Activities to Develop a Spatial Perspective Among Students in Introductory Geography Courses

Raymond K. Oldakowski

Abstract

Teaching students to gain a spatial perspective is one of the most difficult yet important components of geographic education. This paper presents a series of activities designed to develop a more comprehensive understanding of spatial concepts among students in introductory geography courses. The activities and content are most appropriate for high school or university undergraduate students. An evaluation of these activities demonstrates that they enhance the student's spatial perspective and their understanding of the role of spatial concepts in geography.

Key Words: *spatial perspective, spatial distributions, choropleth maps*

Dr. Oldakowski is an associate professor of geography at Jacksonville University, Florida. His interests include geographic education, and population and social geography.

Introduction

Getting students to think in spatial terms can be one of the more difficult tasks in teaching geography at an introductory stage. However, it is also one of the most important components of geographic education. Instructors must demonstrate to students that most variables studied in both the natural and social sciences have a spatial distribution. Whether it be crime rates or immigration flows, soil types or the occurrence of tornadoes, a variable can be viewed spatially. Teachers also need to convince students that in most instances, a spatial perspective will meaningfully enhance their understanding of a variable (Rittschof and Kulhavy 1998). Furthermore, students should be made aware that examining spatial organization is useful not only for descriptive purposes, but also for understanding the causes and consequences of a variable (Gritzner 1990, Mosenthal and Irwin 1990).

It is important that students become familiar and comfortable with the spatial perspective at an early stage in their geographic education. The Geography Education Standards Project (1994) clearly states that the ability to think in spatial terms is central to a person's being geographically literate. Spatial concepts are essential building blocks upon which geographic understanding develops, and they are key to comprehending more complex concepts within the discipline (Bausmith et al. 1998, Pattison 1964, Stoltman 1997). Moreover, it is apparent that a sound spatial perspective is important to understanding and utilizing technological advances in geography and geographic education such as GIS (Johnson 1996, Myer et al. 1999, Nellis 1995, Sui 1995).

Studies have shown that thematic maps and mapping exercises are useful in initiating and developing a spatial perspective among students (Bausmith et al. 1998, Omrod et al. 1988, Trifonoff 1995, Wilson et al. 1998). The remainder of this paper presents a series of activities that are designed to introduce the student to spatial organization and spatial distributions. The activities and content have been designed for high school or university undergraduate students. The paper begins with a quiz that demonstrates the common knowledge and applied value of a spatial perspective. Next, students are asked to identify variables whose spatial distributions are illustrated with choropleth maps. They also analyze the spatial distributions they have identified. Finally, students create and analyze choropleth maps of variables they have selected on their own. A concluding section examines the effectiveness of these activities in helping students to understand the spatial perspective.

Spatial Organization Quiz

The series of activities begins with a quiz whose purpose is to familiarize students with the concept of spatial organization. It is safe to assume that most students, even those in high school and university undergraduates, have had little exposure to the word "spatial."

At first glance, the quiz appears to be a simple test of trivial knowledge. However, it is designed to demonstrate that trivial knowledge is not necessary

Journal of Geography 100:243-250

Table 1. Spatial Organization Quiz

1. You're more likely to get frostbite in January in:
   a. Milwaukee, WI
   b. Miami, FL

2. To attend an NBA basketball game, you should go to:
   a. Chicago, IL
   b. Boise, ID

3. You're more likely to hear country music on your car radio while driving through:
   a. Arkansas
   b. Connecticut

4. You're more likely to bitten by a shark in:
   a. The Gulf of Mexico
   b. Lake Erie

5. An average 4-bedroom ranch home would typically cost more in:
   a. Mobile, AL
   b. Los Angeles, CA

6. You'll probably take home more of your paycheck if you live and work in:
   a. Massachusetts
   b. Tennessee

7. You're more likely to hear Spanish being spoken by residents of:
   a. New York City, NY
   b. São Paulo, Brazil

8. Your chances of being murdered are greater if you live in:
   a. New York City, NY
   b. Tampa, FL

9. You're more likely to find a Vietnamese restaurant in:
   a. Seattle, WA
   b. Minneapolis, MN

10. You're more likely to encounter a senior citizen (person aged 65 or older) if you live in:
    a. Arizona
    b. Pennsylvania

to score well on the quiz. Students who are familiar with simple spatial distributions, or those who can conceptualize a variable spatially, will also be able to determine the correct answers. The questions are simple and represent a wide variety of topics and interests. Table 1 presents an example of such a quiz. Of course, instructors can easily develop questions of their own which may be more relevant to their students.

