarinen's final use for the data, which I think could be done with my seventh graders is that he counted the number of times a country was included on the maps and then created a cartogram (p. 168). This approach to the data is telling because it gives a glimpse of what parts of the world are easier to learn and remember. Many islands above a certain size are prominent "because they are set apart from the continents providing a clear gestalt, they are remembered and included more frequently;" (p. 168) smaller islands are not represented. Again, "the Eurocentric shared image of the world is obvious...the cumulative impact of many frequently included countries makes the total for Europe larger than for any other continent" (p. 170). Also, the interior Sub-Saharan African states seem to be the least well known.

Saarinen concludes, "to change the current views will require a shift toward a model of the psychological unity of humanity, and away from ethnocentric beliefs and the overvaluing of certain regions and cultures" (p. 173). I do not want to push a new politically correct worldview on my students any more that I want to push a Eurocentric worldview onto my students. Examining a study of the misconceptions of another region of the world illustrates how students' perceptions of the world are influenced by their education.

In a study by Ibrahim and Saarinen, the Muslim image of the world is investigated. This study suggests a way students could examine their own perception of

the world. It also addresses ways geographic education can influence a student's perception of the world and through its recommendations for geographic education in Muslim countries prescribes essential ways that geographic education can more effectively create a broader worldview.

The Muslim students were asked to draw sketch maps of the world and then the maps were analyzed and compared to other sketch maps from students throughout the world. The maps of the students from Muslim countries were most accurate and had the most detail in South West Asia and North Africa and are also more likely to include countries with appreciable Muslim populations at rates above the world average (p. 27). The Muslim students' samples included fewer countries and continents per sketch map the average from the total world population (p. 27). A the same time the authors note "it is evident that most students from the non-Muslim world have a limited grasp of the Muslim nations. Only two Islamic countries were included by over a third of the map sketchers. Many were unknown to 90 to 95% of non-Muslim students" (p. 50).

When examining the curriculum and resources available to the students in Muslim countries the authors found them to be lacking.

1. A sizeable number of reprehensive countries from each continent should be studied as well as the patterns of nations within each. Broad knowledge of the world is very important in the era of globalization, informational technology, and a newly emerging political order.

2. Individual countries should not be considered as isolates. They must be seen within the context of adjacent countries. The names of other countries should appear on their locations along with the name of the country under study.

3. Using colors to differentiate between countries will make them more visible and defendable. This will help students to remember relative and absolute position.

4. The practice of drawing maps should be encouraged at all levels of geography education especially during intermediate and secondary school. Students at these ages and levels have natural curiosity about the world and visual display has an attractiveness and ability to communicate information that both supplements written text and serve as an enticement to those who are more attracted to this educational format (Ibrahim and Saarinen, 2000, p. 50).

In the rational for standard two it states, "The way people think about places and regions varies according to how they organize, interpret and use information. Personal attitudes, experiences, and judgments are important in shaping the variations (Colorado Department of Education, 1995). Ibrahim and Saarinen's recommendations provide empirical support for the power of geographic instruction to affect a person's perception of place. I think results of these two articles is to be aware of how much time is devoted to different regions of the world and to refocus some time and resources on those regions that are the most neglected. By taking care to present a balanced and inclusive curriculum as a part of our student educational experiences we establish the framework needed for the students to have a worldview that stretches beyond local cultural biases.

Standard 3: Physical Processes

The third standard states that students will understand how physical processes shape Earth's surface patterns and systems (Colorado Department of Education, 1995). This standard is addressed in my district's science curriculum.

