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Title

Transitions from Childhood to the Workforce, Specialist Meeting Introduction and Position Papers

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Research Unit on Spatial Cognition and Choice (RUSCC), UCSB

The TCW workshop that was held in Santa Barbara at the Upham Hotel. Participants represented a variety of disciplines at the nexus of Geography, Education, Psychology and Cognitive Science.

Each day started with a panel presentation of some ideas related to the day's thematic topic. Panelists were urged to use their own work as the basis for their comments. General discussion by all participants followed the panel presentations. In the final 15-20 minutes of the panel sessions, we defined 5 topics as themes for "breakout groups" and participants selected which breakout to attend. Breakout groups met for approximately 1.5 hours to discuss their chosen topic. The final 15 minutes of each breakout discussion was devoted to producing a summary of what had transpired and a set of recommendations on what was generally seen to be important areas for future research. The summaries became essential components for a final White Paper that was submitted NSF in mid-December and made publicly available at the NCGIA Varenius website.

Panel Topics:

Integrating Research & Education in the Spatial Domain

Panelists: Mike Gerber, Janellen Huttenlocher, Roger Downs, Gary Allen, David Mark, Barbara Battenfield, and Dedre Gentner

- Developmental Theory, Spatial Abilities, and Spatial Cognition;
- Information Processing as a link between research and education;
- Individual Differences and the Transition from Childhood to the Workplace;
- Translating Laboratory Research findings into Real-world Education Experiences;
- Effective Ways of Transferring Current Research Findings to the Educational Arena.

Spatial Problem Solving in the K-12 and Undergraduate Arenas

Panelists: Lynn Liben, Sarah Witham-Bednarz, Susan Hardwick, Rich Mayer, Ron Eyton, Ed Cornell, and Rickie Sanders

- Building on Fundamental Spatial/Geographic Concepts in the Geography Standards and Geography for Life projects;
 - Task-oriented Spatial and Geographic Teaching Techniques for the 21st Century K-12 curricula; The Web, Distance Learning, Virtual Environments and other Future Spatial/Geographic Technologies for use in the 21st Century;
 - Undergraduate Curricula;
 - Assessment/Evaluation of the Acquisition of Spatial Knowledge in various educational settings.
-

Meeting Participants

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Participant Position Papers

The following position papers were prepared and distributed prior to the meeting

Gary Allen (South Carolina)

Ed Cornell (U. of Alberta)

Mike Gerber (UCSB)

Janellen Huttenlocher (U. Chicago)

Sarah Witham-Bednarz (Texas A&M)

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An Interactive Cognitive Resource View of Cognitive Development during Childhood: Spatial Implications

Gary L. Allen

University of South Carolina

Cognitive resources are information-processing capabilities and knowledge that can be used to perform mental tasks. Previous research has shown very convincingly that generic information-processing capabilities, such as processing speed and working memory capability (Fry & Hale, 1996; Kail, 1991), show age-related increases over the course of childhood. Also, it is clear that children acquire knowledge of specific facts, effective procedures, general concepts, and useful strategies as they progress through elementary school.

It is reasonable to hypothesize that the two categories of cognitive resources, information-processing capabilities on the one hand and various forms of knowledge on the other hand, have an interactive relationship. Changes in processing speed largely account for age-related differences in working memory capability, and these two information-processing resources together exert a strong influence on the performance of tasks ranging from simple memorization to logical reasoning. However, research on skill acquisition shows that with repeated exercise, the use of specific facts and effective procedures becomes more automatic, with the consequence of freeing information-processing resources for other tasks that can be performed simultaneously (Neves & Anderson, 1981). Also, repeatedly applied concepts and strategies can become imbedded in task-solving procedures, the result being the development of higher-order cognitive structures that facilitate situationally specific skilled performance (Ericsson, 1996). Thus, knowledge of various types results in resource available because of automaticity and because of what has been referred to as skill- or task-dedicated long-term working memory (Ericsson & Kintsch, 1995).