The quiz should be administered by asking the students to circle the correct answer for each question. Inform the students that the quiz is not for an official grade, and that it will be corrected by the class together as a group. Call on individual students and ask them to answer one question at a time. As students answer the questions correctly, emphasize that their knowledge and/or understanding of spatial organization can result in determining the correct answer. For example, when a student answers "Milwaukee" to Question 1, it may be that they have been taught (and remembered) that Miami is warm and Milwaukee is cold. However, it is just as likely that the student is familiar with the spatial distribution of temperature in the United States: that with all other factors being equal, the farther north the location the more likely temperatures will be colder. When a student answers "Chicago" to Question 2, remind them it is not only because they know of the Chicago Bulls. They are also probably familiar with the spatial distribution of major sports franchises, which tend to locate in larger cities.

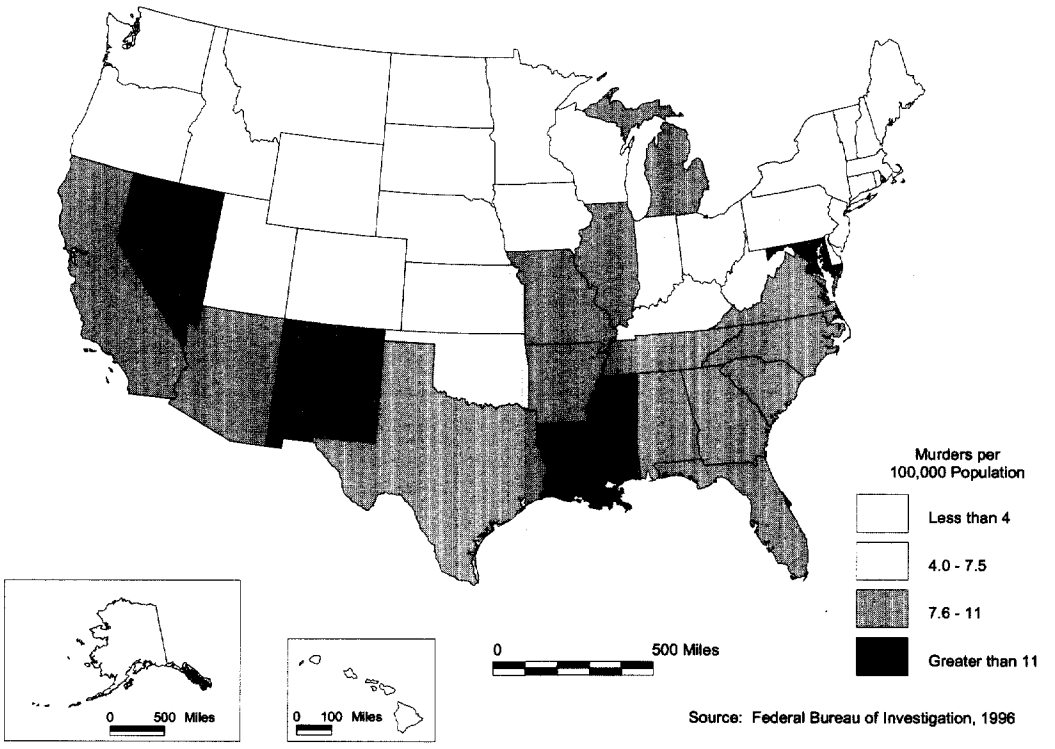

Figure 1.

Hence, even if they did not know the locations of all the NBA franchises, the larger cities (or metro areas) would be more likely to have a sports team. This helps to downplay the necessity of memorizing facts about places, an unpopular chore associated with learning geography, and highlights the value of being familiar with a spatial distribution or conceptualizing a variable spatially.