Standard 4: Human Processes

The fourth standard, students will understand how economic, political, cultural, and social processes interact to shape patterns of human populations, interdependence, cooperation, and conflict (Colorado Department of Education, 1995). The rational

expands on the role of population . "The geographic study of human populations focuses on location, movement, and the dynamics of size. Populations tend to locate in clusters rather than spread out evenly over the land surface" (Colorado Department of Education, 1995, p. 15). Paul Robbins urges geography educators to push past the notion that he traces back to Thomas Robert Malthus. Robbins cites Cockburn 1997 and Hartmann 1995 to describe the staying power of Malthus' simple formula. The idea "that geometric population growth must outpace arithmetic resource growth, remains near-orthodoxy in the popular imagination" (Robbins, 1998, p. 241). Instead Robbins contends, "Population can be shown to be the product of rational and meaningful choices by informed and intelligent people rather than an uncontrolled disease engulfing the earth" (p. 246). He then recommends using a case study of households in a community in India to explore the issue. Robbin's does not comment on the effectiveness of case studies or problem-based learning, but he makes the case for their use in this situation. "Case studies using elements of role play provide an incomparable opportunity to think about the positions and logistics of people who are often treated abstractly and are therefore excellent tools for exploring demography" (p. 248).

Standard 5: Human-Environment Interaction

The fifth standard, Students understand the effects of interactions between human and physical systems and the changes in meaning, use, distribution, and importance of resources (Colorado Department of Education, 1995). A sub-standard in this category is that students know the changes that occur in the meaning, use, location, distribution, and importance of resources and a benchmark would be that students would be able to describe why people have different viewpoints with respect to resource use. A discussion

of geographic ethics seems relevant here. Kirman advocates for the use of transformative geography. "It offers a framework to encourage elementary and secondary students of geography to practice the discipline of geography for the well-being of people and the environment in order to improve the world" (2003, p.93). Transformative geography is being taught everywhere young people are learning to be active stewards of the earth and responsible for its welfare and that of its people" (p. 97). This idea has it roots with Paulo Freire of Brazil. Transformative geography "offers a problem-posing pedagogy that engages students and teachers in discussion, debate and dialog...helps students think critically about themselves and the world around them-to transform then from passive receptacles of knowledge to active agents for change" (Merrett, 2000, p. 215).

This seems like promoting a point of view to me. I have encountered this idea often in my research. Kirman suggested "it might be argued that transformative geography is a form of indoctrination since it attempts to encourage behaviors. But it differs from indoctrination since it allows for differing opinions, a variety of actions, dissent and individual choice backed by research and debate" (p. 97). In a seventh grade classroom there is often very little dissent or debate unless alternative points of view are identified on an even playing field. It would be interesting to compare attitudinal surveys of student who were presented with a transformative geographic approach and those who were presented with a variety of viewpoints on the issue.

Standard 6: Application of Geographic Knowledge

The sixth standard, students apply knowledge of people, places and environments to understand the past present and future (Colorado Department of Education, 1995, p. 23). One way to apply geography is through technology. Stoltman and DeChano

suggested, "mapping using GIS [technology] provides applications of geographic principles and practice in using them to solve actual problems" (Stoltman & DeChano, 2003, p. 132). Scott Walker cited the lack of technology integration into classrooms as his reason for creating a project to introduce technology to preservice teachers. He hypothesized that providing preservice teachers with experience with available technology would make them more comfortable utilizing technology with their students. His research focused on whether technology integration increases cognitive and affective outcomes for his students. Subjects were to use the Community Atlas to create projects about their own community, threatened habitats, or their community's history. Data was collected with a new six-scale Likert-style survey called Test of Geography-Related Outcomes (ToG-RO) administered as both a pre-test and a post-test (p. 55). The test did indicate a positive affect on location relationship. "Despite the difficulty students may have in generating maps, this study suggests that an increase in geography conceptual knowledge occurs as the result of technology-based geography projects." (p. 63). The author infers that this "may be attributed to the fact that the students were *doing* geography rather than merely *studying* it in an out-of-context environment" (p. 63).

However, implicitly introducing geography by means of an education technology project appears not to have had an appreciable influence on preservice teachers' enjoyment of geography" (Walker, p. 51-69). Once more, the students predicted that their students would not enjoy geography with this type of technology-geography activity. "Perhaps this predictive perception is due to what the preservice teachers recognized as the complex nature of the technology involved in the Community Atlas project" (p. 63). The trouble the preservice teachers had brings up the question of when

does ill-structured activities become overwhelming for the students and become counter productive? The fact that the subjects still made cognitive gains despite their trouble suggests that the threshold had not been crossed in this case.