The implications of this resource-based view of cognitive development for the spatial domain in particular are largely unexplored. Tasks with predominantly spatial components have been used to assess processing speed, working memory capability, and even logical reasoning skill (Fry & Hale, 1996), but the emphasis has been primarily on validating a general model of cognitive change rather than on differentiating among domains. Recently, it was suggested that the domain of spatial abilities could be considered as a group of functionally related families. One of these families concerns situations involving a stationary individual and manipulable objects; another concerns situations involving either a stationary or mobile individual and moving objects; and a third has to do with situations involving a mobile individual and large, stationary objects (Allen, 1999). The cognitive resources pressed into service in the context of any of these families has not been well specified (Allen, 1999), particularly with respect to the third family, which concerns wayfinding and orientation in large spaces (Allen, Kirasic, Dobson, Long, & Beck, 1996). Consequently, one is on solid conceptual ground in positing that information-processing capabilities and existing factual, conceptual, and strategic knowledge are crucially involved in the development of spatial skills, but it is difficult to tell a convincing story of how these resources interact in the context of a specific task.

How cognitive development in the spatial domain impacts the transition from childhood to the

workplace is largely a matter of informed speculation. Psychometric tests of spatial abilities have demonstrated validity for careers in engineering, architecture, aviation, dentistry, surgery, and others involving concepts and applications from geometry. Each of these work areas involve extended periods of preparation and training, thus making the transition from childhood to the workplace a lengthy one in such cases. However, in a very general sense, several factors suggest that change is on the horizon with respect to children's role in the workplace. First, the control and use of information is becoming an increasingly substantial part of the economy. Second, improvements in communication technology have made information accessible to the public at large, children included. Third, by middle childhood most children are perfectly capable of acquiring expertise regarding a defined factual knowledge base. Taken together, these factors suggest that although children may not be engineers and dentists in the near future, their general status as producers and consumers in the global economy may be subject to rapid change.

How can knowledge of children's cognitive resources be related to speculation about children's future role in the workplace? One way of attempting to relate the two is to think about the dialectic involving information-processing resources as universal constraints and knowledge resources as means of overcoming universal constraints. The rate at which new knowledge is acquired during childhood is constrained to some extent by cognitive speed and working memory capability. Curriculum design and training/educational procedures should obviously accommodate this developmental reality. On the knowledge side of things, we need more insight into the process of elaborating upon central concepts (see Chi, Hutchinson, & Robin, 1989, for example). In geographic space, the concept of Euclidean spatial relations is extremely useful for organizing spatial experience. In contrast, cyberspaces are notoriously non-Euclidean. What are the central utilitarian concepts in these spaces, within the Internet, for example? One of the major challenges in the future workplace may be mapping the consequences of transactions done in cyberspaces onto the logistical realities of geographic space. This seems a formidable undertaking for curriculum designers and education practitioners.

Information technology has changed the face of work in post-industrial societies, and logically, it is changing the face of the educational experience designed to prepare future workers. Fortunately, technological advances have placed some remarkable tools at the disposal of educators. However, those tools came with no user's manual in terms of societal goals to which they are to be applied. Basic research from Geography and Psychology can provide insight into fundamental cognitive and behavioral phenomena, but the integration of this insight into an effective curriculum depends ultimately upon the delineation of societal goals. In an increasingly pluralistic society, getting political leaders, the educational establishment, and business forces to agree upon such goals is challenging, to put it mildly.

References

Allen, G. L., Kirasic, K. C., Dobson, S. H., Long, R. G., & Beck, S. (1996). Predicting environmental learning from spatial abilities: An indirect route. *Intelligence*, 22, 327-355.

Allen, G. L. (1999). Spatial abilities, cognitive maps, and wayfinding: Bases for individual differences in spatial cognition and behavior. In R. Golledge (Ed.), *Wayfinding behavior: Cognitive maps and other spatial processes* (pp. 46-80). Baltimore: Johns Hopkins University Press.

