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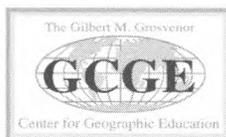
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Learning Style and Academic Achievement of Middle School Geography Students in Korea

Sung-Hee Yoon
and
Kathryn S. Atman

This study was conducted to identify the nature of Korean students' learning styles and to determine the relationship between learning style and geography achievement. This study was based on the learning style model developed by David A. Kolb and the teaching style models by Svinicki, Dixon, and Sheehy. The Learning Style Inventory (LSI) was administered to 791 Korean middle school geography student and a survey designed to identify a teacher's teaching style was administered to their teachers. The results showed that the distributions of geography students' learning styles in Korea were different from previous research studies in other cultures. Environmental considerations, including school experience and educational settings, may be factors in such results. In addition, the data from this study showed that the approach traditionally taken in Korean geography education provided the best learning environment for one study of learning style: that of the assimilator. Through these results, this study suggested that Korean geography education could improve through provision of opportunities for students to learn self-monitoring skills for improving their academic achievement, and for teachers to train in new and various instructional methods in order to meet different students' learning preferences. In addition, teachers have to be trained in technology education such as geographic information systems (GIS). This study develops baseline data on Korean students' learning styles in geography education and may aid in making geography textbooks' contents more concrete and effective.

Key Words: *learning style, teaching style, geographic education, Korea*

INTRODUCTION

The concept of "learning style" has become one of the cornerstones of the modern educational reform movement. Increasingly, leaders in education recognize that the processes of learning and goal setting ability are critically important. Thus, considerable research in education has been directed toward identifying the effects that individual student differences, as expressed through the concept of learning style, have on academic achievement.

Everyone has a learning style. Learning style has been modeled as a moderating variable in learning effectiveness and efficiency. The National Association of Secondary School Principals (NASSP) defines “learning style” as the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment (Keefe 1979, 1). NASSP views learning style as a set of unique internal processes that guide how we take information from our surrounding environment (Ursin 1995). Gregorc and Ward state that “learning style consists of distinctive behaviors which serve as indicators of how a person learns from and adapts to the environment. It also gives clues as to how a person’s mind operates” (1979, 234).

According to Dunn and Dunn (1993, 2), “learning style is the way each individual begins to concentrate on, process, internalize, and remember new and difficult academic information or skills.” Although many students can master information presented in a style that is not comparable with their own, they are thought to learn more efficiently and rapidly when they capitalize on their own learning style strengths.

Learning style may be analyzed in the classroom setting because each student has a specific optimal style of learning. Teachers are faced with many different learning styles in the classroom. Learners differ in a variety of ways, and these differences are likely to influence how learners respond to and benefit from a given instructional method. By taking learning preferences into account, educators can develop a curriculum that improves students’ attainment of course objectives.

Most reported research studies dealing with this topic have been carried out in the United States. However, in recent years there has been an increased need for research regarding learning style and teaching style in Korean classrooms. This need is significant because one of the most serious educational problems in Korea involves teaching that is undertaken without consideration of individual differences among students and the use of teaching materials, classroom instructional methods, and educational methods that are the same for all students. Teachers rely heavily on the technique of lecturing, regardless of the characteristics of instructional objectives. Traditional methods of teaching focus primarily on supplying students with the necessary information/skills for concept development and subsequent rehearsal for learning retention (Szewczyk 1987). This traditional instruction methodology (mainly lecture and recitation) may neglect many aspects of individual learning preferences that contribute toward more effective cognitive growth (McCarthy 1981). Traditional teaching modes in Korea are aimed at what is perceived to be the “average” learner. Therefore, they stand in contrast to methods that recognize the unique preference of each student.

Since the beginning of the 1990s, the Ministry of Education in Korea has carried out an innovative effort to streamline the Korean educational system (Ministry of Education 1999). The major thrust of this educational innovation has been directed toward the development of autonomous, rational-thinking, decision-making ability and on increasing the learner's problem-solving ability. The type of education that will serve this new thrust demands that teaching depart from the conventional method of rote learning and memorization of bits of knowledge. The new teaching methods are those that vary to meet individual needs and that develop critical thinking capability, inquiry skills, and creativity through experiential learning.

Geography, in particular, is not a collection of arcane information, but is the study of spatial aspects of human existence. Geography is composed of three interrelated and inseparable components - subject matter, skills, and perspectives. Subject matter is the distillation of essential knowledge and is important in the formulation of geography standards. Skills include (1) asking geographic questions, (2) acquiring geographic information, (3) organizing geographic information, (4) analyzing geographic information, and (5) answering geographic questions. Both subject matter (knowledge) and geographic skills must be considered from the spatial and ecological perspectives that form the third significant element of the discipline (Geography Education Standards Project 1994).

Geography has much more to do with asking questions and solving spatial and ecological problems than it does with rote memorization of isolated facts, and the goal of geographic education is the skill of thinking geographically (Geography Education Standards Project 1994). However, this goal is not supported by the dominant teaching methods in geography classes in Korea, which include teacher-centered lectures, textbook-centered lectures, recitation, paper and pencil tests, and fact-and-concept oriented learning (Han 1989; Paik 1994).

Because Korean geography education needs new teaching methods that will promote geographical thinking, data from this study will assist educators as they examine the relationship between learning style and academic achievement. Moreover, the study will help in identifying teaching strategies that will meet geography education objectives.

PURPOSE AND OBJECTIVES

The major purpose of this study was to identify the nature of Korean students' learning styles and to determine the usefulness of students' learning styles to predict academic achievement for middle school geography students in Korea.

The objectives of this study were (1) to identify the nature of the learning styles of Korean middle school geography students, (2) to determine the relationship between students' learning styles and geography academic achievement by examining whether students' learning styles are useful for predicting academic achievement, and (3) to use the data obtained from this study to make recommendations for enhancing the Korean geography curriculum and teaching methods.

METHODS

Subjects

The sample for this study was 791 ninth grade geography students (328 male and 463 female) and their eight teachers in three middle schools in Seoul, Korea. The schools selected were an all-boy's school, an all-girl's school, and a co-educational school. These schools were medium-sized middle schools located in Seoul and attended by students whose families lived in a low-to-middle income urban area. The students in the sample all experienced similar conditions in their educational programs. In addition, they all had similar interests about participation in the study.

Procedure

1. Identification of Student Learning Style

In order to determine students' learning styles, Kolb's Learning Style Inventory was used. The Learning Style Inventory (Kolb and Smith 1985) is a self-descriptive instrument designed by David A. Kolb to assess an individual's preferred learning style. The instrument helps learners identify their learning styles and determine how they absorb and deal with new information. Kolb's Learning Style Inventory (Kolb 1984) is based on John Dewey's emphasis on the need for learning to be grounded in experience, Kurt Lewin's work that stressed the importance of a person's being active in learning, and Jean Piaget's theory on intelligence as the result of the interaction of the person and the environment.

Kolb (1986) developed the 12-item Learning Style Inventory (LSI) to assess learning styles. Each item asks respondents to rank-order four sentence endings in a way that best describes their learning style. One ending in each item corresponds to one of the four learning orientations: an experienced-based Concrete Experience (CE), a conceptually based Abstract Conceptualization (AC), an action-based Active Experimentation (AE), and

an observation-based Reflective Observation (RO) (Kolb and Smith 1985). These four modes create four learning styles (Figure 1).

Students classified as divergers, and identified as a combination of concrete experience and reflective observation, are interested in people and tend to be imaginative and emotional. Assimilators, identified by a combination of reflective observation and abstract conceptualization, believe it is important that any theory be logically sound and precise. Convergers, identified as a combination of abstract conceptualization and active experimentation, organize knowledge through hypothetical-deductive reasoning so that action takes place. The greatest interest for accommodators, identified as a combination of active experimentation and concrete experiences, lies in doing things, in carrying out plans and experiments, and involving themselves in new experiences (Kolb and Smith 1985). Kolb's learning theory suggests the design of instructional materials to develop the strengths of the student's dominant learning style, as well as to encourage the strengthening of non-dominant preferences (Akin 1992).

The LSI has been used mostly in education and management training. It has been used to help learners and teachers understand the learning process and preference for different kinds of educational experiences (McFadden 1986). It has been applied to several cultural settings. Farina (1997) compared learning characteristics of physical therapy students in the United States, Australia, and Canada. The cross-cultural efficiency of the LSI has been substantiated in several studies, including Ruksasuk (2000), Hanpol (1999) who applied learning style theory within a Thai educational setting, and Hajizainuddin (1999) who researched it in Malaysia.

For this study, the Learning Style Inventory (LSI) was translated into Korean by the researcher and a Korean English Teacher after obtaining permission for translation from the publisher. The two versions of LSI were compared and differences eliminated by the researcher. A Korean language teacher then reviewed these. Internal consistency was examined for the LSI Korean version using the same sample of Korean geography middle school students as used in the study ($n = 791$). The internal consistency of the LSI Korean version as measured by the coefficient alpha for the learning orientations ranged from 0.53 to 0.67 (CE = 0.53, RO = 0.56, AC = 0.67, and AE = 0.63; See Table 1). The Korean version of LSI was then administered to the sample of 791 ninth grade students in the second semester of 1998. Each teacher explained the objectives and procedures of testing to students. Students were administered the test during a single class period of 45 minutes. No make-up tests were administered.

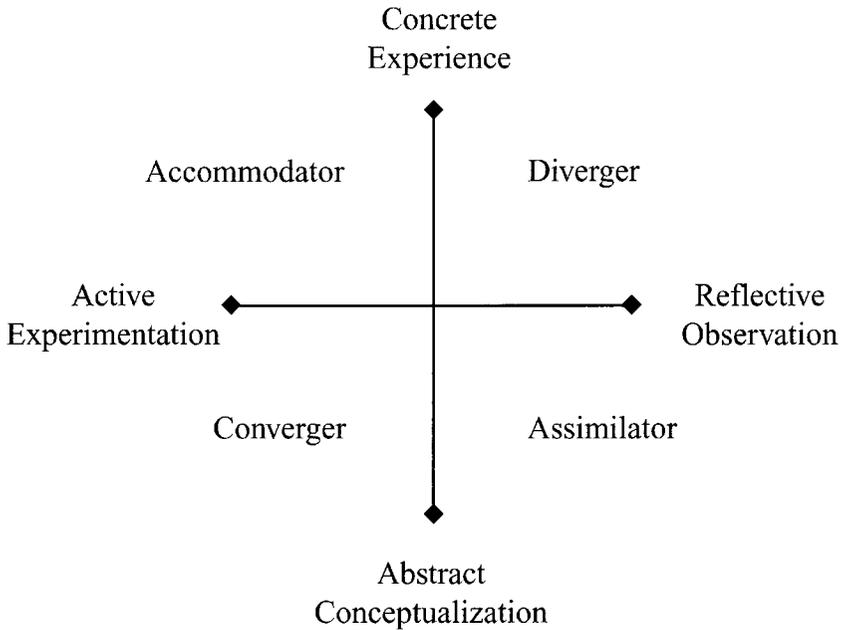


Figure 1. Kolb's Experiential Learning Model (Smith and Kolb 1986, 16)

2. Identification of Instructional Methods

In order to determine the methods of instruction used by teachers, the researcher conducted a survey of teachers' instructional methods by synthesizing the lists of Svinicki and Dixon (1985) and Sheehy (1996). Svinicki and Dixon (1985) identified four specific classroom-learning activities that are complementary to the four phases of Kolb's Experiential Learning Cycle. Sheehy (1996) discovered that the Svinicki and Dixon adaptation did not include a sufficient number of activities and assessments, and consequently, designed supplemental lists of activities and assessments that provided for more learning style activities. Both the Svinicki and Dixon (1985) and Sheehy (1996) adaptations elaborated the Kolb model slightly by designing the four activities with action verbs that described the activity of the learner at each step. Thus, concrete experience becomes experiencing; reflective observation becomes examining; abstract conceptualization becomes explaining; and active experimentation becomes applying.

	Eng+*	Eng+**	Eng+***	Kor++
Concrete Experience (CE)	0.82	0.56	0.85	0.53
Reflective Observation (RO)	0.73	0.67	0.80	0.56
Abstract Conceptualization (AC)	0.83	0.71	0.83	0.67
Active Experimentation (AE)	0.78	0.52	0.81	0.63

Table 1. Comparison of the internal consistency of the English and Korean Versions: LSI. + - English; ++ - Korean; *Smith and Kolb 1985; ** Veres, Sims and Locklear 1991; *** Ruble and Stout 1991.

Twenty-nine kinds of instructional methods were randomly selected from the lists of Svinicki and Dixon (1985) and Sheehy (1996), and served as the basis for a survey used to classify the teaching styles of the eight geography teachers involved in the study.

The Survey for Teaching Methods was administered to the eight teachers that taught geography to the 791 ninth grade middle school student participants during the second semester of 1998 in order to classify their teaching styles according to Kolb's model. The teachers indicated the frequency for each instructional method: 5 = every class, 1 = never used. Table 2 presents the instrument used in collecting and analyzing the four phases Teaching Methods data based on Kolb's Experiential Learning Cycle. While the study collected and analyzed data for each of the eight teachers, Table 2 represents the data from just one teacher in order to demonstrate the format.

The classification and analysis of the completed surveys revealed four categories of instructional methodology: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). These categories of instructional methodology may be further elaborated. For example: field experiences, laboratories, direct data collection, and reading of primary resources are all designed to give the learner firsthand, personal experiences with the content (CE). Activities such as discussion and journal keeping encourage students to reflect on their experience (RO). Model building, research papers, or lectures that present a model foster abstract conceptualization (AC). Simulations and projects encourage students to apply the models to problem situations (AE) (Svinicki & Dixon 1985).

3. Assessing Student Achievement

The achievement test was developed with 70% multiple-choice questions and 30% short answer questions. It was designed to reveal the effects of the instruction and learning style elements on student achievement. All of the questions were focused on the content and concepts for the ninth grade, second semester geography class. The topics were: Chapter Five, industrialization, urbanization, and environmental problems; Chapter Six, natural resources and regional development; and Chapter Seven, Korea in international society.

The students in the sample were administered two content-based tests, a midterm exam, and a final exam. Mean scores for the tests were calculated as a composite score. Academic achievement data for geography were also obtained from each student's transcript. The composite score (midterm and final exams) for the geography students for each of the schools is presented in Table 3. The table shows that the gap between the highest and lowest mean composite score for the three schools is greater than 15 points. Consequently, the students' achievement scores were converted to T-scores, with a mean of 50 and standard deviation of 10, in order to make comparisons between schools practical (Table 4). Conversion to T-scores is a statistical technique used to make raw test scores comparable. Although curriculum and exam style (70% multiple choice questions and 30% short answer questions) were the same in each school, the questions themselves were judged conceptually similar by the researcher, but were not duplicate questions because the test items were constructed by teachers in each school.

RESULTS

Analysis of Data

Several scores from the Learning Style Inventory were used to explain geography academic achievement as indicated by the teacher-generated test. The regression equation $y = b_0 + b_1 x_1$ was used where x_1 denotes learning style of student, and y denotes academic achievement. Each student exhibited a preferred learning style: diverger, assimilator, converger, or accommodator. Learning style was the categorization variable coded from 1 through 4. Each value was transformed to a new variable value to accommodate the assumption of equal intervals underlying the regression model. This allowed the researcher to capture the information contained in the categorization scheme and analyze its effects as an estimation of standard regression.

	Every Class	Once a week	Once every two weeks	Once a month	Never Used
1. Lecture	X				
2. Define	X				
3. Time Line			X		
4. Review	X				
5. Note Taking	X				
6. Map		X			
7. Evaluation of Work			X		
8. Observation	X				
9. Primary Text Reading	X				
10. Simulation / Game					X
11. Field Work					X
12. Class Participation		X			
13. Summary	X				
14. Presentation				X	

Table 2. Teaching style questionnaire. One teacher’s responses entered to demonstrate format.