Discussion

Wilson, Weller, and Cole inadvertently addressed the fact that some of the standards and elements were the focus of ample research while finding relevant research on others was quite difficult. Their study surveyed preservice teachers at the University of Northern Colorado to determine whether the preservice teachers were prepared in appropriate content areas to teach the Colorado Model Content Standards. Their surveys of faculty and undergraduates show that among the students there was agreement that they knew geography content as measured by the essential elements. The faculty however, had "a low level awareness of the geography standards and no implementation of those standards in their courses" (1998, p. 274).

"In general students did not rank themselves as high with regards to matters of analysis and the higher levels of the cognitive domain in all content areas" (p. 275). The weakest areas were physical geography, economics, and standard six, the ability to apply geography to life. The surveys prompted one faculty member to realign the course in question so it better reflected the standards. This article, and more broadly this chapter that was organized around the standards has given me the opportunity to reflect on which standards are emphasized in my class. Anecdotally I feel that my course is heavy on standards one and two, moderately covers standards four and five, and weakest on standards three and six. It seems that the areas that need the most improvement are the areas that I have found the least information on.

However, by utilizing the research available, I can propose some potentially powerful changes in my curriculum. The standard that seems to receive the least attention, the ability to apply geography to life needs to take a central role in my geography curriculum. Whether the topic is world population growth, environmentalism, water quality, hunger, nationalism, or international organizations, there are a number of issues that will confront students throughout their lifetime. Geography classrooms should provide ample opportunities for students to investigate these types of issues.

The research also suggests the importance of connecting new learning to prior knowledge. Examples were given about how this can help students improve their map reading skills and set the stage for new learning. The articles on mental maps provide a concrete way to start with what the students currently know about an area and then build on that. Getting students to draw their mental image of the world is a gateway not a destination. The maps need to be used to start conversations and discussions about why the think way they think. These discussions are an important way to engage students in geographic learning. They provide an opportunity for the students to examine their personal conceptions and misconceptions about the world.

Finally, this review of the research pushes my curriculum beyond the knowledge aspects of the geographic domain and toward the analytical possibilities offered by the discipline. Students need to use geographic tools to better understand their world. Geography is about asking questions. We will always need to ask where, but it is essential that during geography class students have the opportunity to ask why there.

Chapter three has examined what outcomes a geography classroom should be striving toward. It has provided insight into what should be taught to harness the essence

of geography. Chapter four considers the principles that are needed to make that instruction a reality. It focuses on the pedagogy that can transform my geography instruction.

Chapter IV

Introduction

The research points to three guiding principles that will impart the most effective change in my geographic instruction. First, what distinguishes geography from other disciplines is a sense of place. It has three major components: spatial relationships, a new conceptualization of regional knowledge, and place location knowledge. A second guiding principle to instruction is geographic inquiry. An important component of geographic inquiry is technology instruction because technology gives us more powerful inquiry and communication tools. The third guiding principle is student attitudes. The research suggests the other principles can lead to increased student interest. Increased student interest can lead to more learning on the part of the student and more application of concepts of geography to solve real world problems.

A Sense of Place

To set geography a part from other social studies classes my class will focus on sense of place by emphasizing spatial relationships, a new conceptualization of regional knowledge, and place location knowledge. This focus is consistent with the goal of the first standard, that students can analyze the varied ways people, places, and environments are organized throughout the world. A place's location impacts the people who live there. Students need to be able to identify patterns or the lack of patterns. The experiment on organizing cities by absolute longitude or latitude seems like a place to start. It provides an opportunity for students to focus on the relationship between the cities. I also think Birdsall's lesson on perspectives of the landscape is relevant. I want to my students to identify and consider the many ways the places relate to one another. I

also think it is important for students to be able to utilize the concept of regions to organize information about the earth.

The regional approach to studying geography has been criticized for being to rigid and static. In a literature review Bell envisions a new regional geography, which teaches "that places and regions are processes, that these processes unfold across multiple scales, that regional identity is fluid, and that territorialized identities and material circumstances are structured by institutions embedded in webs of political and economic exchange" (2001, p. 78). Bell is contemplating the design of a college level course but his tack seems applicable to the middle school level. Instead of treating regions as objects, they can be investigated as processes. The focus of what makes this area a region is mixed with the questions why is it like this here and why is it like this now, along with the idea of what might it be like and how might the boundaries change in the future.