Several questions were written to demonstrate that whereas spatial organization is generally logical, it is not always simplistic or obvious. For example, many students will answer New York City to Question 8. They will rationalize that it is the larger of the two cities, and hence, would have more murders. However, the chance of being murdered is related to the murder rate (murders per 100,000 population). New York City has more murders, but Tampa has the higher murder rate. Question 10 presents a similar scenario. Many students will answer Arizona, as they associate that state with retirement migration and retirees. However, Pennsylvania actually has a higher percentage of persons aged 65 and over due to the outmigration of younger residents and a lower birth rate.

Determining and Analyzing Spatial Distributions

The next activity is for students to examine choropleth maps that illustrate spatial distributions, and have them determine the variable that is being mapped. In addition, students are asked to provide possible explanations for the spatial distribution, and the potential consequences that may result from it. This exercise gives the students visual examples of spatial distributions, and encourages them to begin interpreting and analyzing data spatially.

Figure 1 is a choropleth map depicting the spatial distribution of murder rates in the United States by state. It is helpful, although not necessary, if the maps used in this activity represent variables found in the quiz. Students have already put some thought into the spatial distribution of those variables. Moreover, the instructor can announce this to the students, and that will provide a finite universe of variables that they will attempt to link to the map. Choropleth maps of the United States by state generally work best for this exercise. They are easy to construct and seem to be easiest for students to interpret.[1] Of course the title of any maps used in this activity must be concealed from the students.

It is important that teachers and students do not regard this activity as merely a guessing exercise. A critical component of a geographer's spatial perspective is the ability to observe data in its spatial form and draw logical conclusions from that data (Gersmehl 1996). Teachers should suggest that the students act as pattern detectors (Mosenthal and Kirsch 1990). Table 2 presents a list of questions designed to encourage the students to interpret and analyze spatial distributions. Read the questions aloud, and allow all students an opportunity to answer before moving on to the next question. For example, in examining the murder rate map (Figure 1), students should notice a general pattern of light-shaded states to the north and

Table 2. Questions to Analyze the Choropleth Maps

- Which states are dark-shaded? These states have the highest value of the variable being mapped. What might these states have in common?
- Which states are light-shaded? These states have the lowest value of the variable being mapped. What might these states have in common?
- Do you notice any geographic patterns? Do these patterns appear throughout the entire country or just in a specific part/region of the U.S.?
- Are there any irregularities/anomalies to the patterns? Are there any states that seem out of place?

dark-shaded states to the south. More specifically, they will comment that New England and the northern states from Wisconsin to Oregon are light-shaded. States along the southern rim of the country are dark-shaded. Anomalies include Illinois and Michigan, which break the pattern of light-shaded states in the north. Refer the students back to the quiz, and encourage them to determine which variable is being mapped. Ask "What would you find less of, or would occur less in these light-shaded states?" (or vice versa for the dark-shaded states). Eventually, they will conclude that the map illustrates the murder rate.

Next, students should be encouraged to provide possible explanations for a spatial distribution. Why is the murder rate in the north, especially in New England and the Northern Plains, less than other areas of the country? They may mention climate, although Michigan and Maryland do not conform to this explanation. They may mention population size, but remind them that this is a murder "rate" which controls for population. Moreover, states with large populations such as New York or densely populated states such as New Jersey are light-shaded. It is not critical that the students ascertain every possible determinant of the spatial distribution of murder rates. In fact, researchers continue to debate about the factors responsible for regional variations in violent crime levels such as culture, race, poverty, gun ownership, age structure, and so on (Harries 1997). The true objective is for the students to understand that the spatial organization of one variable may help us to understand the spatial organization of another variable (Watson 1996).

Finally, students should be asked to think about the potential consequences of a spatial distribution. In this instance, states with higher murder rates may need to spend more funds on law enforcement. Higher murder rates might also result in negative publicity that may influence an area's tourism or convention industry. It might even affect the flow of migrants or businesses and economic activities in and out of an area.