	Every Class	Once a week	Once every two weeks	Once a month	Never Used
15. Case Study				X	
16. Homework			X		
17. Group Work					X
18. Charting Results				X	
19. Thought Question			X		
20. Brainstorming				X	
21. Journals				X	
22. Rhetorical Questions			X		
23. Role Play					X
24. Laboratories					X
25. Projects					X
26. Trigger Films					X
27. Calculate Results				X	
28. Library				X	
29. Handouts		X			

Interpretation of Data

1. Nature of the Learning Style

The students surveyed were categorized, based upon the Learning Style Inventory, as follows: 40.7% divergers, 34.1% assimilators, 10.6% convergers, and 14.5% accommodators (Table 5). Teachers, on the other hand, used reflective observation and abstract conceptualization as instructional methodologies. This observed difference suggests a mismatch between teaching methods and students' learning style in general. Chi-square analysis showed no significant difference between male and female students on learning styles within the sample ($p = 0.09895$). Thus, the mismatch was evident across the student sample.

2. Learning Style and Geography Achievement

Table 6 shows the results of the multiple regression analysis using learning style to predict geography achievement scores. The variance in the learning style (r^2) attributable to the prediction of academic achievement is 9%. The data suggest that learning style is a minor predictor of academic achieve-

	Mean	Standard Deviation
School 1	75.93	19.10
School 2	66.85	20.85
School 3	60.42	20.43

Table 3. The means of achievement scores by school.

	Mean	Standard Deviation
School 1	49.96	10.05
School 2	49.93	9.93
School 3	50.21	10.22

Table 4. T-scores for achievement by school.

ment despite the significance of the statistic at the 0.05 confidence level. It is believed by the researcher that statistical significance may result largely from sample size (N =791).

The mean scores for academic achievement in geography by students according to their different learning styles are in close agreement between girls and boys within groups. There are noticeable differences between several of the sub-sample groups that exhibited specific learning styles. For example, assimilators had the highest mean score in geography achievement, while convergers and divergers, who rely on experience, feeling, and doing, had low mean scores on geography achievement. This fact may be related to and result from the teachers' instructional methods (Table 7).

A summary of the instructional methods categories for teachers in the sample is presented in Table 8. Individual teacher's scores within each category ranged from a minimum of 8 to a maximum of 40. The predominant teaching methods in geography for the sample are reflective observation and abstract conceptualization. Such instructional environments are believed best for assimilators. While we know that students learn in different ways, the data suggest that Korean geography teachers most often teach for assimilators. Furthermore, the data suggest that instructional methods in geography classes in Korea are most likely teacher-centered lectures geared toward fact and concept-oriented learning. Instructional methods to meet individual needs and to develop critical thinking and inquiry skills through experiential learning are practiced infrequently in geography classrooms in Korea.

	Boys		Girls		Total	
Diverger	125	38.1%	197	42.6%	322	40.7%
Assimilator	133	34.5%	157	33.9%	270	34.1%
Converger	45	13.7%	39	8.4%	84	10.6%
Accommodator	45	13.7%	70	15.1%	115	14.5%
Total	328	100.0%	463	100.0%	791	100.0%

Table 5. Sample of Korean student subjects by learning style. Chi-square test between boys and girls: $p = 0.09895$.

The analyses strongly suggest that learning style and instructional methods each have an effect upon student achievement. Students with the learning styles classified as divergers and convergers had low mean scores in achievement. Those students may have performed at a higher level if different instructional methods were used. Those students perhaps have the greatest need for concrete, imaginative, action-oriented learning experiences in order to improve their academic performance.

SUMMARY AND CONCLUSIONS

Geography education in Korea has been crucial in the quantitative improvement of Korea's human capital (Han 1994). Educational planning has focused on providing the types of training required to fill the manpower needs of the nation's economic development. However, such training may not be effectively reaching all students. Students with a learning style classified as diverger formed 40.7% of the study sample. Those students are characterized by a cognitive function that combines concrete experience with reflective observation. Accommodators, on the other hand, who formed 14.5% of the study, combine concrete experience and active experimentation as their learning style. Divergers enjoy working with people and tend to be imaginative and feeling-oriented. Accommodators are interested in carrying out plans or tasks and in getting involved in new experiences. Since many instructional methods in geography education in Korea emphasize an abstraction process, not a concrete experience, it was not surprising to find divergers and accommodators obtaining lower achievement scores than assimilators and convergers, both of whom prefer contemplating abstract conceptualizations. Based on the cycle of learning involving matching and mismatching, learning style seems to be an important factor in the geography achievement of the students in this study.

From the data available in this study, it was not possible to determine all characteristics of Korean geography education with respect to instructional methods and learning style, but some trends were observed that permit the researcher to speculate. The first trend is that tests and entrance exams have influenced the instructional methods employed in the Korean geography education system. Current test formats in Korean geography education consist

Multiple R	R- Square	Adjusted R-Square	Standard Error	F	Signif F
0.30018	0.09011	0.08664	9.61356	25.97846	P<0.000

Table 6. Regression results for learning style and achievement.

Learning Style Deviation	Gender	Mean	Standard
Diverger	Boy	46.6377	9.0788
	Girl	47.9150	10.4781
Assimilator	Boy	54.3664	10.1884
	Girl	53.8576	8.8724
Converger	Boy	50.7921	9.2446
	Girl	49.3876	9.9629
Accommodator	Boy	46.4587	8.5652
	Girl	48.5911	9.3423

Table 7. Achievement by gender and learning style expressed as t-scores.

	Concrete Experience	Reflective Observation	Abstract Conceptualization	Active Experimentation
Mean	14	26	28	12

Table 8. Instructional methods mean scores by teacher subjects.

of 70% multiple choice and 30% short answer. This has led teachers to depend heavily on lecturing, rote learning, and memorization of isolated facts. In this type of environment for geography education, teachers probably neglect individual student's learning styles. In order to encourage higher order thinking, creativity, and problem solving among students, new and varied geography assessments that include essays, oral examinations, discussion, practice, experimentation, interviews, observation, projects, and performance portfolios, as well as multiple choice examinations, are necessary. Furthermore, those changes may also require changes in the geography curriculum.

The second trend is that too little attention is focused on processes and outcomes. The knowledge that students acquire is important in education, but an understanding of how students acquire knowledge and how they apply information and content is equally important. Instructional methods and discipline strategies that worked ten or twenty years ago may no longer be

effective in light of the current knowledge regarding the variety of student learning styles. It is important for teachers to not only know the content of geography, but to also teach it in a way that matches students' learning styles. Teachers must (1) challenge the intellectual capacity, (2) nurture the emotional stability, (3) encourage the social sensitivity, (4) facilitate the physical well being, and (5) coach the psychological maturity of learners. The challenge facing Korean geography educators is to determine how to raise academic achievement levels by enhancing the motivation of students. Students' growth is facilitated by teachers who consider instructional methods and learning style agreement as important in the process of education (Atman 1991).

The third trend is a deficiency in the scope of teacher education. Teachers must be prepared in new and various instructional methods that permit them to address varied student learning styles. Especially in geography, teachers must be well versed in technology education, such as geographic information systems (GIS). Policy makers in the educational system in Korea must respond to (1) the need for technology in teaching, (2) the need for teacher education in the use of new instructional technologies and methods, and (3) the increasing need for access to technology facilities by all students.

The fourth trend is the absence of action-oriented education. Traditionally, the evaluation of characteristics within the affective domain with Confucian values and evaluation of content proficiency in the cognitive domain through multiple-choice examinations have dominated. Inclusion of concrete goals and content for both domains in the geography curriculum is necessary. Instructional methods and evaluation techniques that measure achievement of clearly stated educational goals must be introduced to students, teachers, and parents. Good communication about educational goals among students, parents, and teachers is essential to the success of students in achieving the goals and objectives established by the educational system. This research suggests that instructional methods that complement student-learning style may be an initial important step.

REFERENCES

- Akin, A. 1992. *An Analysis of the Effect of Matching Student Learning Style To the Method of Instruction*. Unpublished doctoral dissertation. Kalamazoo, Michigan: Western Michigan University.
- Atman, K.S. 1991. *The Mentor's Perspective: A Synthesis of Cognitive, Affective and Conative Maturity*. Paper presented at the American Educational Research Association Annual Meeting, San Francisco, California.
- Dunn, R.S. and Dunn, K.J. 1993. *Teaching Secondary Students Through Their*

- Individual Learning Styles: Practical Approaches for Grades 7-12.* Boston, Massachusetts: Allyn and Bacon.
- Farina, N. 1997. *Similarities Of Learning Styles Among Physical Therapy Students In Three Countries.* Unpublished doctoral dissertation. Pittsburgh, Pennsylvania: University of Pittsburgh.
- Geography Education Standards Project 1994. *Geography for Life: National Geography Standards 1994.* Washington, D.C.: National Geographic Research and Exploration.
- Gregorc, A.F. and Ward, H.B. 1977. A new definition for individual. *NASSP Bulletin* 61:20-26.
- Hajizainuddin, A.M. 1999. *A Study of Learning Styles and Hypermedias Organizational Structures In A Web-Based Instructional Program Designed For Trainee Teachers At The International Islamic University Malaysia.* Unpublished doctoral dissertation. Pittsburgh, Pennsylvania: University of Pittsburgh.
- Han, B. 1989. *A Comparative Study of Selected Junior High School World Geography Textbooks Used In the United States and Korea.* Unpublished doctoral dissertation. Pittsburgh, Pennsylvania: University of Pittsburgh.
- Han, J. 1994. Education and industrialization: The Korean nexus in human resources development. *Education Economics* 2(2):169-185.
- Hanpol, T. 1999. *The Relationships Among Learning Style, Perceived Teaching Style, and Achievement In A Thai University Course.* Unpublished doctoral dissertation. Columbia, Missouri: University of Missouri-Columbia.
- Keefe, J.W. 1979. *Learning Style: An Overview In NASSP Student Learning Style: Diagnosing and Prescribing Programs.* Reston, Virginia: National Association of Secondary School Principals.
- Kolb, D.A. 1984. *Experiential Learning: Experience As the Source Of Learning and Development.* Englewood Cliffs, California: Prentice Hall.
- _____. 1986. *Learning Style Inventory: Self-Scoring Tests and Interpretation Booklet.* Boston, Massachusetts: McBer & Company.
- Kolb, D.A. and Smith, D. 1985. *User Guide For the Learning Style Inventory.* Boston, Massachusetts: McBer & Company.
- McCarthy, B. 1981. *The 4MAT System: Teaching To Learning Styles With Right/Left Mode Techniques.* Barrington, Rhode Island: Excel, Inc.
- McFadden, E.A. 1986. *Clinical Decision Making and Its Relationship To Learning Style and Personality Type.* Unpublished doctoral dissertation. Baltimore, Maryland: University of Maryland.
- Ministry of Education 1999. <http://www.moe.go.kr>.
- Paik, I. 1994. *A Comparative Study Of the Map Content Included In Junior High School World Geography Textbooks and School Atlases In U.S.A.*

- and Korea. Unpublished doctoral dissertation. Pittsburgh, Pennsylvania: University of Pittsburgh.
- Ruble, T.L., and Stout, D.E. 1991. Reliability, classification stability and response-set bias of alternate forms of the Learning Style Inventory. *Educational Psychological Measurement* 51:481-490.
- Ruksasuk, N. 2000. *Effects Of Learning Styles and Participatory Interaction Modes On Achievement Of Thai Students Involved In Web-Based Instruction in Library and Information Science Distance Education*. Unpublished doctoral dissertation. Pittsburgh, Pennsylvania: University of Pittsburgh.
- Sheehy, P.J. 1996. *Preparing Social Studies Teachers To Use Learning Style As An Activity and Assessment Design Element For Use In Outcome Based Settings*. Unpublished doctoral dissertation. Pittsburgh, Pennsylvania: University of Pittsburgh.
- Svinicki, M.D., and Dixon, N.M. 1985. The Kolb model modified for classroom activities. *College Teaching* 35(4):141-146
- Szewczyk, L. 1987. *Effects Of 4MAT, An Experientially Based Teaching Method Upon Achievement and Selected Attitudinal Factors Of High School Geometry Students*. Unpublished doctoral dissertation. DeKalb, Illinois: Northern Illinois University.
- Ursin, V.D. 1995. *Effects Of the 4MAT System Of Instruction On Achievement, Products, and Attitudes Toward Science Of Ninth-Grade Students*. Unpublished doctoral dissertation. Storrs, Connecticut: The University of Connecticut.
- Veres, J.G., Sims, R.R., and Locklear, T.S. 1991. Improving the reliability of Kolb's revised learning style inventory. *Educational & Psychological Measurement* 51:143-150.

Sung-Hee Yoon received her Ph.D. in 2000 from the Department of Instruction and Learning at the University of Pittsburgh. During her studies there, she was a student assistant at the Center for International Studies where she worked developing the Teaching Material Library in Asian Studies Program. Prior to that, Yoon attended the Ewha Woman's University in Seoul, Korea, where she obtained a Master of Science through the Department of Social Studies Education. In addition, she taught geography and world history at Hyundai High School, in Seoul.

Kathryn S. Atman is an Associate Professor in the Department of Instruction and Learning at the University of Pittsburgh. She is Associate Director of the Center for Economics Education, and Director of a project for the Fund for the Improvement of Post Secondary Education (FIPSE). Atman serves on the Executive Board of the Pennsylvania Council for the Social Studies and is President of the Educational Leadership Council of America. Her research focuses on character education and achievement motivation, particularly the implications of goal accomplishment style for at-risk students.

Spatial Cognition of Pre-Service Teachers

Melinda Schoenfeldt

This study is concerned with examining the spatial abilities of pre-service teachers through the analysis of sketch maps. A series of t-tests and a single factor ANOVA analysis were chosen to identify differences between the means in the dependent variable, spatial ability, compared to the independent variables of gender, number of geography course taken, area of study concentration, and self-assessment of one's sense-of-direction. Data suggest that both gender ($p < 0.05$) and self-assessment of one's sense-of-direction ($p < 0.10$) explain significant amounts of the variance in scores on the test of spatial ability.

Keywords: *spatial cognition, pre-service teachers, sketch maps*

INTRODUCTION

Geography has been part of American education since the 17th century (Stoltman 1992). Thomas Jefferson, among other early influential Americans, believed geography to be an important subject for a primary education. In fact, geography textbooks were some of the earliest to appear in American classrooms (Smith 1997). By the 19th century, geography education was mandated in several states. However, in the early 20th century, geography instruction became less important in the American curriculum (Stoltman 1992). From the 1960s through the 1980s, geography was considered a marginal discipline in the United States. By the late 1980s, Americans' ignorance of geography became widespread knowledge (Murphy 1998). Research by Downs and Liben (1987) and others has shown that children and adults are spatially illiterate; from orienting oneself in the environment and finding one's way from place A to place B, to using maps to discover location, estimate distances, and to plan routes.

In recent years, however, there has been considerable attention given to once again include geography in schools. As a result of this attention, more elementary and secondary schools now require courses in geography, and the College Board is adding the subject to its Advanced Placement program (Murphy 1998). Geography is now identified as a core subject for American schools, on par with science and mathematics (Rediscovering Geography Committee 1997).

Significance in Pre-service Education

With attention focused on the importance of including and improving geography instruction in American schools, most resources have been used for staff development of in-service teachers. This effort has not been matched by efforts to improve opportunities for pre-service teachers to learn geography and how to teach it (Bednarz and Bednarz 1995). A recent assessment by the Council of Chief State School Officers found that only five states require geography for certification of elementary teachers (K-5) and only two-thirds require that persons intending to teach social studies have even one course in geography. "Students now enrolled in teacher education programs are not receiving adequate instruction to carry out the increased emphasis on geography in the nation's schools" (National Council for Geographic Education 1992, 5).

The pre-service teachers of today will be charged with the responsibility of teaching geographic concepts in the future, including spatial skills used in visualizing, reading, and making maps. The spatial ability of pre-service teachers may be foundational to the teaching of geographic concepts to their future students. Boehm and Sharma (1994) assert that teachers cannot teach what they themselves do not know. Shaha (1982) concluded that there is a need for "investigating the cognitive processes which underlie spatial abilities" (130). Are pre-service teachers' spatial abilities adequate to help their future students understand the spatial nature of their world? This study was undertaken to examine the spatial ability of a sample of elementary/middle school pre-service teachers by examining how pre-service teachers transfer mental maps into sketch maps in order to see if there are predictor variables that point to strong spatial ability.