Chi, M. T. H., Hutchinson, J. E., & Rosin, A. F. (1989). How inferences about novel domain-related concepts can be constrained by structured knowledge. *Merrill-Palmer Quarterly*, 35, 27-62.

Ericsson, K. A. (1996). The acquisition of expert performance: An introduction to some of the issues. In K. Ericsson et al. (Eds.), *The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games* (pp. 1-50). Mahwah, NJ: Lawrence Erlbaum.

Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. *Psychological Review*, 102, 211-245.

Fry, A. F., & Hale, S. (1996). Processing speed, working memory, and fluid intelligence: Evidence for a developmental cascade. *Psychological Science*, 7, 237-241.

Kail, R. (1991). Developmental change in speed of processing during childhood and adolescence. *Psychological Bulletin*, 109, 490-501.

Neves, D., & Anderson, J. R. (1981). Knowledge compilation: Mechanisms for the automatization of cognitive skills. In J. Anderson (Ed.), *The acquisition of cognitive skill* (pp. 57-84). Hillsdale, NJ: Lawrence Erlbaum.

Spatial Problem Solving, K-16
Sarah Witham Bednarz
Texas A&M University

Curriculum

I am a former classroom teacher committed to improving geography education in American schools. From this perspective, based on conversations with teachers, examination of teacher-produced curriculum materials, and classroom observations, I am sad to report that students today are given few opportunities to develop the ability to think spatially let alone to practice spatial problem solving. I define spatial problem solving from the point of view of the teaching-learning context as the application of geography to solve problems or resolve issues (Geography for Life 1994, 42).

The National Geography Standards state, "It is essential that students develop the skills that will enable them to observe patterns, associations, and spatial order" (Geography for Life 1994, 43). These skills are embodied in the Standards essential element "Seeing the World in Spatial Terms" and capitalized upon in other Standards but particularly in Standard 18, "The geographically informed person knows how to apply geography to interpret the present and plan for the future." Specifically:

- at grade 4 students are expected to know and understand the spatial dimensions of social and environmental problems (140);
- at grade 8 students are expected to apply the geographic point of view to solve social and environmental problems by making geographically informed decisions (181); and
- at grade 12 students are expected to use geographic knowledge, skills, and perspectives to analyze problems and make decisions (221).

Thus, there is external support for spatial problem solving to be included in the curriculum. However, this aspect of the National Standards is not well represented in state standards. Elementary and secondary geography is more about place than space, and more about knowing than doing.

Instruction and Assessment

Technology, specifically geographic information systems (GIS), may be a tool to help teachers and students learn to think spatially and to introduce spatial problem solving into K-12 education. The link between GIS and spatial problem solving in K-12 contexts has not been explored conclusively although research is beginning to show some positive relationships (see Keiper 1999 and Kerski 1999 for case studies at the elementary and a secondary level). GIS is moving into American classrooms at a very slow rate. The reasons for this are varied but include issues related to hardware and software, teacher training, motivation, reward, and broader systemic issues, teacher time constraints, and curricular issues (Bednarz and Ludwig 1997, Bednarz 1999).

Once teachers know how to use GIS themselves and have access to appropriate hardware and software, they must devise ways to use the tool with their students. Teaching with GIS is a challenge for many social studies and science teachers. Designing effective GIS-based learning opportunities for students requires a new approach to structuring the curriculum, to teaching, and to assessing student learning. An approach that may be successful in teaching with GIS is problem based learning. In problem based learning, teachers and students integrate concepts and skills from one or more disciplines to investigate a problem (Jones, Rasmussen, and Moffitt 1997). Problem based learning with GIS requires that teachers structure their teaching around a series of 'problems.' Problems are used to frame, focus, organize, and stimulate learning. Students, working alone or in small groups, investigate these problems using a variety of research tools and technologies, particularly GIS. The effect of this kind of instruction on spatial problem solving is unknown.

