Mapping

Summary of Key Concepts

The word "map" sometimes has a very broad meaning. We talk of "concept maps," mental maps," and "mapping out my day." In the Mapping guide, however, we focus mainly on maps that are used to communicate about physical space. This narrower type of map is called a **spatial** or **geographical map**. Such a map might show friends how to get to one's home, or how the rooms are laid out. These maps reveal different ways to get to a destination, the towns a road passes through, and the distances between the towns. Other spatial maps tell of topography, the weather across the country, or the incidence of a disease, all as functions of location. The focus of Mapping is upon maps as tools of communication. The basic idea is that maps represent places and the locations of things.

Spatial maps are meant to communicate what is in a space, and where each thing is. The map-reader expects a **correspondence** between what is shown on the map, and what is seen in that part of the real world represented by the map. If the neighborhood map shows a school and two candy shops, we expect to find a school and two candy shops when we visit the neighborhood. There should also be a correspondence between the relative positions of things shown in the map and the positions of those things in the real world. If the map shows one candy store across from the school and the other a block to the east, then that is where we should find them on the actual street.

Correspondence in mapping is somewhat of a one-way street. We expect the things shown in a map to be present in the real world. However, we don't expect everything in the real world to be present in the map. Potholes are an unpleasant part of a driver's trip, but we don't expect them to be shown on a map – unless of course we are members of the road crew sent to repair the potholes. Maps only show the things that the

mapmaker wants to emphasize; i.e., that are part of the information that the designer of the map wants to communicate.

In order to depict real-world things the mapmaker uses **symbols**. The symbols may range from a drawing of the thing, to an icon, to something as abstract as a geometrical form. (Because of the role of symbols in mapping, some professional developers have chosen to conduct the workshop on Signs, Symbols & Codes prior to Mapping.) In the initial maps of their rooms, children usually draw pictures of the bed, dresser, desk, television, and so forth. Later they develop more abstract ways to represent these things. As the symbol system becomes more abstract, the need for a legend or key becomes more apparent. The **key** connects each symbol with its meaning.

Maps are drawn from one or more **points of view** or **perspectives**. In their earliest maps, children may use multiple points of view. In children's first maps of their bedrooms the bed is frequently drawn from the top, or bird's eye view, while the dresser and walls are drawn from a side view. As they gain experience, children become more consistent in their use of perspective.

When using a map to find the way to a destination, the map must be **oriented** to the space it represents. There are two main ways to orient a map to a space. If the direction of North is known and the map shows North by an arrow or compass rose, then turn the map so the arrow indicating North points in the northward direction in real space. To use the second method of orientation, identify where you are on the map. Then align the map so that the direction from your location to a landmark on the map is the same as the direction from you to the same landmark in the real world. A landmark could be anything shown on the map, and also observable from where you are.

Most published maps are drawn to a **scale**. This means that a particular distance on a map represents a specified distance in the world; for example, one inch stands for one mile. Thus if it is one mile from 100th Street to 120th Street, then the map is drawn so that the map distance from 100th Street to 120th Street is one inch. The scale expresses the fixed **ratio** or **proportion** between map distance and real distance. By appropriate choice of scale, a map-maker can fit a whole country, a state, a city, a building, a classroom, or a desk top on an 8 ½" x 11" piece of paper. If the scale is reasonable, the map can be made to fill most of the available paper.

The set of lines on graph paper is called a **grid**. A grid is useful in making a map to scale. Initial classroom maps may use a scale in which one grid square represents one floor tile. The grid can also provide a way of finding specific locations on a map. Letters and numbers can identify the horizontal and vertical rows and columns, respectively. Then, each square on the map is assigned a letter and a number, based on the row and column that intersect there; e.g., the intersection of row G and column 8 would be called G8. In math, this method of identifying a location in space is called a **coordinate system**.

Pre-workshop Scavenger Hunt

Ask participants bring any interesting maps with them to the workshop.

Workshop Preparation

Prior to the start of the workshop, you will need to make an outline map of the workshop space on a large sheet of gridded chart paper. To make this map, measure the length and width of the room using a convenient unit, such as floor or ceiling tiles, wall panels, light fixtures, or windowpanes. Then determine an appropriate scale, relating grid squares to measurement units that will allow you to fit the entire map on the page. Use a scale other than one-to-one, so that participants can see how the scale of a map is related to ratio-and-proportion. For example, one grid square on the chart paper might represent a square of four floor tiles (two-by-two); or two-by-four grid squares might be equivalent to one large rectangular ceiling panel, etc.