From Memorizing to Thinking

To most Americans, geography is about place names. Concerns about geographic ignorance usually focus on people's inability to locate places on a world map. Geographic instruction is often equated with teaching about remote locations. But, geography should be thought of as a means rather than as an end (Rediscovering Geography Committee 1997). Geography is concerned with understanding the spatial dimension of human experience (Geography Education Standards Project 1994). Students need to be able to use geography to solve problems and to understand the spatial nature of the discipline and its impact on our lives (Petry 1995). Geographic literacy involves the use of maps to assist in the analysis of information. According to Stoltman (1992, 17),

Map skills have long been recognized to include tasks similar to those developed by Jean Piaget in his research on spatial development. Piaget's theory of spatial development presented the idea that as children mature, they change their views of how items in a landscape are related to each other. Map skills require students to think spatially and recognize different perspectives as they use maps for manipulating, comparing, and contrasting spatial information.

THEORETICAL FRAMEWORK: PSYCHOLOGY AND GEOGRAPHY COMBINE FACTORS

At the turn of the 20th century, social studies disciplines, including psychology, sociology, and anthropology, were established on university campuses. In trying to gain the stature enjoyed by the "pure" sciences, social sciences began researching the human mind. The research centered on topics that included problem solving, the nature of consciousness, and perception. The scientific method used by most of these researchers was introspection; self-reflection of the researcher's own thought patterns (Gardner 1985).

From the 1920's through the 1940s, behavioral psychology was popular. Behaviorism is based on the belief that forces in the environment that are beyond human control determine behavior. Behaviorism attempted to study human learning using techniques employed in studies of animal behavior (Gardner 1985). Behaviorism is sometimes called an "empty organism" theory of behavior. Behaviorists view the world in terms of stimuli and responses to those stimuli without acknowledging what happens in a person's mind (McNergney and Herbert 1995).

By the mid 1950s, cognitive psychology, or cognitive science as some called it, began to influence the research of social scientists (Gardner 1985). Human cognition studies look at ways in which people process information mentally. This is very much a reaction to stimulus-response theory. "Where stimulus-response theorists were interested primarily in the antecedents and consequent of intelligent behavior, information-processing psychologists are interested primarily in the mental phenomena that intervene between stimulus and response" (Sternberg and Salter 1982, 3).

"No one affected developmental psychology more than Jean Piaget" (Beilin 1992, 191). Piaget (1977) conducted many research studies involving spatial cognition. He identified stages of development: sensory-motor, preoperational, concrete operational, and formal operational. He assigned age ranges to each stage to explain that though he believed all children pass through the stages sequentially, they may do so at different ages. Piaget (Piaget

and Inhelder 1956) assigned the ability to understand representational forms of spatial organization (map reading) to children over eight years of age.

Geography is recognized as the spatial science concerned with the location of elements on the earth's surface and their relationship to each other (Stoltman 1991). Cognitive representation is the way individuals mentally represent information about their environment. Human cognitive representations of space have been studied in geography for more than 25 years (Rediscovering Geography Committee 1997). As Downs and Meyer (1978) note, "cognitive mapping studies find affinity with and inspiration from psychology" (68).

Psychologists David Stea, Terence Lee, and Stephen Kaplan teamed with geographers in an attempt to understand the mental processes involved in cognitive representations of the spatial environment. Downs and Meyers (1978, 73) point out,

The ties between psychology and geography strongly influenced the direction of collaborative effort. Psychology brought a sense of cognitive process, geography a sense of environment, and the concern switched from an emphasis on static, visual images and maps to an exploration of the processes of learning and manipulating information about the spatial environment.

Storage of Spatial Cognitive Information

Researchers have identified two basic types of spatial cognitive storage: imagery (analog) and propositions (Evans 1980; Miller and Burton 1994). Imagery depicts mental images as internally coded in a spatial structure (Miller and Burton 1994). Kosslyn, Ball, and Reiser (1978) suggested that people who use such coding are able to scan mental images of a map as if they were looking at an external map. Propositional recall suggests that mental images be encoded in terms of linear orderings that sequence the items. People who use this type of coding create mental maps that represent paths between familiar locations. Both forms of storage schema for cognitive maps, analog or propositional, (Evans 1980; Weitzman 1981) can be externally represented through the use of sketch maps.

Tests Used to Measure Spatial Ability

Many methods have been used to measure spatial ability (Kearney and Kaplan 1997). Semantic proximity (word association) tasks, open-ended

interviews, and free-card sorting techniques have used verbal recall of spatial information. The assumption of using such tests was that people acquire and store information about their surroundings in some schematized form (Rovine and Weisman 1989).

There are problems, however, assuming that linguistic structure is representative of cognitive structure of spatial data (Kearney and Kaplan 1997). Other types of tests used to assess spatial ability include paper folding, mental image rotation tests (MIR), and block counting (Turner 1983). These tests were designed to look for isolated spatial abilities such as rotating perspective or understanding three-dimensional models. Researchers in cognitive studies have largely depended on an individual's hand-drawn sketch map as a way to externalize the individual's mental map of the environment.

Evans (1980) cites three possible shortcomings of using sketch maps. One concern was that poor drawing ability might underrepresent a person's knowledge. There was a substantial correlation (0.62) between ratings of children's accuracy on sketch maps and their scores on the Goodenough-Harris Draw-A-Man-Test (Evans 1980). However, Rothwell's (1976) adult data indicate that artistic ability may have only slight effect on sketch maps. While sketch maps may not be appropriate for use with young children, the subjects in this study were adults.

A second of Evan's (1980) concerns in using sketch maps is that they may test a subject's free-recall ability rather than recall of one's cognitive map. Bannerjee (1971) and Milgram and Jodelet (1976) found that accurate picture recognition was slightly greater than free-recall for accuracy in drawing sketch maps. The current study used picture cues of the buildings on campus for the subjects rather than reliance on their free recall.

A third concern reported by Evans (1980) is that first-drawn elements of sketch maps may have substantial effects on the relative position of subsequently drawn elements. The current study showed subjects the visual cues twice and they were instructed to make changes to their drawings at any time.

Golledge (1976) lists sketch maps as one of four methods for "extracting" cognitive information. Rovine and Weisman (1989) report that sketch maps were the most commonly used techniques in early cognitive mapping research and argue for their continued use. They cite research by Rothwell (1976) that suggested that sketch maps are reliable and valid in research with adults. Data gathered in environmental cognition studies by Lynch (1960) came primarily from hand-drawn sketch maps. After controlling for Evans' three concerns, and following the lead of respected researchers, the use of sketch maps seemed justified on a logical and empirical basis and became the research focus for the present study.

STUDY DESIGN

Research Hypotheses

H₀: There is no difference between the means of the dependent variable, spatial ability score, when compared with the independent variables of gender, number of geography courses taken, self-assessment of one's sense of direction, or area of content concentration in elementary level pre-service teachers.

Methodology

Subjects were asked to self-assess their spatial ability by classifying their sense of direction as good or poor before producing a sketch map. Subjects were also asked to identify their gender, number of geography courses taken, and their content subject area of concentration. Each study subject was then given a blank 8 x 11-inch piece of paper. Boundary roads were verbally identified for the subjects. The subjects were then asked to draw in the boundaries and to identify north on their map. When given visual stimuli (color slides of thirteen familiar buildings on campus), subjects were asked to map the locations of the buildings. They were allowed to make changes at any point, especially after seeing all thirteen buildings. Golledge (1976) reported that individuals establish the position of places with respect to each other and with respect to cardinal directions. A series of t-tests and a single factor analysis of variance (ANOVA) were used to analyze the influence exerted by four independent variables on the dependent variable of spatial ability. The four independent variables were gender, subject content area concentration of study, self-report of one's sense of direction, and number of formal geography classes taken.

Demographics

The subjects for this study were four intact groups (N=73) of students enrolled at a Midwestern university in an elementary/middle level education program that is accredited by the National Council for Accreditation of Teacher Education (NCATE). The university is a land grant institution with a strong research orientation and a total enrollment of approximately 20,000 students. The College of Education graduates approximately 400 students each year. The subjects of this study were predominantly of Anglo ethnicity, and a minority of the sample subjects was Hispanic and African-Americans. There were eleven male and sixty-two female subjects. The small number of males

reflects the smaller number of males enrolled in the elementary education program. All subjects have a cumulative GPA of 2.75 or higher. The study was conducted using all available pre-service teachers in four sections of the Elementary/Middle Level Social Studies Methods course. All students were in their last semester of study before student teaching.

Data Collection

The individual sketch maps were scored on a scale from zero to twenty-six, and the maps were categorized as either representative of an analog or propositional cognitive recall. In this study, buildings placed in the correct quadrant of the campus received one point. Buildings placed in correct relative location (due south, northeast) to the next nearest-pictured building received another point. A perfect score was twenty-six. The mean score on the dependent variable was compared with respective mean scores for each of the independent variables. Maps drawn using linear, pathlike drawings were labeled propositional, while maps that used a "scanning the environment" technique were labeled analog. For example, subjects who drew a gridwork of streets as a way of locating landmarks were considered to be using analog recall. The maps were scored and categorized by two different raters. The inter-rater reliability was 0.97.

The independent variables represent categorical data. Self-report of one's sense of direction was categorized as good or poor. Number of geography courses taken were divided into three categories; 1) one course represents minimal exposure, 2) two courses taken represents a step beyond minimal exposure, and 3) three or more courses taken represents maximum exposure. There is no zero category since all education students at this university are required to take at least one geography course. Research reports (Rothwell 1976; Stoltman 1992; Bednarz and Bednarz 1995; Casey 1996) have made the case that math, geography, art, and science require spatial ability. Those content specialties were categorized as high spatial subjects. Other areas of content concentration were categorized as low spatial subjects. Subjects who listed social studies as an area of concentration were put in the high spatial category since geography is subsumed under the more general category called social studies.

ANALYSIS OF DATA

The null hypothesis stated there would be no difference in the mean test score between spatial ability and the mean values for the independent variables of gender, self-assessment, area of concentration, or number of geography

courses. Analysis included submitting the data to *t*- tests and a one-way ANOVA to test the mean values for differences at the 0.10 or less significance level. The significance level for accepting and rejecting the hypotheses was set at the 0.10 level due to the nature of the spatial ability test and the independent variables. That level of significance was determined to introduce adequate rigor to the data analysis procedures.

The mean scores for the sketch map drawing criteria compared to gender (Table 1) suggest that males tend to score higher than females in sketch map drawing. The statistics in Table 2 indicate that a difference this large or larger can be expected only about three percent of the time. This is a statistically significant difference and so the null hypothesis for the case of gender is rejected. There is a significant difference between the sketch map drawing of male and female students, and it is slightly in favor of males. Data suggests a significant effect ($p < 0.05$) of gender on spatial ability score.

Area of concentration was represented by two categories, high spatial and low spatial. Data in Table 1 shows that subjects enrolled in low spatial areas of concentration scored slightly higher than subjects enrolled in high spatial areas of concentration. But Levene's Test for Equality of Variance in Table 2 shows no statistically significant difference between the two groups. The null hypothesis is accepted for the independent variable of study of concentration.

A third independent variable of this study was self-assessment of one's sense of direction. Subjects identified themselves as either good or poor. The data in Table 1 show that those who identified themselves as having a good sense of direction outscored those who identified themselves as having a poor sense of direction by almost two points. Levene's Test for Equality of Variances suggest there is a significant statistical difference ($p < 0.10$) between the two groups' sense of direction. Therefore, the null hypothesis for self-assessment of one's sense of direction is rejected. The data suggest self-assessment of one's ability is an important element in spatial ability.

The null hypothesis was proposed regarding differences in the mean values for spatial ability scores compared to the number of college geography courses taken. Data are shown in Table 3. The *p* value (0.4149) is greater than the alpha level (0.05) and the null hypothesis is accepted. Data suggest there is no significant difference in spatial ability mean scores between groups of students based on geography courses completed.

Perhaps as interesting as the mean score differences by gender are the scores themselves. The overall mean score of twenty-one, which is approximately eighty-one percent of a perfect score, suggests that many of the pre-service teachers were able to complete the sketch map of campus, a familiar environment, with proficiency. However, scores of five and eight were recorded suggesting a wide range of ability relative to the task.

Closely related to individual score was whether more pre-service teachers used analog or propositional recall strategy when drawing the sketch map. Maps of twenty-four subjects, thirty-three percent of the total sample, were classified as using analog recall. Table 4 shows the type of map drawn by gender. Males in the sample tended to use analog recall while females tended to use propositional recall strategies. Six maps were scored with a perfect twenty-six. All six demonstrated analog recall strategies.

Arguably, the most interesting sketch map was map number nine (Figure 1). This particular map received a score of five, the lowest score in the sample and can almost be thought of as a *mirror map*. The northern and southern boundary roads are correct. The eastern and western boundary roads are reversed, as are the thirteen campus landmarks and buildings. When held up to a mirror, the buildings are in remarkably accurate relative location to one another and placed in the proper quadrants. It would be interesting to have that subject repeat a sketch map task to determine if the practice is consistent. The confidentiality of subjects assured by the research design made it impossible to identify the individual.

Figure 2, map number fifty-eight, received a perfect score from both raters. It was also classified as analog by both raters. The subject added internal roads as a grid system to aid in more accurate placement of the campus buildings and landmarks. Another interesting element of map fifty-eight is that the subject accurately drew the roads, including curves. Evans (1980) reported that the more commonly noted distortions of sketch maps are the straightening of long, gradual curves, the squaring of non-perpendicular intersections, and the aligning of non-parallel streets. Those distortions existed on most of the maps. Note in particular (Figure 2) that the northern boundary road, called Claflin Road, curves sharply. Eight subjects drew the road with a curve and half of those curved the road in the wrong direction.

Figure 3, map number eighteen, shows an example of a map that was classified as propositional by the two raters. Two internal campus roads are added, but they appear to be used as paths to certain buildings or areas of campus. They do not seem to be added to establish a grid system. The addition of the roads did not help the subject to place landmarks more accurately.

SUMMARY

Males from the sample population outscored females. These findings appear to coincide with study results from Halpern (1992), Law, Pelligrino, and Hunt (1993), and others who have reported that males outperform females on spatial tasks. Though males' mean scores were higher than the

Factor of Interest	n	Mean	SD
Gender			
Male	11	23.82	2.48
Female	62	20.70	4.47
Area of Concentration			
High Spatial	31	21.03	4.45
Low Spatial	42	21.29	4.34
Self-Assessment			
Good	52	21.73	4.08
Poor	20	19.85	4.93
Number of Geography Courses			
One	34	20.76	4.67
Two	30	21.97	3.23
Three +	6	20.00	6.42

Table 1. Means and standard deviations by sample categories. Mean scores shown for each independent variable (sample N=73).

mean scores for females, it should be noted that the six perfect scores of twenty-six were evenly divided between the genders.

Subjects who identified themselves as having a good sense of direction outscored subjects who identified themselves as having a poor sense of direction. Ninety-one percent of the males identified themselves as having a good sense of direction, while only about sixty-six percent of the females did so. These findings seem to confirm Lunneborg's (1982) study that concluded that university-aged males tend to self-assess themselves higher than do females on performance-based activities. It seems that males have higher self-esteem on spatial tasks. But the data from this study do show that the males had higher scores and that the subjects, both male and female, were seemingly able to identify their spatial strengths with some degree of accuracy.