Several additional choropleth maps which can be used in the exercises above have also been provided. Figure 2 illustrates the spatial distribution of population aged 65 and over in the United States. Lesser numbers of senior citizens are found in the West, with greater numbers in the Plains States and Midwest. States with high percentages of seniors due to the outmigration of younger populations (such as Pennsylvania and West Virginia) or due to the in-migration of retirees (such as Florida and Arizona) are also evident. Potential consequences of this spatial distribution are numerous as age structure influences economic activities, state tax and spending levels, the provision of health care, and so on.

Figure 3 illustrates population change during the 1990–1997 time period. States in the West and South grew at rates that exceeded the national average, whereas states in the Northeast and Midwest lagged behind. As with the previous two maps, students will have little trouble discussing the causes and consequences of population change. They will associate population growth and decline with a variety of factors such as jobs or climate. Students can then discuss the positive and negative impacts of population change. For example, population growth may lead to economic development, but may also result in increased traffic or pollution.

Creating Choropleth Maps

A final activity (either in class or as an out of class assignment) would be to have the students create a choropleth map of their own. Students should be responsible for finding their own data and producing their own maps. For university undergraduates, it is useful to ask them to generate a map of a variable that would be relevant to their major. That helps students to develop a spatial perspective on their field of study. It may also encourage them to utilize maps when presenting data in papers and presentations for other courses (Monmonier 1993). Maps can be colored by hand, or this assignment can also be used to familiarize students with computer mapping or basic procedures in GIS software.

Many data sources can be recommended to students including almanacs, city and county data books, census publications, and countless sources on the internet. Students should be advised to avoid variables that represent raw frequencies of population-based variables (such as number of deaths, number of licensed drivers, and so on). These variables result in maps that are almost identical to the distribution of population (that is, California, Texas,

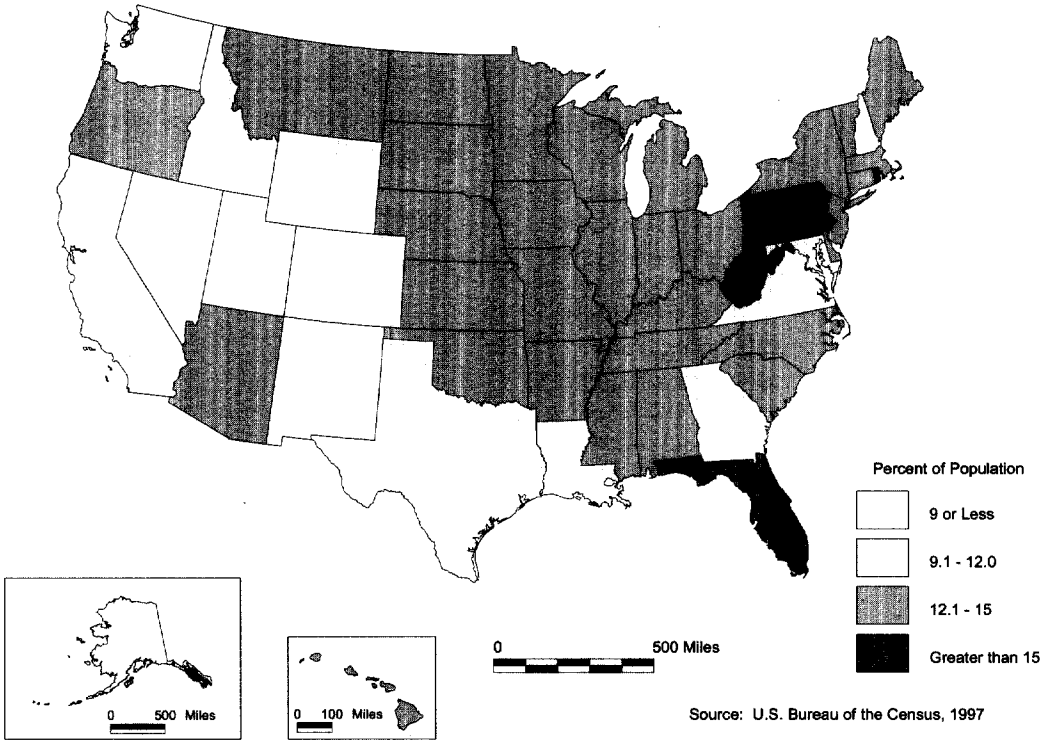

Figure 2.