Research

I recently read an article in Educational Researcher that reflects my ideas about the connection between theory and practice. Paul Cobb and Janet Bowers summarized the problems they perceive in translating theoretical tenets directly into instructional prescriptions. The context for their paper is mathematics education and situated learning theory versus cognitive theory, but their point is salient here:

The key point to emphasize in this process is that theoretical constructs evolve in response to problems and issues encountered in the classroom (emphasis added). As a consequence, theoretical constructs developed in this way do not stand apart from instructional practice, but instead remain grounded in it (Cobb and Bowers 1999, 12).

They argue for research that is based on the activity of experimenting in classrooms. "These approaches therefore reflect the concerns of the participants in the learning-teaching process rather than those of a spectator to classroom events" (Cobb and Bowers 1999, 13). I hope that as we talk about research in and about spatial problem solving we set as a goal improving educational practice. This means engaging in classroom based research in collaboration with teachers.

References

Bednarz, Sarah Witham. 1999. Impact and success: Evaluation of the GIS Institute for Teachers. Proceedings, ESRI User Conference, San Diego, CA, July 1999.

Bednarz, S.W. and G. Ludwig. 1997. Ten things higher education needs to know about GIS in primary and secondary education. Transactions in GIS 2:123-136.

Cobb, P. and J. Bowers. 1999. Cognitive and situated learning perspectives in theory and practice. Educational Researcher 28(2):5-15.

Geography Education Standards Project. 1994. Geography for Life: National Geography Standards. Washington D.C.: National Geographic Research and Exploration.

Jones, B.F., C.M. Rasmussen, and M.C. Moffitt. 1997. Real life problem solving. Washington, D.C: American Psychological Association.

Keiper. T.A. 1999. Gis for elementary students: An inquiry into a new approach to learn geography. Journal of Geography 98(2):47-59.

Kerski, J. and S. Wanner. 1999. The effectiveness of GIS in high school education. Proceedings, ESRI User Conference, San Diego, CA, July 1999.

Integrating Research and Education in the Spatial Domain

Edward H. Cornell
University of Alberta

I have two suggestions for classroom exercises that could be incorporated into geography curricula. These suggestions fell out of our work with urban police who are responsible for search for missing children. However, I believe the pedagogical rationale is that the exercises link the child's real-world activities with cultural conventions that must be learned.

The first suggestion comes from the police practice of asking parents of missing children "What is the farthest place that your child goes to independently?" This question is used to estimate the crow's flight distance of possible travel from point last seen. The distance serves as a radius of a circle to contain initial search operations.

Crow's flight distance from home is also a measure used in environmental psychology to index home range. Home range is the territory that includes the child's self-initiated travel. It is curious in both cases that an area should be represented by a linear estimate, and one suggestion was that police could ask parents about all of the known destinations of their children. This would yield a skeletal route map and by connecting the endpoints of various routes, a polygon that includes areas where the child may have attempted connections between routes.

A search manager suggested that a periodic exercise for parents and children would be to sit down with colored pencils and draw a sketch map of the child's travels. Parents would have more realistic knowledge of their child's adventures and police could ask for recently produced maps.

The extension to teaching of geography is similar to the use of "experience charts" in the whole language method of teaching reading. Sketch maps are an opportunity to teach--with content that is known and personal--representation of scale, form, and cartographic conventions. The sophistication of the mapping skills in the curricula can parallel the expansion of home range through the primary school grades.

My second suggestion comes from a police constable who teaches urban safety. His dialogues in the classroom require children to explain why some landmarks are better than others and what to do when lost. The opportunity to hear arguments and strategies of peers in a group setting seems to free some youngsters from the embarrassment of discussing their way finding errors. The constable then asks the youngsters why it is that their parents restrict their travel and what their parents tell them to do when preparing for a trip. The opportunity to explain the reasoning of another helps children to remember to produce strategies when appropriate (cf. Siegler, 1995, *Cognitive Psychology*).

