Facilitator:
Lynn Liben

Participants:
Soo-siong Lim
Nora Newcombe
Amy Lobben
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Kim Kastens

- Introductions
- Reminder of the topic
- Areas of convergence
    - Type of questions
    - Methods
- Lynn: How do we go about developing or selecting assessment appropriate for a specific group while considering functional equivalence to other groups and results?
    - Differences exist in assessment when assessments could be equivalent
    - Need for "authentic" assessment within messy environments (e.g. classroom, real-world)
    - Practicality issues
        - Cost
        - Context
        - Contributing to educational objectives
    - Discussion around assessment hurdle Sandra mentioned in introductions; trying to integrate content knowledge and spatial skills in an instrument.
- Susan: Need to think about both improvement of specific skill and transfer beyond that; Assessment varies based on desired effect
    - Breadth
    - Accumulative effects may not be visible immediately
    - Spatial thinking divided into parts and assessment of these parts may differ based on goal of the measurement
- Kristin: Finding a spatial assessment is a big task, depending on what type of spatial thinking you are trying to measure
- Nora: Any ideas about particular spatial skills when talking about authentic assessment?
- Sandra: There are many spatial assessment but no assessment connected with geographic concepts or incorporating spatial skills into geographic content

- Lynn: If spatial thinking is infused within the context of the discipline, then indirect measurements of success such as high retention of women in an engineering program after training in spatial thinking skills.
    - Many things may contribute to the outcome (confounding variables)
    - "Assess what we value and value what we assess"
- Nora: Source for content assessment might come from the high stakes tests in geography? Examine items that integrate content and spatial skills.
    - Discussion about why geography educators want geography included in requirements for state assessment. Link between funding for what is tested.
- Lynn: Source for content assessment might come from AP Human geography items. AP human geography is growing and successful. Items may provide examples of content with spatial skills.
- Susan: Identifying specific concepts then content-laden spatial skill tests can be developed
    - Discussion shifted here to ideas for performance-type tasks for assessment.
- Liben: Needs for a taxonomy. Somehow we can start filling of matrix from a variety of sciences and combining studies.
- Soo-siong: Is there a cluster of [ST] skills related to a specific domain? Which skill(s) is separable and transferable? Which skills are not connected [to other skills]? Is there any "flow-back" among the different skills?
    - This introduced discussion about a "common language" among groups; a taxonomy of agreed upon spatial skills
    - Discussion of trying to outline a research agenda
    - Perhaps there could be agreement on rotation, embedded orientation, but then there is the "everything else" category
- Suggestion to combine lab, behavioral, and intervention approach with an emphasis on "proof of concept" [evidence that a model or idea is feasible].
- Soo-siong suggested evaluation of 6-8 variables that could be agreed upon
    - Different variables
    - Non-overlapping
    - Which variables could be bundled with others? What variable(s) are affected by changes in others?
    - Attempt to have at least one measurement of each identified variable
    - Discussion on equipment requirements, practicality
- Liben: Can we identify core spatial skills? Can we make practical assessment related to (demonstrating) domain knowledge?
- Critical need identified: Assessments that are good proxies for outside environment
    - Face validity issues for authentic assessment
    - Suggestion that NAEP items may provide a "sketch" of essential concepts and how they might be assessed
- Kim: Computer aided assessments
    - Discussion on GIS assessments
    - Assessment of "domain mastery"

    - Computerized tests add to image quality; rich digital maps could perhaps test for different abilities or learning styles better than black & white paper & pencil tests (for example verbal only, 2-D representation, and 3-D representation)
    - Issues of dynamic interactive computer-aided assessments and static paper & pencil tests
        - Discussion on problems with computer-aided assessment reaching the classroom level. Emphasis on keeping dialogue open between researchers and educators.
- Research should lead to alerting teachers to "tricks of trade" for integrating spatial thinking skills.
    - Materials make a difference in abilities to integrate spatial thinking into the classroom
    - Consideration of students' prior knowledge affects integration of spatial thinking skills
- Newcombe: Instrument sharing
- Kim: Identifying shared interests among cognitive psychologists and geographers
    - Developing a geography equivalence to physic's "content inventory"
    - Identifying core concepts of geography with a manageable number
- Kim: Meta analysis and data Sharing
    - Instrument sharing
    - Crucial importance of the meta-data on the instrument
    - In order to classify data and instruments we should identify "What does it mean to be a spatially literate person and how do we get there?"
    - Returned to the discussion on trying to agree on a set of key spatial skills and spatial concepts
        - These may (or may not?) be based on a developmental curve; when to teach what skill? (example 2-D rotation versus 3-D rotation)
- Susan: Spatial thinking standards
- Soo-Siong: Data sharing is important not just for archiving but also for managing data
    - No need to restrict the data availability to just the centers
    - Determining data format?
    - Data structure?
    - Return to importance of quality meta-data
    - Privacy issues over shared data
- Amy: Using example of developing instruments for navigational map use introduced context-specific instruments; instruments developed for a very specific place, context, and purpose
    - Mental rotation was not a predictor for "navigational map using"
    - Mentally rotating a geometric shape is different from mentally rotating a map

In summary more questions were raised than solutions. These questions came down to;

1) What are the key conceptual pieces and how do we get agreement among members of the research community?

> In considering these key concepts, what are the differences among spatial concepts, spatial skills, spatial tasks, and spatial processes? Which should be emphasized and how are they related to each other?

2) What is a feasible and practical way to archive, organize, and make available data and instruments related to evidence and assessment of spatial learning?

3) How do we get at the link between spatial skills and spatial literacy? In other words, how do we get at causality (the why) and implications (the so what)?