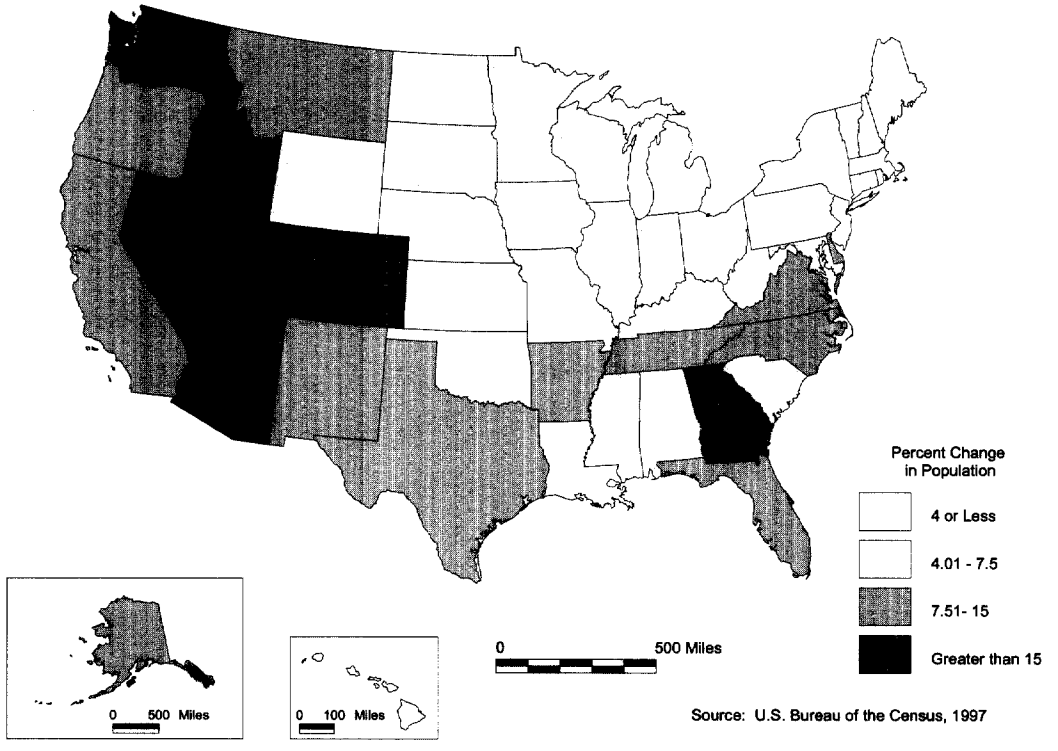

Figure 3.

New York, and Florida will have the highest values). However, if these variables are divided by the state population to produce a per capita rate, they result in maps that do not necessarily reflect the population distribution.

It is useful for students to use the same geographic units (for example, the United States by state) so that maps of similar variables can be compared. Students should also receive basic instruction on the different types of data classes, and how those data classes are constructed. The most common methods include equal frequency, equal interval, and natural breaks. The equal frequency method divides the data so that an equal number of geographic units is assigned to each data class. For example, mapping data for all fifty U.S. states could use five data classes. The ten states with the lowest data values would be in class one, the ten states with the next highest data values would be in class two, and so on. The equal interval method divides the data into classes of equal ranges between the lowest and highest numbers. For example, a variable that has a low of 1 and a high of 100 can be broken in to four data classes with an equal interval of 25 each (1 to 25, 26 to 50, 51 to 75, and 76 to 100). Finally, one may look for "natural breaks" in the data and create data classes based on their own judgment and knowledge of the variable. No matter which method is chosen, it should be emphasized to students that using different numbers of data classes or different methods for constructing data classes can drastically alter the appearance of the map, and hence one's perception of the spatial distribution (Gersmehl 1991) .

A written assignment that includes a detailed description, possible explanations, and potential consequences of the spatial distribution is also appropriate. Several articles detail different activities that can be implemented in choropleth map construction including Kuby et al. (1998), Schulze (1996), Sullivan (1993), or Wheeler and Gossette (1993).