Workshop Materials

- 8 ½" x 11" graph paper for map making
- Chart paper and markers
- Rulers and tape measures
- Large Post-its, colored index cards or construction paper
- Masking tape
- A diverse collection of spatial maps, including road maps, topographical maps, weather maps, political maps, floor plans, building maps, bus line maps, maps of parks, zoos, and so forth
- A few things that might be considered "maps," but that do not represent physical space: e.g., tables, graphs, flow charts, concept maps, time lines, and block diagrams
- A collection of discarded magazines and newspapers
- Overhead transparency films and markers (if projector will be available)
- Copies of Map Analysis Worksheet and Mystery Table Map Worksheet (see next two pages)

Map Analysis Worksheet

Looking at Maps of Physical Space	
Title of Map	**List of features found on the map**
List the features NEEDED for a map of physical space:	

Mystery Table Map Worksheet

Original Design	
Map features List the features you included on your map.	**Observations and Outcomes** Describe the difficulties the testers had in using your map.
After Redesign	
Map features List the features you added each time you redesigned it	**Observations and Outcomes** Describe the remaining difficulties the testers had in using your map.

Directions to Participants

The following six pages provide a set of instructions for the workshop activities, suitable for copying to transparency films, PowerPoint slides, or chart paper, for use during the workshop.

MAPPING

1. Scavenger Hunt

- Search newspapers and magazines for anything you might consider a map.

- Cut each one out and save it in a pile.

2. Guess my Categories!

- Sort the maps from the scavenger hunt, plus maps supplied by us, according to your own SECRET CATEGORIES.

- Place your groups of maps on the table so others can try to guess the basis for each category.

3. Looking at Maps of Physical Space

Examine a variety of maps of physical space. Determine the features that each map uses to represent some aspect of physical space. Use the Map Analysis Worksheet to list:

- The features you found on EACH map
- The features that SHOULD BE included on any map of physical space

4. Mystery Table Arrangement

- Place a circular object, a long straight object and a rectangular object randomly on the table.
- Make a map, showing their locations accurately.
- Remove the 3 objects to one side.
- Challenge another group to restore the original arrangement, using only the map as a guide. NO COACHING!
- Based on the problems the other group encounters, redesign your map to make it easier to follow. Then let the other group try again.

Record all data on the Mystery Table Map Worksheet.

5. Map this Room

- Each person, make a quick, rough map of this room and post it on the wall.
- Compare your map and others' maps. Look for similarities and differences.
- Which maps are easy to read?
- Which are more difficult?
- What map elements make the maps easier to understand?

6. Scale Maps

- Make a paper cut-out of your table to the same scale as the master map of the room.

- Place the map of your table in the proper place on the master map.

Sample Workshop Agenda

Introductions (10 minutes)

Scavenger Hunt (10 minutes)

Ask the teachers to search through the old newspapers and magazines for anything they might consider a map. See Activity #7 in Mapping.

Sorting: Guess my Categories! (30 minutes)

Combine the maps you have assembled with those brought in by teachers, and those cut from magazines and newspapers. Include such items as concept maps, flow charts, time lines, block diagrams, and other graphic devices for organizing information. Provide each group with a diverse collection of maps, and ask them to sort them according to their own secret categories. The other groups will then have to guess the categories.

Analysis: Looking at Maps of Physical Space (20 minutes)

Provide each teacher with a variety of maps that represent some form of physical space. This has probably been one of the categories used in the sorting activity. What features does each map use to convey information about physical space. What characteristics do they have in common? How do they differ? Then ask the groups to decide what features a map of a physical space should have. The Map Analysis Worksheet will make it easier to organize the information. Activities #2, #8 and #9 are relevant here.

Design I: Mystery Table Arrangement (40 minutes)

Ask each group of teachers to select three small objects: one circular, one rectangular, and one linear. Examples are a roll of tape or a CD, a small box or index card, and a pen or pencil. They should place these objects randomly on their table, and then make a map showing the locations of the three objects. Next, they remove the objects to the side, and ask members of another group to place the objects in their original locations, using only the map as a guide. Emphasize that the purpose of the test is to evaluate the map, not the map-reading ability of the testers. The designers of the map should not provide any hints or coaching, as their map is being tested. They should note carefully the kinds of ambiguity or errors that result from attempts to use their map, and then use this information to redesign it. Then they should try it out again, keeping a record of the changes they made, and how effective they were. The Mystery Table Map Worksheet should be used to record all data. See Activity #14.

Design 2: Map this Room (30 minutes)

For a first experience in map-making, have each teacher individually draw the room they are in, as in Activity #11. This map should be done quickly on any sheet of 8

½" x 11" paper, not to scale, and then posted on the wall. Then conduct a "Gallery Walk," where each participant examines all of the maps. Ask the teachers to compare one another's maps for similarities and differences in how the room is portrayed. Encourage them to explore items that were included or excluded in their maps, and also to look for generic features of maps, such as point-of-view, correspondences between the map and the space that was mapped, use of symbols and a key, orientation, scale, and coordinate system (see "Key Concepts").