The extension to teaching of geography is the prospective use of maps. Children can be provided city bike trail maps, road maps, and survey maps. They can examine the format and

key in groups, using the map to solve a traveling salesman type problem—a least distance solutions to visiting several sites on the same outing. The conventions of city grid systems, trails based on topography (passes reduce climbing), and information available from different representations can be taught in the context of what the child is doing during the expansion of their home range.

Viewing Geography: Construction Projects for Educators

J. Ronald Eyton
Southwest Texas State University
Position Statement

1. Beginnings

- photographic, video, and digital viewing technologies
- viewing Geography
- objectives- format

PART I: BASICS

2. How We See: Color Theory

- additive and subtractive color mixing demonstration
- constructing an additive viewer
- multiband additive viewer demonstration
- photographic and digital color

3. What To Use: Cameras, Films, and Digital Equipment

- photographic cameras versus digital cameras
- print/slide/scanned images processing systems
- film scanners and writers
- special accessories and field equipment

4. Making Instructional Copy Slides: Copy Stands

- opaque versus transparency copying
- constructing a copy stand
- lighting, film, and filters
- copying magazine photos, maps, and airphoto transparencies

PART II: NORMAL-COLOR, FALSE-COLOR, AND MULTI-TEMPORAL VIEWS

5. Viewing The Wide-Wide World: Three-Camera/Three-Projector Panoramic System

- panoramic cameras and projectors
- constructing a three-camera photographic system
- constructing a three/projector/three-screen presentation system
- shooting and showing three-camera panoramics
- environmental considerations

- cameras, films, and filters for aerial photography
- constructing stereograms and flight-line mosaics
- field trip and flights

7. Viewing The Visible And Near-Visible: Multiband Video Viewer

- visible and near-visible EMR illuminating the earth
- constructing a multiband digital video viewing system
- constructing an infrared flashlight
- multiband views of landscapes

8. Viewing Visible/Near-Visible Connections: Dual Normal Color and Color Infrared Photography

- the importance of the color infrared format
- color infrared signatures
- constructing and using a dual camera system
- utilizing paired slides in the classroom

9. Viewing Change: Photographing Time

- short duration (immediate, diurnal) repeat photography
- long duration (seasonal, anniversary date) repeat photography
- constructing repeat photography stations
- constructing multitemporal and change detection composites

PART III: THREE-DIMENSIONAL VIEWS

10. Viewing Stereograms: Ground-Based Stereo Landscape Photography

- constructing two and three camera stereo systems
- stereo site photography
- constructing photographic and digital stereograms
- constructing viewers for looking at photographic and digital stereograms

11. Viewing Virtually: Video Stereograms

- digital video cameras and liquid crystal displays
- constructing video stereoscope displays
- constructing heads-up helmet displays
- constructing a virtual classroom

12. Viewing Landform Anaglyphs: Parallax Induced Stereo Pairs from DEMs

- left and right perspective views from DEMs
- constructing map (gray scale, contour, hillshade) anaglyphs
- constructing transformation (slope, curvature, flow) anaglyphs
- constructing overlay (satellite image, land use, temperature) anaglyphs
- spectral colors and depths
- constructing maps with data coded as a spectral color sequence
- constructing maps with contours and hillshade added to a spectral color sequence
- holographic glasses for viewing a spectral color sequence

14. Viewing Volumetric Maps: Tomographic Processing

- slicing map distributions by depth
- printing a volumetric map from the Volmap Kits (see Appendix C)
- constructing a registration jig for the printed volumetric map slices
- constructing and displaying a volumetric map