The regional approach is appropriate for a survey course in world geography. Within that framework it is also important to incorporate place location knowledge (PLK). Torrens puts forth this argument. "Place location is an important skill in which students should have an adequate grounding...to reap the benefits of global trade and interaction" (2001, p. 60). In this study secondary students in Ireland were asked questions about blank maps and completed a questionnaire. The study tried to figure what variables led to correctly identifying the location. If the location was close to the home of the subject, near the edge of a continent, more developed economically, had a large area, was stable, or was an island the subjects were more likely to identify it correctly. Conversely, historical significance, media profile, and European Union membership seemed to have little influence on subject success.

The study also examines personal influences and found several to be significant. The first influence was gender. If the subject was male he was much more likely to correctly identify the location than if the subject was female. Other positive influences of PLK were local and European travel, high geography examination scores, and viewing general and geographic specific television. Influences that were tested but did not show a significant influence were age, world travel, socioeconomic background, location in Ireland, nationality, gender mix of subject's school, amount of time listening to the radio, or time spent reading the newspaper. The fact that the level or amount of geographic education or history instruction that the student had experienced did not have a significant influence was discussed in greater detail. "Controlling for age, this result suggests that higher-level geography syllabi offer no improvement in PKL education over courses directed at younger age groups" (p. 58).

The study revealed the deficiency in PKL that it suspected it would find. But then it made the following recommendations to improve PKL education in the school system. First, it seems as if effective PKL knowledge was not a part of geographic education in Ireland at the time of this study. They thought maybe time was spend on areas close to home, lack of knowledge on the part of the instructor, or maybe PKL was not considered important. Also, the practice of memorization of lists was criticized. Based on a review of research on memory development and the retention of locational knowledge Stimpson concluded, "locational information is less likely to be retained when it is taught in a void and without a specific well understood purpose in mind (1991, p. 78). He generated a list of practical suggestions to improve retention of locational knowledge. There is no data on the effectiveness of these suggestions but there is a rational basis for their legitimacy.

It seems appropriate to consider them in regard to my place location knowledge agenda in my classroom.

For example, I inherited a tradition of studying every country in the world as part of A Nation A Day. We continue this practice. Students present information about each country and then they learn their location and are tested on the locations on regional quizzes. Stimpson recommended avoiding place name overload and avoid it if it does help answer the question being posed? Do students really need to know where Antigua and Barbuda is located? In Stimpson's conclusion he reiterates his position that seems to relate to this dilemma. "It is essential to understand where places are because their location and their position in physical and socioeconomic space leads to explanation and concept formation" (p. 81). I think exposure to all of the countries through "A Nation A Day" is relevant and useful to develop complete pictures of the different regions of the world.

The rest of the recommendations are in line with my current practice. He advised to describe locations in the environmental context that help explain the feature being discussed and have student use maps to find locations. The first time a student is introduced to the place the information needs to be correct. This can be problematic when students present locations to each other. Use sketch maps, give practice with sketch maps, use simplified geometric shapes to represent countries, and refer to past locations when introducing new ones. Use maps that have the information the students need but are not too complex and give students time to look at the general framework of the map. When necessary have students create mnemonics and emphases the importance of knowing where something is (p. 81). Torrens referred to the favorable result of his

research when he suggested identifying what television programs are influencing their student's PLK and make it part of your instructional strategy. Torrens research also points to the need for more understanding about the role of gender in place location knowledge.

But are they in line with new geography. Stimpson concludes "acquisition of location knowledge is most likely to be successful in the framework of student-centered, issue-oriented geography teaching through which individuals students see the need for enhancing their own personal locational dictionaries" (p. 82).