The study's data do not show a statistically significant relationship between number of geography courses taken and a high score on the sketch

Factor	Assumption of Variance	Test Statistic	Standard Error	P-Value
Gender	equal	2.24	1.388	0.028
	unequal	3.31	0.939	0.003
	Levene's Test: F=0.007	p=0.132		
Areas of Concentration	equal	-0.24	1.039	0.808
	unequal	-0.24	1.043	0.809
	Levene's Test: F=0.007	p=0.934		
Self-Assessment	equal	1.65	1.139	0.103
	unequal	1.52	1.240	0.140
	Levene's Test: F=1.254	p=0.267		

Table 2. Comparison of factor levels by sample categories.

map task. Eighty-eight percent of the subjects had taken one or two geography courses. Forty-seven percent had taken only one. Since a relatively small percentage, eight percent, had taken three or more courses, it was not possible to develop scores across a wide range for geography courses completed. Furthermore, it was not known what types of geography courses had been taken, and whether certain types of courses had greater effects on spatial skills than did others.

Number of Geography Courses					
Source	D.F.	Sum of Mean Squares	F Squares	F Ratio	Prob.
Between Groups	2	32.70	16.35	0.8913	0.4149
Within Groups	67	1229.08	18.34		
Total	69	1261.78			

Group	n	Mean	SD	SE 95%	Conf Int. for Mean
1 Course	34	20.7647	4.6710	0.8011	19.1348 to 22.3946
2 Courses	30	21.9667	3.2322	0.5901	20.7597 to 23.1736
3+ Courses	6	20.0000	6.4187	0.6204	13.2671 to 26.7359

Table 3. One-way analysis of variance on the effect of number of geography courses taken on sketch map scores.

Gender	Type of Map			Row Total
	Analog	Propositional		
Male	n	7	4	11
	%	63.6	36.4	15.1
Female	n	17	45	62
	%	27.4	72.6	84.9
Column	n	24	49	73
	%	32.9	67.1	100

Table 4. Analog and propositional spatial skills usage compared by gender. More preservice (67%) teachers used a path-like (propositional) cognitive recall strategy. A larger percentage of males (63.6%) than females (27.4%) used a grid-like (analog) recall strategy.

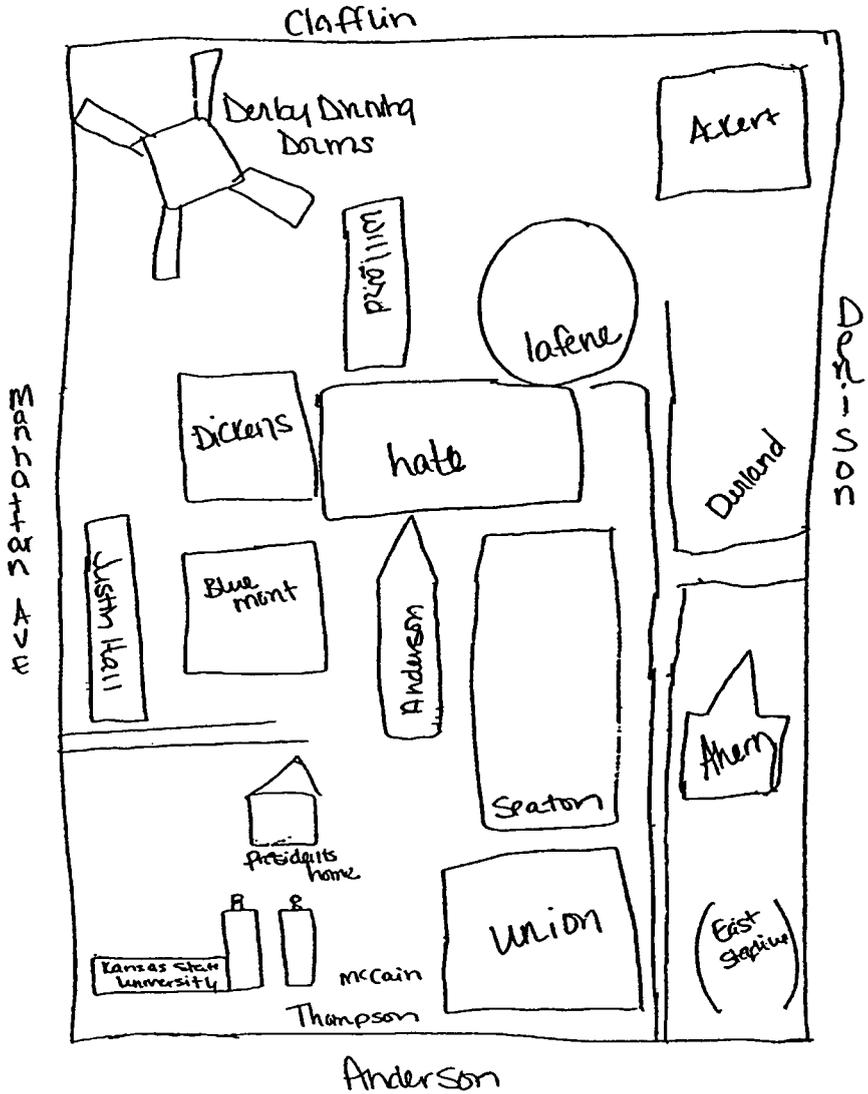


Figure 1. A "mirror map." Northern and southern boundaries are correctly placed. All other information is reversed. Drawn by a female subject.

DISCUSSION AND RECOMMENDATIONS

It is important to remember that students now enrolled in pre-service education programs attended elementary, middle, and high school during years that geography instruction was de-emphasized or missing altogether. University geography courses may have been the students' first encounters with geography. Depending on what geography courses are taken, it is likely that pre-service teachers may not receive much experience with spatial concepts. In retrospect, it was not surprising to find that the number of geography courses taken by the subjects of this study did not have a statistically significant influence on their sketch map test scores. It would seem important to determine through research which geography courses most influence spatial skills development.

Future research could focus on variables dependent upon instructional method and gender. Research suggesting that males and females learn spatial skills differently would be helpful in designing appropriate geography-based spatial learning opportunities for pre-service teachers.

The findings of this study indicate a wide range of spatial ability for elementary pre-service teachers. A core, required geography course that emphasizes the development and refinement of spatial skills seems to be an important part of teacher education programs. Learning the importance of and how to purposefully integrate spatial clues of environments within a course appears to be meaningful. Purposeful input may be illustrated by thinking of a driver and passenger passing through unfamiliar territory. The driver of the car is more likely aware of buildings, landmarks, and routes, as well as his own relation to those sights, than is a passenger. The driver has the task of navigating and so pays keen attention to the environment, while the passenger may only make note of special landmarks or attention-grabbing landscapes. Research is needed to determine if spatially unskilled subjects significantly improve their performance on spatial tasks after receiving purposeful input.

The pre-service teachers would also benefit from tying geography skills to current learning theory. A study of cognitive theory within their pedagogy classes would be appropriate to help the pre-service teachers begin to think about how their future students encode and retrieve spatial data. Liben (1981) speaks of spatial storage, spatial thought, and spatial products. Including those ideas into a higher education pedagogy course would perhaps help pre-service students connect geography and psychology.

At the very least, pre-service teachers need to have a working knowledge of the National Geography Standards (Geography Education Standards Project 1994). Pre-service teachers must be taught from the standards and be taught how to use the standards in lesson design. In so doing, they become

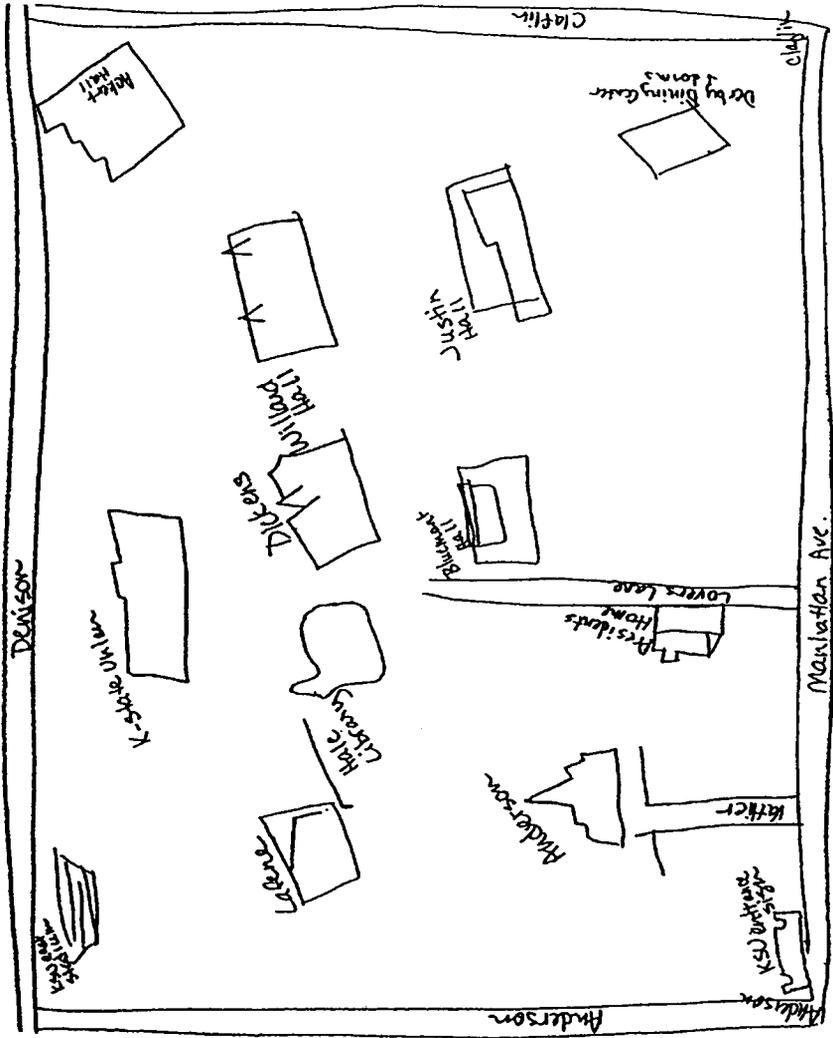


Figure 3. A map identified as representative of a path-like or propositional cognitive recall strategy. Drawn by a female subject.

more geographically proficient and ready to apply their geographic knowledge in elementary classrooms.

REFERENCES

- Banerjee, T.K. 1971. *A Study in Environmental Perception and Learning*. Unpublished doctoral dissertation. Cambridge, Massachusetts: Massachusetts Institute of Technology.
- Bednarz, S., and Bednarz, R.S. 1995. Pre-service geography education. *Journal of Geography* 94(5):482-486.
- Beilin, H. 1992. Piaget's enduring contribution to developmental psychology. *Developmental Psychology* 28(2):191-204.
- Boehm, R., Brierly, J., and Sharma, M. 1994. The bete noir of geographic education: Teacher training programs. *Journal of Geography* 93(2):21-25.
- Casey, M.B. 1996. Understanding individual differences in spatial ability within females: A nature/nurture interactionist framework. *Developmental Review* 16(3):241-260.
- Downs, R.M., and Liben, L.S. 1987. Children's understanding of maps. In *Cognitive Process and Spatial Orientation in Animal and Man*, eds., P. Ellen & C. Thinius-Blanc, pp. 202-219. Boston, Massachusetts: Martinus/Nithoff.
- Downs, R.M., and Meyer, J.T. 1978. Geography and the mind. *American Behavioral Scientist* 22(1):59-77.
- Evans, G. 1980. Environmental cognition. *Psychological Bulletin* 88(2):259-287.
- Gardner, H. 1985. *The Mind's New Science: A History of the Cognitive Revolution*. New York: Basic Books, Inc.
- Geography Education Standards Project. 1994. *Geography for Life: National Geography Standards*. Washington, D.C.: National Geographic Society.
- Golledge, R.G. 1976. Methods and methodological issues in environmental cognition research. In *Environmental Knowing*, eds. G.T. Moore, and R.G. Golledge, pp. 4-47. Stroudsburg, Pennsylvania: Dowden, Hutchinson, and Ross.
- Halpern, D. 1992. *Sex Differences in Cognitive Abilities (2nd ed.)*. Hillsdale, New Jersey: Erlbaum.
- Hermann, D. 1995. Overcoming geographic innocence in geography education. *Journal of Geography* 94(5):527-529.
- Kearney, A.R., and Kaplan, S. 1997. Toward a methodology for the measurement of knowledge structures of ordinary people: The conceptual content cognitive map. *Environment and Behavior* 29(5):579-617.

- Kosslyn, S.M., Ball, T.M., and Reiser, B.J. 1978. Visual images preserve metric spatial information: Evidence from studies of image scanning. *Journal of Experimental Psychology: Human Perception and Performance* 4(1):47-60.
- Law, D.J. , Pellegrino, J.W., and Hunt, E.B. 1993. Comparing the tortoise and the hare: Gender differences and experience in dynamic spatial reasoning tasks. *Psychological Science* 4(1):35-40.
- Liben, L.S. 1981. Spatial representation and behavior: Multiple perspectives. In *Spatial Representation and Behavior Across the Life Span*, eds., L.S. Liben, A.H. Patterson, and N. Necombe, New York: Academic Press.
- Lunneborg, P.W. 1982. Sex differences in self-assessed, everyday spatial abilities. *Perceptual and Motor Skills* 55(3):200-202.
- Lynch, K. 1960. *The Image of the City*. Cambridge, Massachusetts: MIT Press.
- McNergney, R.F., and Herbert, J.M. 1995. *Foundations of Education: The Challenge of Professional Practice*. Boston, Massachusetts: Allyn and Bacon.
- Milgram, S., and Jodelet, D. 1976. Psychological maps of Paris. In *Environmental Psychology (2nd ed.)*, eds., H. Proshansky, W. Ittelson, and L. Rivlin, pp. 115-121. New York: Holt, Rinehart & Winston.
- Miller, H.B., and Burton, J.K. 1994. Images and imagery theory. In *Visual Literacy: A Spectrum of Visual Learning*, eds., D.M. Moore & F.M. Dwyer, pp. 65-83. Englewood Cliffs, California: Educational Technology Publications.
- Murphy, A.B. 1998. Rediscovering the importance of geography. *The Chronicle of Higher Education* 45(10):64.
- National Council for Geographic Education. 1992. The role of geography in pre-service teacher preparation: Geography in the social studies. *Journal of Geography* 91(5), Suppl. 2.
- Petry, A.K. 1995. Future teachers of geography: Whose opportunity? *Journal of Geography* 94(5):487-494.
- Piaget, J. 1977. *The Development of Thought: Equilibration of Cognitive Structures*. New York: The Viking Press.
- Piaget, J., and Inhelder, B. 1956. *The Child's Conception of Space*. London, England: Routledge and Kegan Paul.
- Rediscovering Geography Committee. 1997. *Rediscovering Geography*. Washington, D.C.: National Academy Press.
- Rothwell, D. 1976. Cognitive mapping of the home environment. In *The Behavioral Basis of Design*, eds., P. Suedfeld & J. Russell, pp. 97-123. Stroudsburg, Pennsylvania: Dowden, Hutchinson & Ross.

- Rovine, M., & Weisman, G.D. 1989. Sketch-map variables as predictors of way-finding performance. *Journal of Environmental Psychology* 9(2):217-232.
- Shaha, S.H. 1982. *Cognitive Processes Functional in Spatial Recall. Report No. CSE-R-193*. Washington, D.C.: Institute of Education. (ERIC Document Reproduction Service No. ED 228 271).
- Smith, B.A. 1997. *Social Studies Teacher's Companion*. Boston, Massachusetts: Houghton Mifflin.
- Sternberg, R.J., & Salter, W. 1982. Conceptions of intelligence. In *Handbook of Human Intelligence*, ed., R.J. Sternberg, pp. 3-28. New York: Cambridge University Press.
- Stoltman, J.P. 1991. Research on geography teaching. In *Handbook of Research on Social Studies and Learning: A Project of NCSS*, ed., J. P. Shaver, pp. 437-446. New York: Macmillan.
- _____. 1992. *Teaching Map and Globe Skills, K-6*. Skokie, Illinois: Rand McNally Co.
- Turner, D.R. 1983. *Practice for officer candidate tests*. New York: Arco Publishing.
- Weitzman, D.O. 1981. *Individual differences in spatial memory: Thinking backwards*. Paper presented at the 22nd annual meeting of the Psychonomic Society, Philadelphia, Pennsylvania.