15. Endings

- what was included
- what was excluded
- what is most important
- what next

Appendix A: Catalog of Color Infrared Signatures

Appendix B: Terra Firma - A Display and Analysis Package for Raster Data

Appendix C: Volmap Kits

- Volmap Kit 1: Mt. Rainier (hillshade), Grand Canyon (spectral colors), Harrisburg (land use), Peyto Lake (Landsat image)
- Volmap Kit 2: Mitchell Dome (hillshaded bathymetry), Houston Astrodome (hillshaded LIDAR), Mars (spectral colors), U.S.A. (isobars)

Lost in Space: Need for Spatial/Geographic Research and Research Application in Elementary Education

Michael Gerber
University of California, Santa Barbara

Space in school learning is the microspace of desktops and the paper tasks on them, as well as the macrospace that form concentrically around students -- classroom-school, neighborhood-community, state, nation, world. The curriculum references the latter, at least as regards cartographic knowledge and skills. The current California State standards insist that students begin geography-referenced learning from kindergarten onwards. However, despite employing promising language, like "spatial thinking," the standards actually focus only on a limited repertoire of map skills. In fact, first grade students are introduced to manipulations and problem solving with its abstract representations as shapes and symbols on paper before they have much opportunity to experience, let alone investigate the geography itself.

Spatial learning in the microspace of paper (or chalkboard) representation is fundamental to all other learning that occurs -- or fails to occur. This learning traditionally prepares students for performing and receiving instruction at the level of symbolic representation. Although teaching in primary grades strongly targets concept learning, overt reference to spatial concepts and skills is largely ended by first grade. However, learning to read, write, and spell requires coding information about the orientation of oneself with respect to symbols and symbol systems that are the common tools of academic learning. Letters of the alphabet, for example, appear in different spatial planes and at different scales -- chalkboard, paper, book. Copying the lower-case b, d, g, p, from chalkboard to paper, therefore, can be problematic for children in primary grades. They must learn a kind of small-scale navigation -- self-regulated as well as in response to teachers' directions. Following directions while learning basic skills means locating and relocating and remembering how to locate. Finding one's way through book pages and work papers and information resources on walls requires acquisition of schemas that code objects in physical as well as conceptual spaces.

Students who write English words from right to left, often with letters in mirror-image orientation, or write "pet" for "bet," or who lose their place while reading, are likely to be disoriented in space, not necessarily in visual acuity or knowledge of phonics. For several decades, teachers have infused the mathematics curriculum with tasks requiring manipulation of material objects either as foundation or enrichment. However, the spatial character of simple arithmetic eludes many children. In multidigit multiplication, for example, students must retrieve simple multiplication, remember place value rules, and remember the actual "places" where these rules apply.

Most children make spatial errors in writing, reading, and arithmetic initially but quickly learn and become reliably correct. Between 7 and 10, most have also learned the navigation systems required for receiving instruction in all classroom, book, and desktop learning tasks. About 8% of all children do not. Another 7% may have life-long difficulties remembering position,

coordinating physical responses, sequencing, "reading" symbolic representations in their proper spatial orientations. These persistent difficulties might be trivial were it not for the fact that their presence almost inevitably correlates with substantial deficiency in basic skills as well as the content knowledge and skills, including geography, that require fluency and reliability of elementary skills. The fact is, even research that focuses exclusively on these children and their learning difficulties is poorly informed by contemporary research on spatial cognition and geographic thinking. Also, though, researchers who work at the interface of geography and spatial cognition are generally disinterested in applying their research to learning problems of atypically developing children -- with perhaps the one striking exception being children who are visually impaired.

The truth is that very little research on spatial learning or spatial cognition finds its way into the public schools either as an influence on new methods of instruction or on curriculum content. This is an unfortunate loss of opportunity for all students, one that makes bringing new undergraduates from map-reading to GIS a little more laborious. For perhaps 15% of elementary school students, though, the absence of spatial-geographic research applications in teacher training and school curriculum is not merely a matter of lost opportunity. For these children, failure to bridge between research and practice may have far more serious and long-term consequences.