Evaluation and Conclusion

The effectiveness of these activities was evaluated through the use of a quiz after six class meetings of two course sections of world geography. One section was designated as an experimental group, the other as a control group.[2] Both groups were comprised almost exclusively of freshman who were taking geography to satisfy the social science component of Jacksonville University's general education requirement. None of the students had any prior geography courses at the university level. An overwhelming majority of the students were of traditional college age and came from working- or middle-class suburban backgrounds. Each group contained slightly more males than females (about 60 percent male). The racial and ethnic composition of each group was similar to that of the university population as a whole, approximately 85 percent white and 15 percent black, with roughly 10 percent of the students being foreign born.

The evaluation was conducted in both the spring

Table 3. Evaluation Quiz

1. Identify, briefly explain, and provide an example of the 4 traditions of study in geography.

Tradition	Explanation	Example
I.		
II.		
III.		
IV.		

2a. Spatial distributions refer to:

a. geographic patterns of a variable

b. satellite views of the earth's surface

c. functional regions

d. interrelations of humans with the environment

2b. The word geography is derived from the Greek words meaning:

a. human society and the earth

b. cultural landscape of the earth

c. description of the earth

d. the measurement of the earth

2c. The focus of geography that distinguishes it from other disciplines, is the study of :

a. time

b. place

c. physical phenomena

d. cultural phenomena

Table 1. *Evaluation Quiz Results: Percent Correct Answers*

	Spring		**Fall**	
	Experimental	Control	Experimental	Control
Identify Spatial Tradition	94%	67%	100%	69%
Correct Explanation/Example	82%	43%	87%	38%
Question 2a Correct	97%	77%	100%	63%
(n)	(33)	(30)	(30)	(32)

and fall semesters of 1998. Neither the experimental nor the control group received advance warning of the quiz, which was administered at the beginning of the seventh class meeting. Both groups had been asked to read the introductory chapter of *Introduction to Geography* (Getis et al. 1998) and Pattison's (1964) article on the Four Traditions of Geography. For the experimental group, the first six class meetings included a discussion of the two reading assignments and activities described in this article. For the control group, the two reading assignments were discussed, but the activities described in this article were not used until later in the semester.

The evaluation quiz is presented in Table 3. Questions 1 and 2a are most relevant here. Results from both semesters demonstrate that the experimental group performed better than the control group (Table 4). A chi-square analysis revealed that the differences between the groups for all three items in both semesters were statistically significant at the .01 level. Members of the experimental group were more likely to identify spatial distributions (or spatial analysis, spatial organization) as a tradition of study, and to provide a correct example of the spatial tradition. They also performed better on Question 2a indicating a better understanding of the spatial perspective.

This paper has presented a series of activities intended to familiarize students with the spatial perspective of geography. An evaluation quiz indicated that students who participate in these types of activities have a better understanding of the spatial tradition. Perhaps more important, students who don't participate in these types of activities may have only a limited or vague understanding of the spatial tradition.

Activities that place special emphasis on important concepts such as spatial organization or spatial distributions seem meaningful for several reasons. First, instructors and students often times have differing interpretations of new or abstract concepts and this can lead to confusion in the classroom (Thompson 1999). Exercises that familiarize students with new concepts in different ways may help alleviate that confusion. Second, understanding the spatial perspective of geography is critical to comprehending more complex concepts in the discipline, and utilizing technological advances such as GIS. Therefore, it seems judicious to spend the extra time and effort to insure that students clearly and fully understand such "building block" concepts. Finally, a discipline such as geography has many facets that may appeal to students and entice them to study further. Some enjoy learning about people and places across the world. Others enjoy studying the Earth's natural environment. In addition, some may be intrigued by the critical and analytical skills they will develop by viewing the world with a spatial perspective. Hence, these types of activities may help to attract more students to study geography.

Notes

1. Choropleth maps of the U.S. by county require that students be familiar with regional variations within states in data. Choropleth maps of the world by country require that (at a minimum) students be familiar with continental variations in data. Hence, maps of the U.S. by state are easiest for the students to interpret and analyze.