Melinda Shoefeldt taught in public and private elementary, middle, and high schools for eighteen years before she received her Ph.D. from Kansas State University. Her Ph.D. is in curriculum and instruction with an emphasis in social studies education. She is very concerned about the quality of pre-service teacher education programs and the competencies of the teachers those programs produce, especially in the area of social studies and, more specifically, in geography education. She is currently assistant professor in the elementary education department at Ball State University in Muncie, Indiana.

Aerial Photography, Place Related Behaviour and Children's Thinking

Margaret Robertson
and
Margaret Taplin

This paper reports on research that considers the ways in which younger children interpret aerial photographs and construct patterns and relationships from topographical and land use features within the natural and built environments. The children who participated were six-, eight-, and ten-year-old pupils in two geographically distinct locations (N=82). One school was located in a large town, the other in a rural community. While all children regardless of age showed no difficulty interpreting aerial photographs, there were differences between the two location samples that highlighted the influence of everyday experiences of place and provided some evidence of age development. Development aspects were noticeable in the rules used by the children to explain any patterns they detected in the land use placement. Place relatedness was apparent in the vocabulary used and the features recognised.

Keywords: *children's imagery, situated learning, aerial photographs, graphicacy, visual perceptions*

BACKGROUND THEORY

An interest in seeking to understand children's thinking in relation to pattern recognition and cognitive rules generated from aerial photographs requires some reflection on current educational theory and research. Current theories of situated cognition provide a starting point. Such theories seek to explain cognitive behaviour in terms of the prior knowledge and experiences of learners. They explain 'knowing' in terms of the events and contexts that lead to that knowledge (Sebba 1991; Resnick 1992; Spencer and Darvizeh 1995; Strohmayer 1996; Järvelä and Niemivirta 1999). While traditional Piagetian theory (Piaget and Inhelder 1956, Piaget 1973) retains validity for understanding developmental aspects of thinking, the neo-piagetians' interest in the role of social interaction in the construction of meaning demands a broader view. They seek to reground learning theory (Ackermann 1998) in the context of everyday knowing.

To understand the 'knowing' of the person requires a reconstruction of the steps that have led to the response or set of responses that ensue. Ackermann

(1998) states “a learner’s conceptions - as limited as they may be - are always the grounds on which new learning occurs” (383). Be it related to an object or the wider environment (Stea, Blaut and Stephens 1996), once the new information is recorded internally by the person, the learning progression can continue. To arrive at this point is the first step towards the integration of thinking and possible new insights to be gained. At the same time, the end point of this new learning may be judged by others to be misconceptions. The constructivist who sees the learner as an active agent in the production of meaning would view this outcome as good reason to seek to analyse the ‘novice’ view. Diagnosis of the point of departure from expected thinking can signal the ways forward for correction (Marton 1981; Wyndhamn and Säljö 1997).

Constructivist learning theory provides a basis for understanding the learning outcomes that derive from the formal or structured experiences of schools-based curriculum. To comprehend these outcomes there is need for educators and researchers to focus on the informal, unstructured experiences of everyday living. The latter are likely sources of interest and motivation that regulate meaningful learning and uncover barriers to progress.

Such thinking is not new. Dewey (1916) advocated this approach long ago. In environmental education, children’s informal ways of knowing have underpinned the action research of Roger Hart for three decades (1979, 1997). Lamentably, it was only in the closing stages of the twentieth century that such interest in ‘street’ knowing attracted researchers in more traditional mainstream disciplines such as mathematics and science (Hartnett and Gelman 1998).

Place relatedness and space

Researchers know that place specific knowledge can lead to conceptual development that shapes the reasoning of learners and results in concepts that are contextually bound to the realities of the learners themselves (Robertson 1996). In post-modernist thinking, the search to understand place meaning has shifted the base from the traditional geographic construction of space to one that is bounded by the territories of personal connectedness to real and perceived spaces that are many and complexly intertwined for each individual. To explore such interpretations of the effects of globalisation and the impact of time-space compression demands a critique of the intellectual landscape. Writers like Foucault (1970), LeFebvre (1991), Harvey (1996), Soja (1996) and others who advocate the centrality of subjectivity help explain the new thinking about people, place and individual development (Light, Shedlon, and Woodhead 1991).

So too, social theory can help to make sense of current and predicted realities of social interaction. Geographers like Duncan and Ley (1993),

Gregory (1994), Pile and Thrift (1995), Pile and Keith (1997), Peet (1998) and feminist geographers like Massey (1994, 1997) seek to reposition geography in this central arena of critical social theory. They argue for the connectedness of lifeworlds and landscapes in the debate. Importantly, the arguments recognise the importance of 'difference', provide guidance on cultural transformation, and make suggestions about ways to interpret such phenomena as resistance and popular culture.

Aesthetics and moral geographies

Central to place connectedness are feelings and attitudes towards the environment. The writings of Yi Fu Tuan (1974, 1989, 1994) that relate to his construct of *topophilia* are persuasive reminders of the power of the aesthetic in people's lives regardless of being part of the built or natural environments. As well, David Matless (1994, 1996, 1997) highlights this element convincingly with his research into the moral geographies of past and present social communities.

In brief, the research described in the following sections of this paper draws upon a wide literature base that symbolises the diversity and complexity of post-modernist thinking. The brevity of this sketch is acknowledged. Nevertheless, raising such issues is regarded as indicative of the complexity of influences on thinking outcomes. Situated learning with its associated developmental and gender related issues along with an interest in place connectedness were the contributing variables to the research. These issues were explored through the medium of aerial photography and imagery related to children's everyday lives. As the results indicate, the responses highlight the influence of global, national, and locally specific aspects of space related thinking.

GENERALISATIONS, RULES AND AERIAL PHOTOGRAPHY - FROM THEORY TO RESEARCH

In Vygotsky's view, "communication presupposes generalisation and development of word meaning" (trans. 1986, 7). This conclusion is well supported in our previous research that examined the capacity of adolescents aged twelve and fifteen to make generalisations from visual-spatial problem solving tasks (Robertson 1995, 1996; Taplin and Robertson 1997). Verbally presented problems and mathematical representations of space required participants to generate rules, describe patterns, and finally represent these constructs in graphic formats. Although this research highlighted some place-specific thinking, the expected developmental progression in thinking was

not obvious, thus prompting new enquiry with younger children. Other research had also shown the importance of icons or conventions of every day living associated with young people's perceptions of home (Abbott-Chapman and Robertson 1999). As a result, we sought ways to integrate everyday knowing into tasks that would reveal cognitive patterning and meaning as well as place-specific, contextually relevant knowing.

The decision to use aerial photographs for the task was based on the long standing knowledge that very young children have little difficulty understanding them, often revealing greater depth of understanding than their language development permits explanation (Spencer and Darvizeh 1995). We also recognised that while others have tried to advance models of spatial cognition, there is still much that is unexplained. As Couclelis (1996) comments, "the relationship between the spoken words and the underlying cognitive structures is far from transparent" (133). Nevertheless, if as Stea, Blaut and Stephens (1996) argue, cognitive mapping of the macro-environment is 'a cultural universal' and begins at a very early age, then educators need to find out the content of these maps to use in developmental teaching strategies and be cognisant of the greater influences that pervade social reality for the twenty-first century. These arguments helped shape the detail of the study.

THE STUDY

Against this background of social, educational, and geographic theory, we sought ways to investigate children's interpretations of real space using aerial photographs and designing tasks that we hoped would reflect their everyday worlds or situated cognition of visually presented information. Other aims were to seek the preferred strategies used by children to represent their understandings, to assess their understanding of and skills with graphical representation of ideas, and to identify variations in children's thinking that may be attributed to cognitive development, place of residence, and where possible, gender.

Sampling and research sites

Samples of children were drawn from two primary schools located in contrasting geographic and socio-economic locations of Tasmania. One school was located in a rural town recognised as central to a prosperous farming district and in close proximity to small coastal fishing ports. The other school was located at considerable distance from the first in a low socio-economic suburb of a medium sized urban place. Apart from these place differences, all children in the suburban town location lived locally and were either taken

to school by car or walked. In the rural town, the majority of the children travelled to school by bus from surrounding villages and farms. Journeys of one hour to and from school were common.

The final sample of 82 children who contributed to the findings reported were randomly selected to take account of gender and ability from each of school grades one (six-year-olds), two (eight-year-olds) and four (ten-year-olds). Table 1 shows the final numbers by grade and gender.

METHODS

In order to study the children's cognitive processing of visual-spatial stimuli and the generalisations they make from the patterns they recognise, a number of tasks requiring problem solving through observation, memory, and recall were developed and implemented. These were administered in one-to-one interviews of approximately forty minutes duration conducted over a period of one week in each school.

All children were tested for visual perceptual skills using a standardised instrument (Gardner 1996). This procedure followed previous findings revealing closer correlation between interpretive reasoning of real world tasks and performance on visual spatial standardised tests than performance on general reasoning tests supposedly measuring general intelligence (Robertson 1995). Although standardised in the United States, the test is also recognised by the Australian Psychological Society. Furthermore, the scales of the test included items that could be valuable when linked to other analyses. They were visual discrimination, visual memory, visual spatial-relationships, visual form-constancy, visual-sequential-memory, visual figure-ground, and visual closure. Hence, administering this instrument to an Australian sample was justified as providing another source of information on perceptual cognition to compare with outcomes from the real world problems.

The key task involved a forty by sixty centimetre colour aerial photograph of a village and surrounds (see Figure 1A - F for illustration). The photograph was placed on the floor where trials had shown that young children were able to manage the required tasks. When asked to state what they could see in the photograph, children mentioned the fields, houses, trees, and roads. No prompting was required. Having confirmed this recognition the task involved positioning on the photograph, two-centimetre square blocks featuring photographic images of common town landmarks "where they would expect to find that 'place'." There were twenty-four blocks in total and children were given complete freedom in the order they chose them and the total number placed. There was no time restriction. Images included the following: petrol stations, bakery, police, library, cemetery,

School Type	Student Age	Girls	Boys	Total Students
Rural	6	8	9	17
	8	6	5	11
	10	4	5	9
Towns	6	3	4	7
	8	8	10	18
	10	12	8	20

Table 1. Sample numbers by age, gender, and place (N=82).

hotels, hospital, church, supermarket, bank, school, cinema, McDonalds, public toilets, public telephone box, and video shop. Like the big M sign for McDonalds, some contained features known to be symbols. While some could be interpreted from written signs, others appeared to have no known symbolism. For each interview, blocks were randomly arranged beside the photograph and children were encouraged to 'locate' as many they could and explain as they went what they were doing or could see in the images. Interviewers recorded the order with which the blocks were placed and the reason given for each placement. Once the placement of blocks was completed, children were shown a basket of one-centimetre blocks that they were asked to regard as people and place in handfuls where they expected the people to be found in the places identified on the photograph. Underlying this request was the search for pattern understanding of geographic concepts of density and distribution.

Having 'completed' the task, children were asked to give an explanation of any pattern or 'rule' that helped the placement. These verbal explanations were recorded. Finally, children were asked to 'draw a graph or picture' to represent in graphical form their understandings of perceived patterns.

RESULTS

Responses to the aerial photograph were analysed using phenomenographic categorisation of meanings (Marton 1981). Generally, the task was handled confidently by children in both residential locations, with

placements that seemed supported by feasible explanations. Six categories of meaning were identified from the placement of land use and people blocks. This six point scale was used in the final categorisation of responses. Categories were as follows:

1. Random placement
2. Personalised explanation
3. Links land use and people
4. Links land use, people with place location
5. Links land use, people, and place location with 'logical' distribution on photograph
6. Shows abstract understanding of distribution and density of people and land use.

A similar process of analysis was conducted with the graphical representations produced by the children. The results of this process suggested the following seven levels of graph representations:

1. drawing of an unrelated picture (intuitive/iconic thinking)
2. lists of city locations and country locations
3. sketch maps showing locations of some or all of icons but not acknowledging the 'people' variable
4. sketch maps showing exact replicas of what had been placed on the aerial photograph
5. similar to (4) but beginning to give an indication of clusters of people
6. column graphs showing the numbers of people at each location (beginning to draw on taught knowledge about graphing)
7. graphs showing some sense of relating the number of people to the location of the services (intuitively applying taught knowledge to the given context).

Figure 1A – F provides examples of the land use categories and graph types selected to show the range of responses and the patterning of thinking used by the children when translating their aerial photograph land use and people placement into representational meaning.

As can be seen in the examples, the tasks were tackled in highly individualistic ways. Six-year-olds, Jessica and Mary, demonstrated an understanding of the relationship between people and land use and generally gave a good indication that this was linked to place on the aerial photograph. Jessica's comments add to this conclusion. "*They look like heaps of shops. Heaps of people where heaps of houses because they live in the houses.*" However, Mary was quite different in her explanation. While her placement of the blocks and people showed their linked association, her placement on the photograph did not suggest any connection to the 'real' places. For instance, she placed a bank and people in the middle of the

forest. At the same time, her pictorial representation of her efforts seemed to suggest a higher order outcome.

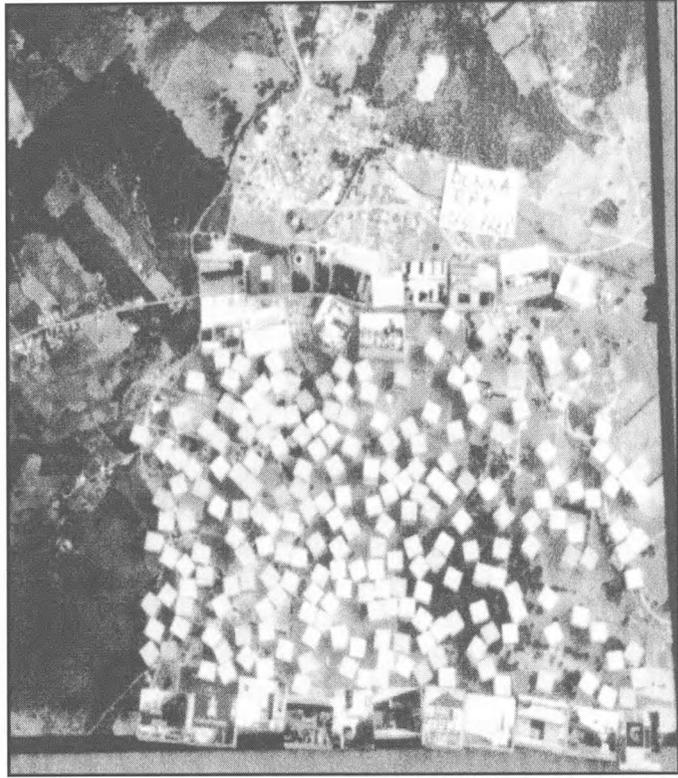
Donna, also six years old, was the one to highlight the importance of giving children open-ended challenges and listening to their reasoning. Along with members of her preparatory class she had visited the nearest 'big' town during the week prior to the testing. This required travelling some two hours by bus and included lunch at McDonalds. At the time of testing, she was apparently still trying to integrate the experience into her existing mental maps. As illustrated in Figure 1, her efforts were quite an extraordinary illustration of situated cognition 'in action'. In response to the question regarding the photograph she showed she understood the main features. When asked to place the blocks on the aerial photograph she created two parallel lines. The one nearest to her she described as the town she had visited (included the McDonalds symbol) and the other which aligned with the town buildings in the photograph she described as her own town. The placement of 'people' in vast quantities between these two lines was explained as follows. "*These are the X town people all trying to get to Y town. And these are all the Y town people all in their cars trying to get to X town.*" The conclusion may have been that Donna had no, or very little, understanding of the task. Yet the explanation and the actions revealed quite a complex story and one that would certainly provide direction for the teacher to develop her spatial skills.

By contrast, the examples of the efforts of the three ten-year-olds, Joshua, Damon, and Samantha, show the progress in formal and informal learning after four years. All were able to link people, place and locations together in a logical pattern on the aerial photograph. Samantha demonstrated the most expert understanding here with the placement of land use blocks and people in appropriate density and distribution patterns. To complement these understandings, the representations of Joshua and Samantha suggest a genuine grasp of graphical concepts and generalisations. By contrast, Damon's pictorial effort at showing the land use pattern does not seem to reflect much more than an attempt to replicate the land use placements on the photograph.