Spatial Problem Solving in the Undergraduate and K-12 Arenas Panel Discussion

Susan Hardwick
Southwest Texas State University

North American distance learning guru, Michael Moore, published an editorial on maintaining quality in distance learning in the *American Journal of Distance Education* in 1997 (V. 11, 1-7). When I came across his commentary, I was browsing nervously through that morning's *San Francisco Chronicle* and the glossy magazines in the waiting room of the Vice President's office at California State University, Chico -- preparing to tell him that I had just accepted a faculty position to help build a new Ph.D. program in geographic education in central Texas.

Coincidentally, I also had just finished my first experience teaching an undergraduate class through distance education. This introductory Human Geography course had two quite different groups of students enrolled -- one on-site in Northern California in a dank classroom located at the end of a dark hallway in the basement of the campus library -- the other in a crisp black and white, high tech, fully mediated classroom in Tokyo, Japan. The following fall semester, I was situated in my new faculty position at Southwest Texas State University, responsible for the development and dissemination of a graduate degree program in geographic education that centered on the use of a variety of distance learning technologies. Little did I know that my experience teaching Japanese and California students simultaneously, along with Moore's mantra for maintaining quality in distance education,, would ultimately help shape the development of our Step Up to Geography through Distance Learning project at SWT.

According to Moore, there are four important considerations to keep in mind when creating and maintaining high quality distance learning courses and programs. These include: (1) remembering that because technology is most commonly used in everyday life to disseminate basic information, there is a tendency to equate presentation of information with education ("distance learning must become more personal"); (2) reminding administrators that faculty may not know how to teach a distance education class even though they are presumed to know how to teach their subject competently in conventional settings ("faculty training is essential"); (3) distance-based efforts cannot be entirely controlled on only one end of the connection ("local facilitators and technical supporters are essential"); and (4) with the expansion of technology and consequent need for specialization, low quality accompanies the institution that attempts to be all things to all people ("identify your area of excellence and specialization and build on these").

In the same issue of this journal and elsewhere, other scholars and teachers presented data on their assessment of the success of numerous courses and programs now being offered primarily on the Internet and through videoconferencing in North American colleges and universities (see, for example, Strong and Harmon (1997, 58-70). Nowhere in this journal, however, or elsewhere on the web or in the literature focusing on the evaluation of distance-based classes, has substantive evidence been

provided that establishes the usefulness, or even the credibility, of Moore's list of ideas. The "no significant difference" rule, based strictly on the comparative academic achievement of students enrolled on site compared with students taking courses at a distance, is, even at the end of the 1990s, almost always cited as the only evidence that distance education is working and working well for students, no matter where they may live or who is teaching their course (Russell, 1997).

Despite this very real lack of evidence on affective learning, and qualitative data evaluating changes in student perception and personal experiences, one thing is certain. Distance learning is here to stay. With the help of the Fund for the Improvement of Post-Secondary Education, the development, dissemination, and assessment of SWT's Step Up to Geography project is now in its second year (see Hardwick 1998, 1999). Currently we are testing our materials and methodologies with the help of teacher collaborators in the Rio Grande Valley, located in a remote and underserved region in south Texas, more than seven hours away from the nearest graduate program in geography. Many of the social studies and geography teachers enrolled in our first Internet/video courses are using their credits to apply for certification in geography. All are also encouraged to apply to our distance learning-based graduate program in geographic education through one-on-one mentoring via e-mail and videoconferencing. With the help of this core group of teachers and others registering for our classes from many places in the state and nation, we are gathering both quantitative and qualitative assessment data that will provide a deeper understanding of the teaching and learning process.

Our campus has not been alone in searching for new ways to extend support to classroom teachers using distance learning technologies. For many educators and policy makers, online and videoconference-based degree programs appear to offer a solution to providing support for helping secondary teachers become better prepared to teach the new Advanced Placement course in geography and other new and improved geography classes to students at the middle and high school level; provide new ways to meet the ongoing fiscal problems of many students and campuses; and provide support for teachers and others living in remote rural areas and/or well bounded inner city neighborhoods. As this effort continues to evolve in the new century, it is incumbent upon us all to continue to assess distance learning experiences and approaches diligently-- and to re-evaluate our goals and methods often - to ensure the long-term improvement and high quality of teaching and learning geography.