Design 3: Scale Maps (40 minutes)

Display a blank piece of large grid paper and ask the teachers to figure out what scale should be used to represent the entire workshop room on this piece of paper. You may provide them with the measurements of the room, or have them measure it, depending on the time available. Discuss how well their suggestions would work: Would the entire room fit on the map? Would the map use up most of the available paper? See Activities #18 & #19.

Now display the outline map you have already made of the room (see "Workshop Preparation"), and explain the scale you used. Their task is to add their own tables to your "Master Map." If there are other large furnishings besides the worktables, you may want to subdivide the groups, and assign other furniture items to some of the subgroups. Each group will need to measure at least one piece of furniture, and represent it using the same scale you used. They can cut these furniture "pieces" out from Post-its, if these are available, or else make them out of construction paper or colored index cards. Once a group has created its furniture cutout, ask them to determine the appropriate place to put it on the Master Map. To do so, they will have to take measurements of where the furniture is in relation to some landmarks, such as walls or columns. These measurements, too, will need to be scaled down. They should then attach their individual furniture pieces at the correct locations on the master map. Discuss how such a map could be useful, for example, in redesigning the furniture arrangement.

Sharing (15 minutes)

Lead the teachers in a discussion of the specific challenges of creating a scale map. Help them understand the process in relation to the math topic of "ratio-and-proportion."

Reflecting on classroom possibilities (15 minutes)

The sample workshop agenda begins with activities accessible to all students. The last activities involving scale are generally too difficult below about fifth grade. Lead teachers in a discussion of how they might use these activities in their own classes.

Workshop Tips and Strategies

Workshop Preparation

As you assemble your maps, cast your net as widely as possible. Include not only maps of physical space, but also some more generic maps, which represent concepts, schedules, organizational relationships, or sequences of action. In the first two activities, teachers will make distinctions between maps of physical space, and maps in this broader sense. Also, be on the lookout for maps that are not very clear, such as posted maps that are oriented incorrectly, or maps that are lacking a key.

Scavenger Hunt and Sorting

The aim of these activities is to assemble the broadest possible collection of things that may be maps, and of ideas about what "maps" might be. The "Analysis" activity focuses more narrowly on spatial maps.

When children brainstorm and do scavenger hunts, they may include such things as TV schedules, restaurant menus, and even comic strips as maps. These can generate a fruitful discussion on what a map is. Teachers may be much more constrained and include only conventional geographic or spatial maps. If this is the case, be prepared with examples of concept maps, flow charts, schedules, and menus. Introduce these items to stimulate a discussion on the various possible meanings of "map."

Analysis

This activity narrows the focus from the broad concept of "map" to the more restricted meaning of a representation of physical space. Some common characteristics of spatial maps are:

1. There is a correspondence between things shown on the map and things found in physical space.

2. A map is selective in what it shows; i.e., not everything in the physical space is represented on the map.

3. A map is made for a purpose, and shows information that helps accomplish this goal.

4. Maps use symbols to represent things in the world.

5. There is usually a key, explaining the meaning of each symbol.

6. Most maps have scales that tell the relationship between distances on the map and distances between corresponding places in the world.

7. A map is often made on a grid that uses a coordinate system to make things easy to find.

8. There is some way to orient the map to the real world: a compass rose or landmarks are used to show which way the map should be held when using it.

Design 1: Mystery Table Arrangement

This activity complements the analysis of spatial maps by demonstrating the necessity for some of the features listed above. Therefore, it is important that participants see for themselves what happens when these ingredients are missing or unclear. Make it clear that their only means of communication with the map users will be via the map; they are not to say or do anything that aid in the interpretation of their map. It is likely that people will have trouble using these first maps. These difficulties are important, because they will suggest the additional features that need to be added. By failing to place the objects correctly, users will reveal the deficiencies in the map. In other words, let the participants discover the need for orienting landmarks, scale, and grid systems without being told to include them. They will then invent these components as they redesign their maps.

Design 2: Map this Room

The request to "draw this room" may be elicit the response: "I can't draw!" Emphasize that the drawing of the room is not intended as art, but as an attempt to communicate information. In discussing the maps, highlight how the teachers have used point-of-view, symbols, and labels. Compare the kinds of things they have included or excluded on their maps, what kinds of information these items communicate, and to whom the information might be useful. Discuss how the use of scale, grid system, orientation marks, a consistent point of view, symbols, and a key would make a map more or less useful for various purposes. This activity is analogous to #11 in Mapping, in which children make first maps of their own rooms.

Design 3: Scale Maps

This activity develops a basic understanding of ratio-and-proportion in a real-life situation. However some teachers may exhibit math avoidance (see pp. 31-33 of this Guide). For this reason, it is important to scaffold the activity, so participants can enter it on a variety of levels. Begin with a discussion about how to establish an appropriate scale for the Master Map. Then, you may want to give a demonstration of how to map one table, for example, the one you are using, to the same scale. Later you might lead a discussion about how to place the map of your table in the right position on the map of the entire room.