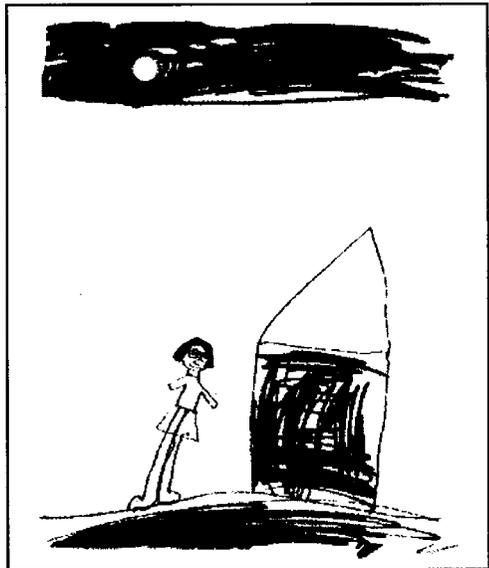
Test of Visual-Perceptual Skills

Along with their scaled scores for performances on the Test of Visual-Perceptual Skills (TVPS), coded data from the aerial photographs (land use placement and graphs) were first analysed by comparing means. Table 2 provides a summary of the means for these three variables by school, gender and grade.

The data show qualified support for a general trend of improved performance on all three tasks with age. There are several other interesting points



Land Use
Category 2



Graph
Type 1

Figure 1A. Aerial photography, land use category, and graph type for Donna, age 6 years.



Land Use
Category 4



Graph
Type 3

Figure 1B. Aerial photography, land use category, and graph type for Jesseca, age 6 years.



Land Use
Category 3

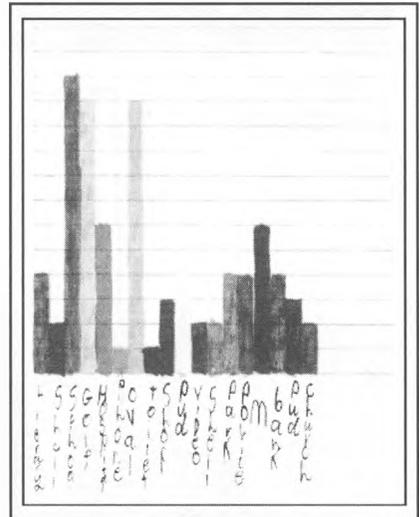


Graph
Type 4

Figure 1C. Aerial photography, land use category, and graph type for Mary, age 6 years.



Land Use
Category 5

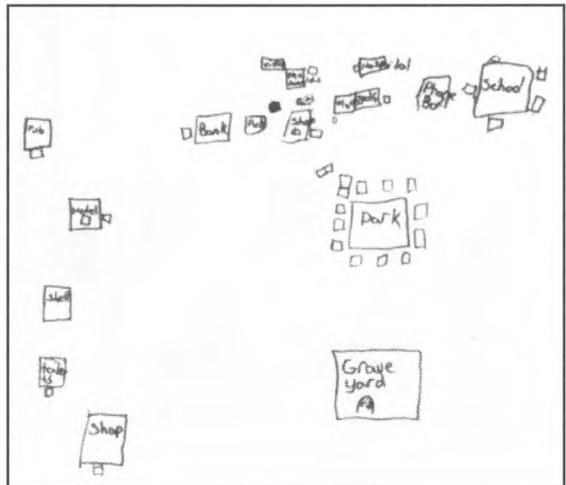


Graph
Type 6

Figure 1D. Aerial photography, land use category, and graph type for Joshua, age 10 years.



Land Use
Category 4

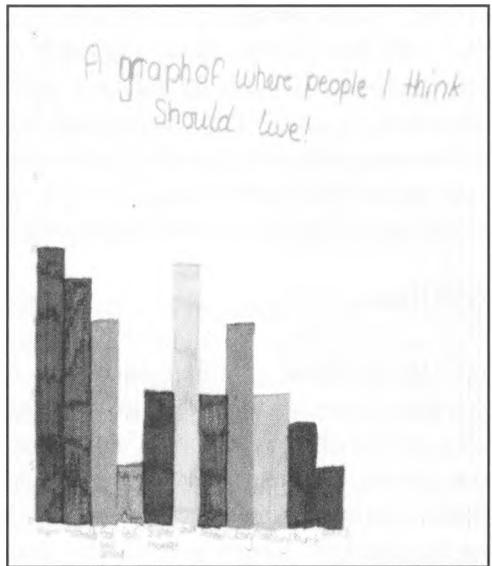


Graph
Type 2

Figure 1E. Aerial photography, land use category, and graph type for Damon, age 10 years.



Land Use
Category 6



Graph
Type 6

Figure 1F. Aerial photography, land use category, and graph type for Samantha, age 10 years.

to note. Generally there is some correspondence between the directions of the means on all three scales. Some gender differences occur, most notably in the urban school, and seem to suggest the greater confidence of the older boys with the graphing exercise. In the grade two class this shows up as one category point difference between performance on the land use task and the graph task.

To test for statistically significant differences on the three tasks, paired *t* test analyses were conducted. Table 3 presents the statistics. Of interest and importance to this study was the absence of statistically significant differences between the land use task and the graph task, which suggested a correlation in the skills required to perform each task. However, the presence of statistically significant differences between both the reality based tasks and overall direction of responses for the standardised Visual-Perceptual Skills tasks ($p < .001$) suggested that the latter might have been measuring different competencies.

The inferences previously described from the means for the separate age, gender and location based sample sub-groups seemed of lesser importance to this finding for the overall sample ($N=82$) and a more accurate measure of the ways in which the various measures of perceptual-spatial competence were interacting.

To examine this finding further, the individual sub-tests of the TVPS test were scrutinised for the apparent 'high achievers' in the sample. Table 4 shows the break down on selected high performance results of children on both the reality based tasks and their corresponding performance on all the sub-scales of the TVPS. The highlighted results illustrate the variation in performance with these selected individuals scoring comparatively 'high' on some sub-scales and apparently 'low' on others. This inconsistency in performance may partly explain the statistically significant differences.

First Choices

As part of the recording process, the order with which each of the blocks was placed was noted. The break down on first choices is shown in Table 5 with all first choices indicated in the first column. Interestingly, in the first four choices approximately half of the total sample placed the same four blocks. Not surprisingly, the image of the 'big M' of McDonalds was popular, but the most frequently placed first choice was a block showing trees to represent a 'park'. Perhaps this illustrates the connection of younger children to nature and the environment. The first choices of the 'school' block seemed well explained by familiarity. The 'hospital' block that was represented by a red cross seemed to invoke an association of symbolism similar to the 'big M'. The issue of symbols that may be embedded in the imagery of the children

Age	School Type	TVPS		Graph Type		Land Use Categories	
		Girls	Boys	Girls	Boys	Girls	Boys
6	Rural	60(8)	50(9)	1.5	1.4	2.5	1.4
	Town	61(3)	61(4)	2.5	2.5	2.7	2.8
8	Rural	76(6)	73(5)	3.6	4.0	4.1	3.4
	Town	68(8)	64(10)	3.0	3.1	2.2	2.5
10	Rural	74(4)	77(5)	3.7	4.0	4.0	3.2
	Town	64(12)	78(8)	3.2	4.5	3.0	4.0

Table 2. Means by year, gender and place for performance on TVPS, graph type and land use placement category. Sample numbers in parentheses.

seems central to an investigation of situated cognition. This theme and others are considered in the discussion that follows.

DISCUSSION

Theoretical considerations of situated learning and subjective interpretations of space and place highlight the value of looking more deeply at the explanations of the children, especially as they relate to place experience. In this study, one of the interesting components was the way in which the younger children dealt with blocks containing well-known land use symbols. Of interest were the visual images that guided decisions in the image identification. Illustrative of this phenomenon are the five land use images contained in Figure 2.

The McDonalds 'big M' and the Shell sign represent global icons and while both are well known, the personal relevance of the 'big M' perhaps accounted for its earlier recognition. The ubiquitous McDonalds was recognised immediately by all children. For the city suburban children there is easy access to McDonalds in the adjacent neighbourhood. Their placement of the block in the middle of the aerial photograph settlement was the logical spot. By contrast, there was no McDonalds in the rural town. However, the six-year-old children having visited the nearest McDonalds, some 100 kilometres away during the week prior to our interviews, used explanations like 'it's in Burnie', thus naming the town. They then proceeded to locate the block on a road running away from the aerial photograph settlement describing this as 'the way to Burnie'. As with Donna's effort (see Figure 1A), observations of the actions of these young children and listening to their reasoning

Variables	df	t-value	p-value
TVPS, Land use category	81	32.846	<0.001
TVPS, Graph type	81	32.410	<0.001
Land use category, graph type	81	0.408	0.6847

Table 3. Results of paired t-test.

provided ample evidence of spatial competence seemingly beyond the traditional Piagetian expectations.

Interestingly, and perhaps quite surprisingly given the prevalence of home telephone ownership, the national symbol of the telephone company ‘Telecom’ was recognised in the first five choices by almost a third of the sample (See Table 5). Some of the reasons for its location explain the thinking. They provide links to the source of their associations.

There in case the car breaks down (eight year girl).

Not all homes might have phones (eight year girl).

It’s next to the road. Convenient (year two boy).

Because it’s in the city (six year boy).

‘cause that’s where the telephones are (six year girl).

On the side of the road, wouldn’t be in the middle of the road - not accessible (ten year boy).

Most phones are on corners (ten year boy).

Landmarks along the routes to and from home and familiar places feature in many of these reasons. Phone boxes observed ‘on the side of the road’ suggest visibility from the bus or car. These comments further suggest that their connections need not necessarily have any relationship to spatial intelligence other than perhaps good spatial memory. The observation was supported by the visual memory sub-scale scores of children who scored well on all three tasks (see Table 4).

Another familiar icon was evident in the block for the Trust Bank. This is the state owned bank and a familiar sign throughout all communities in the region. With eighteen children identifying the ‘bank’ within their first four choices (see Table 5) this was a further favourite for early recognition.

All the symbols identified so far would have a presence in most all or most communities throughout the state where the research was conducted. Only one block in Figure 2 could be argued as containing a symbol that is

	TVPS Total Scaled Score	Visual Discrim- ination	Visual Mem- ory	Visual Spatial Relations	Visual Form Construc- tion	Visual Sequen- tial	Visual Figure Ground	Visual Closure	Graph Type	Land Use Cate- gory
Age Six										
Girl 1*	65	4	14	13	3	13	11	7	4	3
Boy 1	84	11	13	12	15	14	8	11	3	4
Boy 2	90	12	15	15	8	11	17	12	3	4
Age Eight										
Girl 1	85	14	11	11	14	11	12	12	5	6
Girl 2*	77	11	14	9	11	11	13	1	4	4
Girl 3	81	11	14	9	11	11	13	12	4	6
Boy 1	80	15	8	12	11	10	12	12	4	4
Age Ten										
Boy 1	90	12	14	14	11	11	15	13	6	5
Girl 1	88	12	15	12	11	12	12	14	6	6
Boy 2*	49	5	8	11	2	8	11	4	4	5
Girl 2	95	12	11	14	14	15	15	14	5	5

Table 4. Individual performances of selected 'high achievers' in each grade on TVPS test including separate scales, graph task and land use task. *Note:* * indicates variable sub-scale score on the TVPS.

local in significance or specific place related. Many of the six-year-old children from the rural town identified the school lighthouse symbol shown in Figure 2 as an actual lighthouse. The prevalence of the observation was sufficient to make it particularly noteworthy. Furthermore, its identification in the data came as an unexpected illustration of the contextually bound and locally situated power of icons. As the word 'school' in the block was not recognised by these children, their familiarity with the lighthouse as a sign was viewed as a symbol they had learned from their residential location near ports and coastal shipping activities. To make this observation stronger, the word 'sign' was not used by any of the town school children who recognised this as their own school plaque. The older children who were able to read the sign associated it as 'the school'.

The imperative of searching for the meaning that guides action is apparent in the children's explanations. Strong connections to the home environment

	1st Choice	2nd Choice	3rd Choice	4th Choice	5th Choice	Percent of Totals
Park	18	9	7	6	4	54*
McDonalds	16	6	9	4	5	49*
School	12	8	10	7	3	47*
Hospital	11	12	8	5	6	53*
Police	8	7	5	3	4	33
Football oval	5	1	2	4	4	20
Tel. box	3	2	12	4	3	29
Petrol station	2	5	7	5	9	34
Hotel	1	1	3	4	1	12
Cemetery	1	3	4	4	5	21
Supermarket	1	3	3	3	2	15
Library	0	2	0	1	1	5
Cinema	1	0	3	6	2	15
Bakery	1	1	0	0	2	5
Bank	1	8	2	7	2	24
'City'	1	0	0	0	0	1

Table 5. Choice pattern of the first five 'places' located on the aerial photograph (N= 82).
Note: * highlights where approximately one half of the total sample placed the same blocks for the first four choices.

are logically reflected in the land use associations shown with these familiar icons. Such connections to symbols of living are further evident in the conversations recorded from the children's explanations. Representative of these constructs are the reasons stated by two, ten-year-old children located in the rural town and urban town school respectively. Rural town girl, Sarah, who travelled from the country one hour each day to get to school gave reasons for her placements like:

School: *Not much travelling to get there, nice trees around.*

Supermarket: *Distant from first supermarket, central, convenient to town for rural people.*

Bank: *Stop for cash on way to town.*

Petrol station: *First petrol station in town, so second one should be out of town.*

By contrast, town based, ten-year-old Melody, shows a different perspective. Her reasons for placing selected blocks appeared to reveal a sense of violence as well as close proximity to the city.

McDonalds: *Has got enough space for children to play in, could easily go there if you couldn't be bothered cooking a meal.*

Bank: *Close to the police station so they won't get robbed.*

Cinema: *Close to the city. People will go there instead of going out on the road and being silly.*

Cemetery: *Most graveyards are on the outside of towns or cities. If they were in the middle people could go past and graffiti them.*

In all these illustrations the evidence is of the repeated influence of the familiar day to day environment associated with living, travelling to school and personal experience that may come from home, school or other popular culture influences. Although the results suggested some evidence of age-related, developmental competence, they were not great. This observation led to the conclusion that the younger children showed 'higher' levels of competence with visual representation skills relative to the traditional Piagetian based expectations. As carefully determined at the beginning of each interview, the younger children, like the older children, showed no confusion with the aerial photograph. In terms of their efforts to represent any patterns identified in each of the tasks, children in both locations showed comparable results. However, the dialogue attached to the reasons for their placement indicated the obvious influence of contextually related learning. Many of the children attending the rural school travelled long distances from surrounding settlements. At the urban school most of the children live within easy walking or cycling distance from the school. As found in the earlier work of Acredola, Pick and Olson (1975), the different views of the children can be linked to their familiar everyday experiences.

For educators in general, there are several important reminders in the findings of this study. First is the role of teachers as interpreters of the curriculum who build bridges from the policy documents to the minds of children. The metaphor of bridge building with its associated scaffolding is a way of visualising the teaching and learning process. To do this well requires a knowledge of the child's world as it is and not as we imagine it to be. Often teachers are outsiders to the child's neighbourhood. Such physical distance can make the curriculum appear sterile and irrelevant unless translated into the context of the child and their everyday knowing. Second is the importance of removing prejudice from the judgments made concerning readiness to learn. This study, along with many others, supports the view that very young children can make meaning spatially from aerial photographs and representative tools such as graphs and pictures. Children, like adults, live in a visual-spatial environment where they need strategies for daily coping. If we use our imagination, then the world of the child can be the starting point for innovative and lasting learning.