Geographic Inquiry

Second, the standards call for students to be able to apply geography to solve problems, and the research points to the effectiveness of geographic inquiry to increase learning. "Under constructivism students create knowledge by inquiring into the world and reflecting on their experiences...students actively engage in authentic problem-solving activities" (Solem, 2001, p. 87). One way for teachers to determine if their lessons are achieving these goals or are simply masquerading as inquiry based learning is use a rubric to score the lesson. Solem reviewed the reliability of a scoring guide created by Hill that evaluated web-based materials. He concludes, "geographers may find value in using the instrument as a tool for curriculum development and research" as well as to evaluate or create web based materials (p. 93). The guide evaluates the content's topic, title, and data. Is it a relevant, authentic question that the data will allow the students to answer when they are finished? It scores the instructional guides based on their objectives, time, glossary, and procedures. In other words, is it user friendly? Finally,

the learning quality and depth is measured by looking at skill development, level of difficulty, data display, nature of the questions, and level of engagement. (Solem, p. 88-89).

This approach has a variety of applications; obviously scoring guides could be adapted for the nature of the learning. Rating assignments on level of difficulty could be a foundation for differentiated instruction or for modifications. More to the point, they help to establish a standard of quality in the instructional materials that are used with geography students. But for my purposes it serves as a tool to evaluate the lessons that I have thought of as inquiry based. I like the idea of evaluating the skills that the lesson develops. As I move to more a of a problem based environment, we have been doing more mapping, graphing, charting, and we continue to use maps for finding locations. Just considering what skills are being used by the lesson provides an opportunity to make sure students have had the appropriate instruction and that they are being introduced to new skills and not overusing the same skills.

I think the challenge of level of difficulty also deserve some discussion. Problem based learning is designed to challenge the students to do more than get the right answer. They can be very reluctant to do this. If the task is too easy and offers no challenge, it fails to meet this basic requirement. If it is too challenging for the students, the frustration or confusion that act like a storm engulfs the learning that was suppose to take place. By critically analyzing the degree of difficulty the adjustment can be made that will make the lesson more successful.

Hill makes a point that lessons need to include data that the students can analyze and interpret. He suggests the ideal lesson includes real, authentic, authoritative,

completely referenced, and appropriate data. Quality data and a challenging question can serve to motivate the students to engage in critical thinking as they complete the task. I suppose it seems natural that Hill would want divergent questions. I am interested in what the research suggests is appropriate for middle school students. Anecdotally it seems that students avoid the deeper questions, and attempting to help the students with think-alouds often ends with them just accepting that response as the right answer.

Technology can be used to address many of the issues that Hill has brought up and help to make geographic inquiry a viable option in the classroom. Currently in my classes we use a variety of instructional technology for my presentations, such as VCR, DVD, LCD projector, television, laptop versions of *World Book* for basic research. We have also used the Internet for research, to augment my presentations, and in two units I have designed lessons that have students find information on particular websites. The students have created PowerPoint presentations and have videotaped presentations. For the most part, however, this is integrating technology on the fringes or even adding technology to old instructional practices.

But a lesson that I use that employs satellite images posted on the Internet to evaluate how the Aral Sea is changing is an example of how technology can be used to bring geographic inquiry to my students. Kirman and Nyitrai highlight the many uses of satellite images in the secondary classroom. They can be used to determine how land is being used in a certain area. The images can be used to investigate how the tropical rainforests are being used, how cities are growing, glaciers are shrinking, or the effects of strip-mining.

> "Predictions can then be made about the region being studied and possible remedies for improvements...Geography and history are enhanced by the

> views of the earth, and their classroom uses are limited only by the imagination of the teacher. In the future, a new dimension in the current events will be ushered in when schools can easily and cheaply obtain real-time satellite images" (p. 57).

These types of activities can help transcend the line between studying geography and doing geography. Research suggests that even middle school students can benefit from the use of satellite images. Kirman and Nyitrai "examined the potential of sixth grade children to use Radarsat images" (p. 57).

The students worked in pairs to identify locations on the maps. The 27 Canadian children were tested on similar maps at the end of four days of instruction. "The results of this study, based on the observed activities of the children, their test results, and their comments, show that these sixth grade children are able to interpret selected elements of a fine mode Radarsat satellite image. The positive results of testing the child who missed of all of the instruction periods appear to strengthen this claim. Although a Hawthorne effect may be involved, almost all of the children commented that they enjoyed working with the Radarsat images" (p. 61). This research seem to indicate that seventh grade students could work with radar images, but the question remains, could they use them in some of the higher level activities that the authors mentioned in the introduction.

