Students' Misconceptions About the Correspondences Between a Map and the Terrain Represented by the Map

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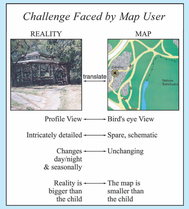
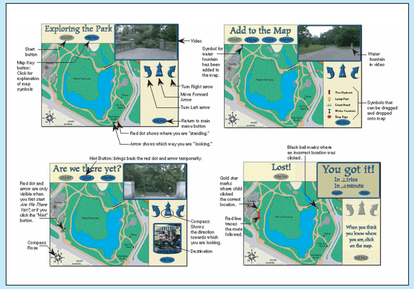
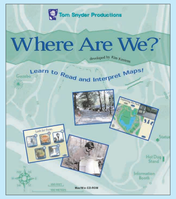
What does *Where Are We?* try to accomplish?

Where Are We? aims to help elementary school children master the skill of "translating" between a portion of the real world and a spatial representation of that same terrain by setting up circumstances in which students must repeatedly make connections between a park map and a video filmed in the park.







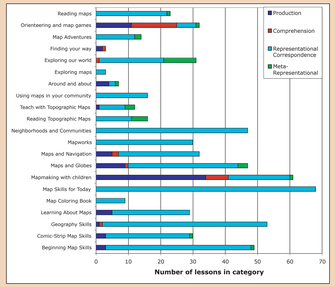
The *Where Are We?* software and curriculum are available from Tom Snyder Productions:

http://www.tomsnyder.com

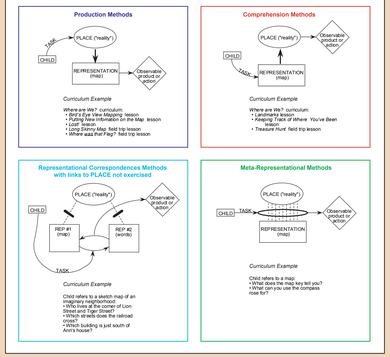
Why was a new curriculum approach needed?

Our curriculum analysis shows that most map skills curriculum materials do not require students to think about the real world; the tasks can be completed entirely within the frame of reference of the representation, i.e. the map.

These types of representational correspondence tasks are useful, but not sufficient for students to learn to use maps for real world tasks.



Method for studying children's understanding of spatial representation of place (after Liben, 1997)



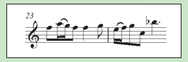
Why is instructional technology so powerful for achieving this learning goal?

Map reading is an example of a broader class of tasks of translating back and forth between a perceived aspect of reality and a paper representation of that aspect of reality.

Other examples:

Paper Representation | **Perceived Aspect of Reality**

Musical notation



Heard music

Mathematical equation for wave elevation

$$\text{elevation} = a \cos(\omega t - kx - \alpha)$$

from Barber (1969), *Water Waves*

Ocean waves

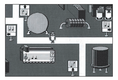
Traditionally such "translation" skills are taught, painstakingly, by a human mentor who watches the learner try, and try again, and try again, and offers guidance after each try.

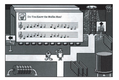
(Image from Geography Education Standards Project (1994). Geography for Life: National Geography Standards 1994, National Geographic Research & Exploration.)

Instructional technology can take over some of this effort by:
1) setting up situations where an aspect of reality needs to be compared with the representation, and
2) assessing the learner's tries and offering feedback.

Classic Music Example: Musical Maze

In *The Treehouse* software, children ages 5-8 advance through the Musical Maze by correctly selecting the sign displaying the musical notation that corresponds to a heard snippet of music. Children can choose to guess the song being formed by the snippets, or continue to collect notes until the song is finished.





The Treehouse software by Broderbund Software.

Classic Math Example: Jasper Woodbury Series

In the video adventure, "Rescue at Boone's Meadow," Emily must retrieve Jasper Woodbury and a wounded eagle from Boone's Meadow using an ultralight plane.

Students analyze alternative ways in which Emily can carry out the rescue, and which way will be the fastest, based on information revealed during the video.

By solving a series of largely mathematical problems, students formulate a rescue plan which takes into account fuel, travel time, payload, and landing area limitations.

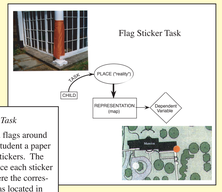
http://peabody.vanderbilt.edu/projects/funded/jasper/Jasperhome.html

How can we tell what students understand and misunderstand about map reading?

Map-to-Reality Task

We gave each student four colored wooden disks and a map with four colored stickers on it. The student's task was to place the disks on the ground to show where each of the stickers was located on the map.

We have developed innovative field-based map skills assessment tasks.



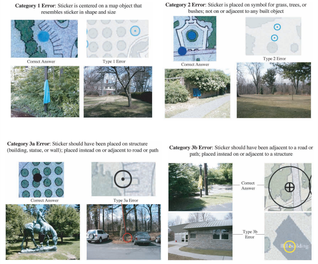
Reality-to-Map Task

We placed eight colored flags around campus and gave each student a paper map and eight colored stickers. The student's task was to place each sticker on the map to show where the corresponding-colored flag was located in the real world.

Types of errors fourth-graders make on the Flag-Sticker (Reality-to-Map) Task:

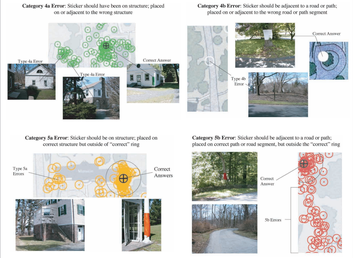
Representational Correspondence Errors:

We interpret these error types to indicate that the student has not fully understood the basic correspondence between symbols on the map and the categories of objects which the symbols are representing.



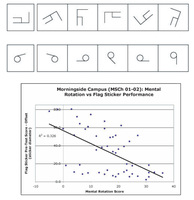
Configurational Correspondence Errors:

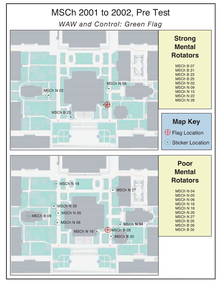
We interpret these error types to indicate that the student has understood the representational correspondence between symbols on the map and categories of object, but they have not successfully used the configuration of the features on the map to disambiguate between multiple occurrences of the same symbol on the map or to pinpoint the correct location within a large map symbol.

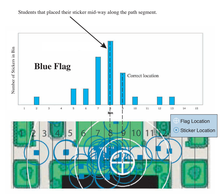


Rotational or Symmetry Problems:

This error type was common among students who performed poorly on a paper-and-pencil test of mental rotation ability. We interpret this error type to suggest that the student has not rotated the map (either physically or mentally) into alignment with the terrain.





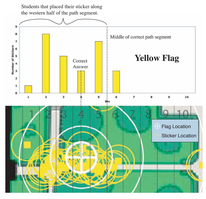


Imprecise Distance Determination:

These students correctly narrowed down their sticker position to the correct region, but most of them failed to use either relative or absolute distance information to precisely pinpoint the sticker within a landmark-less path segment.

We think that many students conceived of the blue flag as being "in the middle" of the path segment, whereas it was actually east of the center.

We think that most students conceived of the yellow flag as being "in that half" or "at that end" of the path segment, and did not try for a more precise localization.



Poster crafted by Linda Pistolesi and Jennifer Griffith