CONCLUSION

In their review of 'connectionist models in spatial cognition', Ghiselli-Crippa, Hirtle and Munro (1996) make clear that the representations of space made by humans are likely to be quite complex. Considerably more detailed analysis than is the scope of this research would be needed to formulate a clear model of the likely locational differences between the two samples. Nevertheless, differences such as the lighthouse icon seem linked to place. Uncovering both the variability and the comparisons in perception has been achieved by contriving situations that enable children to express their meanings in visual, spatial, verbal and graphic ways. Other similarities in children's thinking indicate the influence of regional, national, and global symbolism. The combination of skills enabled by this process is a powerful way to access their situated learning from living, travelling and learning in a culturally specific context.

ACKNOWLEDGMENT

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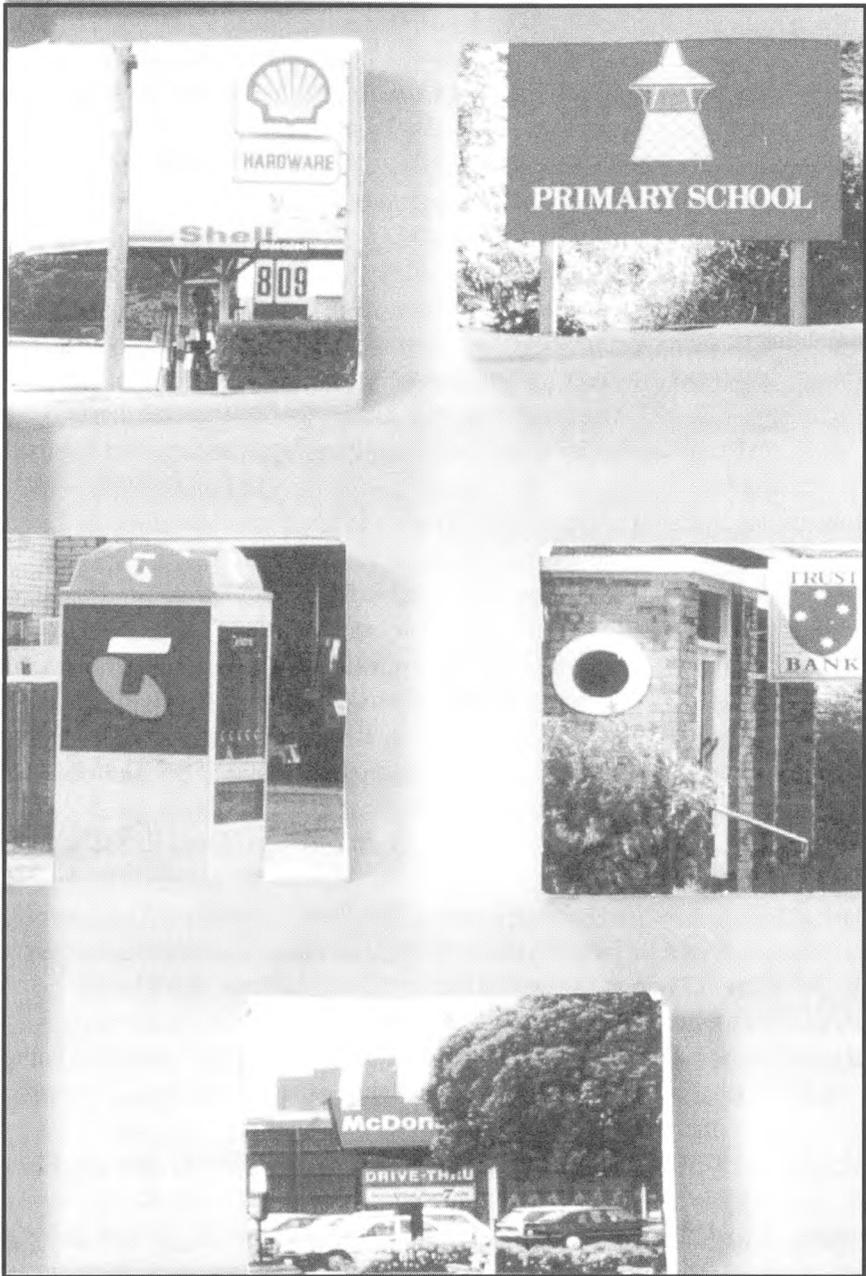


Figure 2. Land use blocks with recognised symbolic imagery.

REFERENCES

- Abbott-Chapman, J. and Robertson, M. 1999. Home as a private space:some adolescent constructs. *Journal of Youth Studies* 2(1):23-43.
- Ackermann, E.K. 1998. New trends in cognitive development: Theoretical and empirical contributions. *Learning and Instruction* 8(4):375-386.
- Acredola, L.P., Pick, H.L., and Olson, M.G. 1975. Environmental differentiation and familiarity as determinants of children's memory for spatial location. *Developmental Psychology* 11(4):495-501.
- Couclelis, H. 1996. Verbal directions for way-finding: Space, cognition, and language. In *The Construction of Cognitive Maps*, ed. J. Portugali, pp. 133-153. The Netherlands: Kluwer Academic Publishers.
- Dewey, J. 1916. *Democracy and Education*. New York: Macmillan Publishing Co.
- Duncan, J. and Ley, D. (Eds.) 1993. *Place/Culture/Representation*. London, England: Routledge.
- Foucault, M. 1970. *The Order of Things: An Archaeology of the Humman Sciences*. New York: Random House.
- Gardner, M.F. 1996. *Test of Visual-Perceptual Skills (n-m) Revised Manual*. USA: Psychological and Educational Publications, Inc.
- Ghiselli-Crippa, T; Hirtle, S. and Munro, P. 1996. In *The Construction of Cognitive Maps*, ed., J. Portugali, pp. 87-104. The Netherlands: Kluwer Academic Publishers.
- Gregory, D. 1994. *Geographical Imaginations*. Cambridge, Massachusetts: Blackwell Publishing Company.
- Hart, R. 1997. *Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care*. London, England: Earthscan Publications Ltd.
- Hart, R. 1979. *Children's Experience of Place*. New York: Irvington.
- Hartnett, P. and Gelman, R. 1998. Early understandings of numbers: Paths and barriers to the construction of new understandings. *Learning and Instruction* 8(4):341-376.
- Harvey, D. 1996. *Justice, Nature and the Geography of Difference*. Malden, Massachusetts: Blackwell Publishers Inc.
- Järvelä, S. and Niemivirta, M. 1999. The changes in learning theory and the topicality of the recent research in motivation. *Research Dialogue in Learning and Instruction* 1(2):57-66.
- LeFebvre, H. 1991. (trans. D. Nicholson-Smith). *The Production of Space*. Oxford, England: Blackwell Publishers Ltd.
- Light, P., Sheldon, S. and Woodhead, M. (Eds.) 1991. *Learning to Think*. London, England: Routledge.

- Marton, F. 1981. Phenomenography - Describing conceptions of the world around us. *Instructional Science* 10:177-200.
- Massey, D. 1994. *Space, Place and Gender*. Oxford, England: Blackwell Publishers Ltd.
- Massey, D. 1997. A global sense of place. In *Reading Human Geography*, eds., T. Barnes and D. Gregory, pp. 315-323. London, England: Arnold.
- Matless, D. 1994. Moral geography in Broadland. *Ecumene* 1(2):127-156.
- Matless, D. 1996. Visual culture and geographical citizenship: England in the 1940s. *Journal of Historical Geography* 22(4):424-439.
- Matless, D. 1997. Moral geographies of English Landscape. *Landscape Research* 22(2):141-156.
- Peet, R. 1998. *Modern geographical thought*. Oxford, England: Blackwell Publishers Ltd.
- Piaget, J. and Inhelder, J.L. 1956. *The Child's Conception of Space*. London, England: Routledge and Kegan Paul.
- Piaget, J. 1973. *The Child's Conception of the World*. St. Albans, England: Granada Publishing Ltd.
- Pile, S. and Keith, S. 1997. *Geographies of Resistance*. London, England: Routledge.
- Pile, S. and Thrift, N. 1995. *Mapping the Subject*. London, England: Routledge.
- Resnick, L.B. 1992. From protoquantities to operator: Building mathematical competence on a foundation of everyday knowledge. In *Analysis of Arithmetic for Mathematics Teaching*, eds. G. Lenhardt, R. Putnam & R.A. Hattrup, pp. 373-430. New York: Lawrence Erlbaum Associates.
- Robertson, M.E. 1995. Adolescents, place experience and visual intelligence: Implications for educators. *International Research in Geographical and Environmental Education* 4(2):65-84.
- Robertson, M.E. 1996. New meanings in time and space: ethical dilemmas for teachers. In *Developments and Directions in Geographical Education*, eds. R. Gerber & J. Lidstone, pp. 225-236. Cleveland, Ohio: Channel View Publications.
- Sebba, R. 1991. The landscapes of childhood. *Environment and Behavior* 23(4):395-422.
- Soja, E.W. 1996. *Thirdspace Journeys to Los Angeles and Other Real- and-Imagined Places*. Cambridge, Massachusetts: Blackwell Publishers Ltd.
- Spencer, C. and Darvizeh, Z. 1995. The case for developing a cognitive environmental psychology that does not underestimate the abilities of young children. In *Readings in environmental psychology*, ed. C. Spencer, pp. 15-26. London, England: Academic Press.

- Stea, D., Blaut, M., and Stephens, J. 1996. Mapping as a cultural universal. In *The Construction of Cognitive Maps*, ed. J. Portugali, pp. 345-360. The Netherlands: Kluwer Academic Publishers.
- Strohmayr, U. 1996. Pictorial symbolism in the age of innocence: Material geographies at the Paris World's Fair of 1937. *Ecumene* 3(3):282-304.
- Taplin, M. and Robertson, M. 1997. Secondary school students' generalisations of patterns. *The Mathematics Educator* 2(2):148-165.
- Tuan, Yi-Fu. 1974. *Topophilia: A Study of Environmental Perception, Attitudes and Values*. London, England: Prentice-Hall.
- _____ 1989. Surface phenomena and aesthetic experience, *Annals of the Association of American Geographers* 79(2):233-241.
- _____ 1994. Environmental determinism and the city: A historical-cultural note. *Ecumene* 1(2):121-126.
- Vygotsky, L. 1986. (Trans. by A. Kozulin). *Thought and Language*. London, England: The MIT Press.
- Wyndhamn, J. and Säljö, R. 1997. Word problems and mathematical reasoning - a study of children's mastery of reference and meaning in textual realities. *Learning and Instruction* 7(4):361-382.

Margaret Robertson is Senior Lecturer in Education at the University of Tasmania. Her research interests in geographic education are in the links between everyday experience and place related thinking.

Margaret Taplin is an educational consultant based in Hong Kong. Her research links to a teaching career in Mathematics Education with interests in gender issues and problem based learning.

Experiences of Geography In Higher Education: The Case of Geography Teachers in England

Ashley Kent

This article starts by exploring the history of the 'gap' between school and university geography. Then, through a survey of twenty geography teachers on a master's course at the Institute of Education, University of London, the nature of the divide is explored. Teachers were asked about the nature of their undergraduate geography courses, its relevance to their teaching in school, and which books had the greatest impact on them. The implications of the survey results are then considered.

Keywords: *University geography, school geography, linkages*

AN EMERGING DIVIDE

Traditionally in the UK there have been very strong links between school and university geographers. "In the early days there was something of a paternalistic and hierarchical relationship between academics and school teachers but there was an ongoing mutual concern about the strength and quality of geography in schools" (Kent and Smith 1997, 193). The schools-universities relationship was perhaps strongest in the 1960s and 1970s when the "new" geography spawned a number of new syllabi and textbooks in schools. By the mid 1980s the climate for geography had changed and concerns began to grow that school and university geography were growing apart. A 1988 conference entitled "From Secondary to Higher Education: Overlap or Divide?" was organised by the Secondary-Tertiary Interface Committee (STIC) of the Geographical Association (GA). STIC's aims were "to facilitate information flows between the secondary and tertiary sectors of geography education and to develop awareness of changes in one sector, that have bearing on the other sector." The 1988 conference stressed the need for those in higher education (HE) to become more familiar with the changes taking place in secondary education and to provide more relevant and stimulating undergraduate courses. Arguably this "distance" has widened in the last ten years or so as school geographers have become more curriculum and assessment orientated, particularly because of the National Curriculum,

whereas academic geographers have become strongly influenced by the periodic Research Assessment Exercises (RAE) and Teaching Quality Assessments (TQA). The related pressures to specialise, write and research has meant that geographers in higher education are less frequently, and in some cases no longer, writing textbooks, examining at “A” level¹ and attending the Geographical Association (GA) Annual Conferences.

This “decoupling” of school from university geography, a term first used by Machon and Ranger (1996), “has left most school geography untouched by the structuralist, humanist, and realist critiques of the positivistic revolution” (*ibid.*, 41). Goudie (1988) has spoken of the “Great Divide” between schools and universities. “A chasm has developed between those who teach at school and those who teach in universities” (Goudie 1993, 338). Recently an MA dissertation (Smith 1996) has explored current perceptions of the “divide” and gathered ideas on ways of improving communications and contact between the two “sides.” That research focused on the university side of the divide by gathering views of HE geographers. Most academics surveyed had only a limited understanding of the school curriculum in geography, particularly the content of “A” level geography syllabi, but at least it was heartening to note that most recognized the need to improve communication and contact in order to raise levels of understanding and to clear up misconceptions. “However it was clear that the constraints of time and money, and of external pressures, especially the demands of the RAE in higher education and the implementation of curriculum changes in secondary education, were seen as exerting severe limitations on progress in that direction” (Kent and Smith 1997, 197).

Various strategies have been discussed and implemented. For instance, the GA’s School-HE Links Working Party proposed the following seven priorities in its January 1998 action plan:

1. Influence assessment methods and curriculum changes in geography—especially important in human geography at the 16-19 level.
2. Raise the number of students taking geography at school and HE.
3. Raise recruitment of geography graduates going on to teacher training.
4. Sell and promote geography as a discipline.
5. Develop dialogue involving both sides of the interface over the need for liaison.
6. Develop GA publications reflecting current research/teaching in HE and the progress in the subject.
7. Promote geography as a discipline alongside pedagogic developments.

These and other strategies are discussed on pages 198-199 in Kent and Smith (1997). Bradford reminds us of the mutual advantage to be gained from greater interaction between geography teachers at the secondary level and geographers in higher education.

Higher education can benefit from learning about curriculum development in secondary education, about approaches to learning and about student profiling and assessment. Secondary education could profitably be updated about research trends in the subject and indeed about what is taught in higher education. Some of the ideas may be suitable for inclusion in secondary education. (Bradford 1996, 286).

RESEARCH UNDERTAKEN

One aspect of the divide that has been little studied is the relationship between the geography studied at university by students who subsequently become secondary school teachers and the geography they teach in schools. Some work has been done on the university geographies experienced by trainee teachers (Bale and McPartland 1986; Rynne and Lambert 1997) but in England, there has not been a study of trained geography teachers and their academic development experiences in higher education geography degree programs. An opportunity sample presented itself in the form of students on the MA Geography in Education course, run by the Institute of Education University of London. This one-year full-time, two-year part-time course was established in 1968 and is probably the most established higher degree course for geography teachers.² It serves as both professional development for teachers and a fully-fledged higher degree course and qualification.

To explore the detailed nature of the relationship between geography degree courses and the teaching of geography in secondary schools, I surveyed ten MA students in both 1996 and 1999, at the start of a module entitled "Progress in Geography: Changing Viewpoints." That ten-session module focuses on changes and developments in geography at higher education level to illuminate different and contrasting philosophies, methodologies, and meanings within geography and to relate these changes to geography in education. The first session of the module is entitled "Experiences of Higher Education" and requires the students to have completed some written homework ahead of the session. This homework is intended to encourage students to reflect on their own experiences of geography in higher education and to share those with fellow students as a humanistic introduction to some of the latest academic developments at the research frontiers that are the substance of the module. That homework provided the data for this research.

I asked the students to undertake a written assignment addressing the following:

1. Summarize your undergraduate geography course of study and outline its strengths and weaknesses.
2. How relevant was your degree course to your teaching career?
3. What geography book had the most impact on you during your degree program? Please elaborate.