Technology can also be used to revolutionize geography. Students can use handheld Global Positioning System (GPS) receivers for way finding or mapping. There are many articles that also promote the use of geographic information system (GIS) in the k-12 classroom. GIS is defined as a collection of computer hardware, software, and geographic data for capturing, storing, updating, manipulating, analyzing, and

displaying all forms of geographically referenced information. Baker and White summarize the potential of the educational use of the technology in this way.

> "GIS is emerging as one of those technologies that can foster contextually rich student learning and aid in-depth analysis, giving greater meaning to the work of students researchers. Students using these geotechnology tools can expand both range of data available and the scale of exploration and analysis, allowing for considerable flexibility in a search of meaning within data...The use of this technology can foster complex cognitive activities by students using sophisticated computer applications and data, all situated in an authentic environment for learning" (2003 November-December p. 243).

But does the research bear this out. In a science experiment , "Lichens as Bioindicators," a control group used paper maps to chart their data and the experimental group use ESRI's *ArcExplore II.* Student attitudes, self-efficacy, and achievement were measured. The GIS group was able to quickly create the maps but they were no better at "creating generalizations across a series of data points, engaging in basic pattern seeking, describing trends in data, or other explanatory activities. It is likely that if all students had engaged in explicit spatial analysis and pattern-seeking lessons prior to the onset of the unit, substantially significant differences may have been realized between the GIS and paper supported classes...no students were adequately prepared to fully leverage the data set" (Baker & White, 2003, p. 251).

My students have used paper-maps and transparencies to analyze data. The problems identified in this experiment seemed to apply. So much time was used charting the data and so many errors were made that it was difficult to clearly see the patterns. Also, authors underscore the need for specific instruction

on how to interpret the data. If GIS software can simplify this process it might free up time for that instruction.

Using GIS technology and paper both had positive effects on the student attitudes and or self-efficacy and give credence to the notion that problem based learning is more engaging for students. "Inquiry draws upon learning theory known as constructivism, which holds that rather than being transferred from teacher to student, knowledge is constructed by the learner based on his or her experiences and making connections" (Driver et. Al., 1994, p. 11).

Even though, this research points to the value of using technology for communication and to inquire about issues in geography, Viadero reports, "Only 3 percent of U.S. schools are effectively integrating technology into all aspects of their educational programs" (1997). The categories that were evaluated were the number of computers, onsite technical support, high-speed Internet access, and teachers with more than 71 hours of training (Viadero, 1997). In 2003 Kerski found that these problems were still hampering the use of GIS technology in secondary schools. "The number of high schools owning one of the three GIS software packages numbered less than 1,900, representing fewer than 5 percent of all U.S. secondary schools. Even among teachers who own GIS software, nearly half are not using it" (p. 129).

Student Attitudes

The new geography or research may improve both motivation and learning. The way students view geography and how those attitudes are influenced by classroom factors is examined by a survey of fourth, fifth, and sixth

grade students in San Marcos, Texas that was gathered in 1983 and repeated in 1993. Sack and Petersen ask, "if certain classroom variables, such as particular teaching methods or techniques, are significantly associated with greater student interest in geography, teachers should be able to use those factors to improve student attitudes toward the subject. As student attitudes toward geography improve, so should their geographic literacy and so will the likelihood that they will want to learn more geography as they get older" (1998, p. 124). Geography was ranked the least popular out of six school subjects in both years. The study did perceive some improvement on student attitudes toward geography between 1983 and 1993. "Classes exposed to active teaching methods ranked geography as a social study more favorably than classes exposed to passive teaching methods. This study tentatively suggests, then, that student attitudes toward geography might improve with the increased use of teaching methods that involve active student participation" (p. 130).

Conclusion

These guiding principles can affect the type of change that is necessary to help students reach the goals established by the standards. Research needs to continue to be done to provide the data that is needed to push geography forward. By focusing on the unique perspective geography has to offer, by incorporating geography inquiry, and by creating positive student attitudes toward geography we can make the changes that have not been made as a result of mandates and legislation.

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