2. The author teaches two sections of World Geography each semester. Both sections meet on a M-W-F schedule (one at 10:10, the other at 12:20) for 55 minutes in the same room. Both times are equally popular among students, and both sections of the course were filled on the first day of registration. Hence, there is no reason to suspect any difference in the academic ability of students based on the section they registered for.

References

Bausmith, Jennifer Merriman and Gaea Leinhardt. 1998. Middle-school students' map construction: Understanding complex spatial displays, *Journal of Geography* 97:93–107.

Federal Bureau of Investigation. 1996. *Uniform Crime Reports, U.S. Department of Justice*. Washington, DC: U.S. Government Printing Office.

Geography Education Standards Project. 1994. *Geography for Life: National Geography Standards 1994*. Washington, DC: National Geographic Research and Exploration.

Gersmehl, Philip J. 1991. *The Language of Maps*. Pathways in Geography Resource Publication. Indiana, PA: National Council for Geographic Education.

Gersmehl, Philip J. 1996. *Why Not Here? Teaching Geography to a New Standard*. Indiana, PA: National Council for Geographic Education.

Getis, Arthur, Judith Getis, and Jerome D. Fellmann. 1998. *Introduction to Geography*. Dubuque, IA: McGraw Hill.

Gritzner, Charles F. 1990. Geography and social studies education: Mapping the interface, *International Journal of Social Education* 5:9–21.

Harries, Keith D. 1997. *Serious Violence: Patterns of Homicide and Assault in America*. Second Edition. Springfield, IL: Charles C. Thomas.

Johnson, Merrill. 1996. GIS in business: Issues to consider in curriculum decision-making, *Journal of Geography* 95:98–105.

Kuby, Michael, John Harner, and Patricia Gober. 1998. *Human Geography in Action*. New York: John Wiley & Sons, Inc.

Monmonier, Mark. 1993. *Mapping it Out: Expository Cartography for the Humanities and Social Sciences*. Chicago: University of Chicago Press.

Mosenthal, Peter B. and Irwin S. Kirsch. 1990. Understanding thematic maps (understanding documents), *Journal of Reading* 34:136–140.

Myer, Judith W., Jon Butterick, Michael Olkin, and George Zack. 1999. GIS in the K-12 curriculum: A cautionary note, *The Professional Geographer* 51:571–578.

Nellis, M. Duane. 1995. Geography for life: Today's innovations are tomorrow's traditions, *Journal of Geography* 94:302–304.

Omrod, Jeanne E., Richard K. Omrod, Ellen D. Wagner, and Rose McCallin. 1988. Reconceptualizing map learning, *American Journal of Psychology* 101:425–433.

Pattison, William D. 1964. The four traditions of geography, *Journal of Geography* 63: 211–216.

Rittschof, Kent A. and Raymond W. Kulhavy. 1998. Learning and remembering from thematic maps of familiar regions, *Educational Technology Research and Development* 46: 19–38.

Schulze, Melanie. 1996. Students as map makers: Creating choropleth maps, *Journal of Geography* 95:168–170.

Stoltman, Joseph P. 1997. The international charter on geo graphical education: Setting the curriculum standard, *Journal of Geography* 96:32–39.

Sui, Daniel Z. 1995. A pedagogic framework to link GIS to the intellectual core of geography, *Journal of Geography* 94:578–591.

Sullivan, Michael E. 1993. Choropleth mapping in secondary geography: An application for the study of Middle America, *Journal of Geography* 92:64–68.

Thompson, Gwendolyn. 1999. "I thought the world was flat like the map showed it!" *Social Education* 63:269–271

Trifonoff, Karen. 1995. Going beyond location: Thematic maps in the early elementary grades, *Journal of Geography* 94:368–374.

U.S. Bureau of the Census. 1997. *Population Estimates*. Washington, DC: U.S. Government Printing Office.

Watson, George G., Jr. 1996. *Geography: Focus on Economics*. New York: National Council on Economic Education.

Wheeler, Jean Dykema, and Frank Gossette. 1993. Computer mapping in regional geography, *Journal of Geography* 92:28–34.

Wilson, Kris, Kay Weller, and David B. Cole. 1998. Colorado's geography standards: An analysis of preservice preparation, *Journal of Geography* 97:269–280.