The twenty teachers I surveyed varied from newly qualified teachers in their first year of teaching to experienced teachers with twenty-five years of experience. Those surveyed were equally split between those who had attended 'newer' universities (established since the 1970s) and those who had attended established Victorian, provincial, so-called "red-brick" universities. The universities of Plymouth, Huddersfield, and Middlesex are examples of the former, whereas Manchester, Sheffield, and Birmingham are examples of the latter. At the same time, as a form of triangulation, I surveyed five of my 1999 teacher trainees using the same questions. My institution is an example of the latter type of establishment.

I will attempt to summarise the results under the three elements of the homework assignment, using direct quotes to illustrate and support the generalizations and implications offered.

UNDERGRADUATE GEOGRAPHY COURSES

The most noteworthy feature of the courses described was their great variety, their modular nature, and the freedom for students to specialise, particularly in the third year. Clearly, in England, there is far from a core curriculum in higher education, although such days may be numbered given imminent "benchmarking." The Quality Assurance Agency is overseeing subject benchmarks with the objective of setting standards for graduates coming out of universities. Geography is in the first phase of this with consultation in the summer of 1999 and the outcome announced at the end of September. At present, however, courses are noteworthy, if my data is to be believed, by heterogeneity.

The other early impression I gained was how teachers found it difficult to recall their courses. "I really do have very little recollection of my undergraduate geography course," "My recall of some of the detail of the course is hazy." It was often the "personalities" they remembered. "I remember the lecturers who were unusual, enthusiastic, and told good stories;" "Peter Hall was himself quite an inspirational figure, a young professor of whom we were all very much in awe."

In spite of finding recollection difficult, most teachers described field trips they went on, spoke of project work undertaken of a variety of types, and the research conducted for dissertations. The older universities seemed to engage in a narrower range of pedagogies and styles of assessment, whereas the opposite was true of the newer universities. Most commented on the wide range of modules and staff interests, summarised rather well by one respondent: "By the end of the course I had begun to realise that there was very little consensus over philosophical, methodological, and ideological issues within the department."

As to the strengths of their courses, most referred to the fieldwork element in a positive vein, for example, "a heavy emphasis on residential, practical fieldwork...this was a strength of the course." Several mentioned the welcome opportunity of specialising in the third year, from a wide range of options and so studying quite new areas of geography.

Weaknesses identified included the reverse of that specialisation point. Several remarked that they could avoid physical geography almost completely in the third and sometimes second years. "You were allowed almost completely, to opt to be either a human geographer or a physical geographer." Some indeed bemoaned the "overmuch freedom to choose" and thereby questioned the coherence and balance of such a "cafeteria" curriculum. Some complained of the excess of lecturing as the predominant pedagogy.

RELEVANCE OF DEGREE COURSE TO A TEACHING CAREER

The majority of respondents found their degree courses relevant. Comments included: "Much of the subject content has been relevant," "On the whole my degree course has been very relevant to my teaching," "I often use much of what I have learned in teaching." However, a minority felt quite differently. "Most of content covered has been totally irrelevant for my teaching," "Few of the subjects except for volcanoes and tropical rainforest were directly relevant to my teaching career," "I struggle to find a great deal of relevance...except that my degree spurred my interest in geography, an interest that I attempt to pass on to pupils at all levels."

Many identified indirect benefits of their geography degree course for teaching. "It increased my desire to travel and as a result of my travelling experiences, I developed sufficient interest, knowledge, and confidence to be a geography teacher," "This course inspired me, in particular with fieldwork and enthusiasm, for getting out there!" "Skills developed to enable learning have been of more use than the subject content learned," "Particularly good at identifying inter-relationships between topics and other disciplines."

Several respondents regretted that they were able to drop most physical geography in the second and third years of their course. “There was not as much physical geography as I would have liked,” “The only mismatch has been the lack of physical geography.”

A GEOGRAPHY BOOK WITH IMPACT

The teachers surveyed mentioned a great range of books, which this author feels is both encouraging and healthy! Interestingly, the only overlap was the mention by three teachers of W.G Hoskins’ *The Making of the English Landscape*, described as a “pioneer study,” “Hoskins’ holistic view of the landscape appealed to me,” “Easy to read and entertaining.” Several books were politically-orientated, offering (at that time!) more radical perspectives. Examples include Hayter’s *The Creation of World Poverty*, Harrison’s *The Third Revolution: Population, Environment and a Sustainable World*, and Dicken’s *Global Shift*.

Other books mentioned were highly specialised, such as Bennison’s *Geological Structures and Maps*, Rapp’s *Slope Processes on High Latitude Mountains*, and *Selling Places* by Kearns and Philo.

A common theme was political geography, including Muir’s *Political Geography*, Short’s *Political Geography*, and de Blij’s *Systematic Political Geography*. Also common were those related to conservation matters, such as *Conservation in Progress* by Goldsmith and Warren, and *A Sand County Almanac* by Leopold. All in all, a fascinating mixture!

IMPLICATIONS

Naturally, the results of this small scale, qualitative, pilot survey have to be treated with caution, but some inkling is given as to the relationship between degree courses and geography teaching in schools. What is clear is that the subject knowledge of teachers based on degree content is highly varied, but most do not feel this has been a problem. However, the younger teachers and some of my teacher trainees (who, incidentally, displayed very similar views to the trained teachers) felt that the National Curriculum and GCSE³ and “A” level syllabi were highly conservative and gave little opportunity for exploring some of the latest developments from the research frontiers that had excited them at university. Clearly a whole range of indirect spin-offs feed into schools, including an enthusiasm for the subject generally and for fieldwork in particular; development of expertise in project work; engagement in research for dissertations; and some of the newer styles

of assessment, such as problem solving. Although content and detail was forgotten with time, enthusiasm and a range of skills lasted!

Highly varied degree courses offering a great deal of individual choice, especially in the third years, were appreciated but at the expense of a broad background in physical geography, which is clearly and rightfully needed in schools. Perhaps, too, in the light of a real staffing shortage for geography in the UK, universities could offer some geography education and geography of education modules as a taster for those considering a teaching career. Furthermore, school curricula need to be more responsive to the latest research developments and trends in HE so they can, where appropriate, be incorporated! If that were to happen, then more in-service courses and publications would be needed to enable experienced teachers to keep up to date.

Overall, the author was pleasantly surprised to discover that the “dislocation” between degree courses and school teachers’ lives is not as great as had been feared and that in all sorts of ways, university geography experiences have positive impacts on geography teaching in schools. Some adjustments, as suggested above, however, could have a number of two-way benefits.

NOTES

1. “A” or “Advanced” level was until recently the three or four subject examination taken as a two year course by the most able 16-19 year olds, often leading to university entrance.
2. Now available as a distance learning course for the English speaking world. For details email: a.kent@ioe.ac.uk
3. General Certificate in Secondary Education (GCSE) – a two-year course taken by fourteen to sixteen year olds.

REFERENCES

- Bale, J. and McPartland, M. 1986. Johnstonian anarchy, inspectorial interest and the undergraduate education of PGCE geography students. *Journal of Geography in Higher Education* 10(1):61-70.
- Bradford, M.G. 1996. Geography at the secondary/higher education interface: Change through diversity. In *Geography into the Twenty-First Century*, eds. E.M. Rawling and R.A. Daugherty. New York: John Wiley.
- Goudie, A. 1993. Schools and universities – the great divide. *Geography* October 18(4):338-339.
- Kent, W.A. and Smith, M.. 1997. Links between geography in schools and higher education. In *Handbook of Post – 16 Geography*, ed. A. Powell, pp. 192-199. Sheffield, UK: The Geographical Association.

- Machon, P and Ranger, G. 1996. Change in school geography. In *Geography Teachers' Handbook*, eds. P. Bailey and P. Fox, pp. 39-46. Sheffield, UK: The Geographical Association.
- Rynne, E. and Lambert, D. 1997. The continuing mismatch between students' undergraduate experiences and the teaching demands of the geography classroom: Experiences of pre-service secondary geography teachers. *Journal of Geography in Higher Education* 21(1):65-78.
- Smith, M. 1996. *The Secondary –Tertiary Interface in Geography Education*. Unpublished MA dissertation. University of London Institute of Education.

Ashley Kent is Professor of Geography Education at the Institute of Education (IOE), University of London. He is Head of Geography and teaches on the PGCE and MA courses as well as supervising M.Phil/Ph.D. students. He is leader of the recently established MA Geography in Education Distance Learning course. He has long-standing professional and research interests in: curriculum development and education; innovation and change (the focus of his Ph.D. work); teaching strategies including fieldwork, the marketing and image of geography; the school/higher education (HE) interface; information technology, including remote sensing; developments in human geography; 16-19 geography initial teacher education and distance learning.

Book Review

Henig, J.R., Hula, R.C., Orr, M. & Pedescleaux, D.S. 1999. *The Color of School Reform*. Princeton, New Jersey: Princeton University Press. 301 pages. ISBN 0-691-01634-8 (hardcover, \$35.00).

For many years, the issue of how to reform and improve public schools in inner city areas within the large metropolitan areas of the United States has been a topic of controversy and intense debate among educational professionals, business leaders, politicians, journalists, and scholars. Inner-city schooling has long been regarded as inadequate, and proponents of reform have pointed to decades of low standardized test scores, high dropout rates, deteriorating physical plants, dissatisfied and unqualified teachers, and violent crime as evidence that inner-city schools have failed. Political controversy has been enhanced by the fact that a large majority of inner-city school children are non-white. School vouchers, charter schools, and corporate or non-profit control of inner-city schools by persons not connected with formal public schooling have been advocated and in some cases attempted, with varying degrees of success.

In *The Color of School Reform*, four well-known political scientists examine the question of inner-city school reform in the context of changes in the political structure of urban areas in the United States. They examine the school systems of four large cities-Atlanta, Baltimore, Detroit, and Washington. All of these cities have African-American population majorities, and African-American mayors and other leaders including Andrew Young, Kurt Schmoke, Coleman Young, and Marion Barry have dominated each city's politics for the past three decades. Moreover, in all four cities the school superintendents and substantial majorities of teachers, principals, and other administrators are African-Americans. Thus Henig *et al.* pose the question of whether the emergence of African-American political power in these cities "has complicated or facilitated the development of civic capacity to undertake and sustain educational reforms that will help low-income and minority children" (6). In examining this question, Henig *et al.* seek to address it in the larger context of whether meaningful school reform is possible. They answer this question by arguing that understanding school reform is only feasible through understanding the politics underlying any viable proposals to reform public education.

The book is divided into eight chapters. The first chapter, "Civic Capacity, Race, and Education in Black-Led Cities," sets forth the research agenda addressed in the book. Pointing out that "some communities [are] able to undertake and sustain systemic educational initiatives while others

settle for shallow or symbolic efforts or deplete their energies in brief spasms of reform that do not take root" (14), Henig *et al.* define the term "civic capacity" in order to measure the extent to which various sectors in a community, including professional educators, politicians, business leaders, students, and the general public, are able to work together to formulate common objectives and pursue and achieve common goals.

Chapters 2 and 3 provide historical context for the measurement of civic capacity. In Chapter 2, the authors describe the demographic, economic, and political changes that led to the rise of African-American political power in each of the four cities. It considers the impact of school desegregation policy following the Supreme Court's decision in *Brown v. Board of Education* in 1954, along with the impacts of the Civil Rights Movement and the consequent rise of African-American political consciousness and activity which followed. Chapter 3 is devoted to the history of schooling and school reform in the four cities, and it describes attempts to combat the endemic problems that have long plagued school reform efforts in each city.

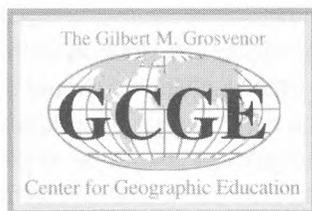
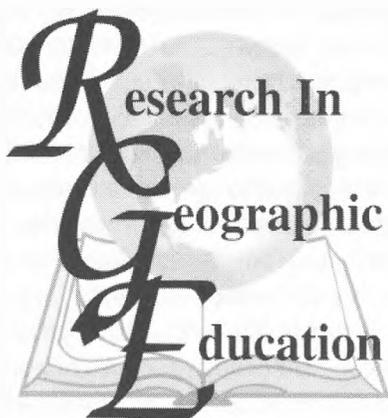
Chapters 4 through 7 deal with the role played by each of four major interest groups whose input is critical to meaningful school reform: teachers, parents, political and business leaders, and external actors including the state and Federal governments, the courts, private foundations, and suburban residents and leaders. In each of these chapters, Henig *et al.* spell out the interests of each of these groups, describing why efforts to persuade their members to become an ongoing part of the "civic capacity" of their cities have been less than fully successful. For example, civic capacity has been eroded by tensions between black political leaders and the white-dominated business community. These tensions are in part the result of sharp differences between business leaders and educational professionals concerning the nature and value of public education. In their words, "In black-led cities there appears to be a substantial conflict between business and nonbusiness actors over the priority given to the schools' role as provider of basic work-related skills versus an expanded version as provider of social services..." (230). The final chapter, entitled "School Reform as if Politics and Race Matter," summarizes the book's arguments and draws conclusions about the possible future of urban education. They conclude that citizen participation and commitment are a vital component of civic capacity, and that successful reform of inner-city schools will require a high degree of civic capacity in light of modest financial resources, political tension and fragmentation, and mistrust among the various actors who must work together in order to achieve any reform that is truly meaningful.

The Color of School Reform is an excellent book. It is thoroughly researched, thought provoking, and well written. Yet it does not deal explicitly

with themes usually associated with the geographic education literature. Why should the complex and seemingly intractable issues addressed in the book be of particular interest to experts in geographic education? First, the book is a significant contribution to the literature on the geography of education-an important subject that should be of increasing interest to the geographic education community. Geographical analysis is central to our understanding of the origin and resolution of political and racial disputes in the provision of education, and to our ability to predict meaningfully the conditions under which reform proposals in the future may work. Perhaps even more importantly, specialists in geographic education-that is, those who have devoted their professional lives to understanding the processes and structures of teaching and learning geography-have much to contribute to improving inner-city schools. The national reform movement in geographic education has done much to raise the public's awareness of the importance of geography as a school subject in the twenty-first century. Citizenship in the twenty-first century will demand even higher levels of geographic literacy and awareness, especially in inner cities with their long history of poverty, crime, and deprivation. Geographic literacy-not only knowing where places are, but even more importantly how the geographer perceives, maps, and understands the world-will be crucial to our continued efforts to combat poverty, racism, and poor schooling in America's inner cities and elsewhere.

Finally, civic capacity as Henig *et al.* define it depends also on geographic awareness. Henig *et al.* contend that civic awareness and responsibility are critical components of civic capacity and its relationship to meaningful school reform. If so, then the discipline of geography can and must be critical to the achievement and maintenance of civic capacity. Specialists in geographic education will do well to read *The Color of School Reform* and to consider in a meaningful way how geographic education can contribute to the difficult and complex, but by no means insurmountable problem of how to reform inner-city schooling in a meaningful way.

Fred M. Shelley is a Professor of Geography and Graduate Program Coordinator in the Department of Geography at Southwest Texas State University. Previously he has taught at the University of Oklahoma, University of Southern California, University of Iowa, and Florida State University. His research interests include political geography, environmental policy, geography and education, and the United States. He has published over 100 books, refereed journal articles, and other publications on these and related subjects. He is a member of the Council of the Association of American Geographers and a past President of the Southwest Division of the Association.



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Dewey, J. 1916. *Democracy and Education*. New York: Macmillan Publishing Co.

Stea, D., Blaut, M. and Stephens, J. 1996. Mapping as a cultural universal. In *The Construction of Cognitive Maps*, ed. J. Portugali, pp. 345-360. The Netherlands: Kluwer Academic Publishers.

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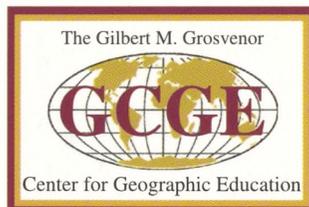
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