References Cited

Hardwick, Susan W. 1999. "Going the Distance: Post-Graduate Reform in Geographic Education," *Open Praxis: The International Journal for Open and Distance Learning*. V.1: 19-22.

Hardwick, Susan W. 1998. "Integrating the National Geography Standards and Distance-Learning into Post-Graduate Teacher Training," *Ubique*. V. 18: 1, 6-7.

Moore, Michael. 1997. "Editorial: Quality in Distance Education, Four Cases," *The American Journal of Distance Education*, V. 11: 1-7.

Russell, Thomas L. 1997. *The No Significant Difference Phenomena as Represented in 248 Research Reports, Summaries, and Papers*. Raleigh, NC: University of North Carolina Press.

Strong, Robert W. and E. Glynn Harmon. 1997. "Online Graduate Degrees: A Review of Internet-Based Master's Degrees Offerings," *The American Journal of Distance Education*. V. 11: 58-70.

Position Statement

Janellen Huttenlocher
University of Chicago

I will report on an ongoing longitudinal study of the impact of school input on spatial growth. Individual differences in spatial skill levels often have been attributed to biological factors -- for example, the ability to do rotational transformations. In earlier work we found that input also has major effects on spatial growth. We tested a population of kindergarten and first grade children at four time points that were 6 months apart. If growth were due to biological factors, performance should increase smoothly over time. But we found that growth was much more rapid over the school periods than over the summer. Since we tested the same population at different time points, it is clear that input is critical to growth. In our present work we are using this design to explore spatial growth in second and third grade children in widely different schools. We have developed spatial scales in addition to the rotational transformation task we used earlier. In this study we are investigating differences in growth in different classes. We also have developed measures of spatially relevant input in the classroom. We are examining how variation in growth is related to variation in input by looking at the amount of growth over the school years in different classes. Our aim is to determine the malleability of spatial skills, and to identify what curricula are associated with the greatest growth.

Position Statement

David Mark

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I would like to raise three sets of issues regarding the connections between spatial cognition, children, and geographic education. I am attempting to be somewhat provocative in the interest of providing a basis for discussion.

The first set of issues, which has bothered me for some time now, deals with the difficulty of obtaining rigorous experimental control on experiments dealing with cognition in geographic space. Rigorous control is a cornerstone of experimental psychology, yet it is almost impossible to find spaces and places at geographic scales that are identical except for what is being tested. Using maps or other small scale stimuli reveals things about cognition of maps, but not necessarily about geospatial cognition. It is difficult to eliminate the possibility that differences observed in geographic space may be due to variables that could not be controlled for.

A second set of issues regards performance of spatial tasks by young children. Poor levels of performance, compared with performance of adults, might reveal that children of that age have not yet developed particular spatial abilities. However, it might also result from the subjects' lack of understanding of the experimental instructions, or a lack of ability to perform a task out of context. The fact that very young children are able to use many prepositions correctly indicates that they can grasp a wide variety of often subtle distinctions in spatial relations. Yet, children may appear unable to perform relatively simple tasks until they are much older. I would be interested in discussion of research methods to overcome this apparent problem.

The third set of issues concerns the link between spatial cognition and geographic education. Do these fields have much in common? Should they? As noted in my first point (above), even the connections between environmental or geographic cognition and spatial cognition for smaller objects is not clear. Geography school books that I have looked at seem to deal more with places and processes, and not much with spatial relations, shapes, orientations, and patterns. I am quick to admit that I have very little knowledge of school curricula for Geography, so I will be interested to hear of ways in which concepts and principles that would be recognized by psychologists as part of spatial cognition show up in or underpin geographic education.

