

Correct Teaching of Tactile Representations

Importance of progression

1. Experiencing real-life concepts
2. Handling real objects
3. Handling models of objects
4. Reading two-dimensional and symbolic representations of concrete objects
5. Reading two-dimensional and symbolic representations of abstract concepts

Success involves

1. Strategies for exploring and interpreting the tactile graphics
 - Tactile discrimination – shape, texture, line
 - Systematic searching – overall page, then varies depending on purpose
 - Tracking and tracing – following the lines and looking for related labels
2. Knowledge of spatial concepts
 - Spatial orientation – including directional
 - Understanding of where things are in relationship to others
 - Understanding of length as a tool for interpretation
 - Combining pieces sequentially to systematically make the whole

Tactile graphics to explore, including when does difference matter and when doesn't it matter

1. Same shape, different sizes
2. Same size, different shapes
3. Same shape and size, different rotation
4. Different directions of lines

Guidelines to consider

- Be sure that students have a good understanding of basic concepts before working with tactile graphics, so that they can concentrate on the new concepts and other information presented in the diagrams.
- Whenever possible, provide the student with experience with the real thing before expecting him or her to develop concepts from representations.
- Use 3 dimensional objects or models alongside symbolic displays whenever possible, but especially when introducing your student to a new concept or type of graphic display (e.g., cans for cylinders, pointed drinking cups for cones).
- Use real life objects and the environment to convey positional/geometric concepts (e.g., the table is parallel to the floor, the corner of the room or desk is a right angle).
- Multisensory displays may be more motivating and provide more conceptual information; however, it is important not to bombard the student with too much varied information at once. Attention can be guided from one part of a concept to another.
- Tactile displays that are interactive (e.g., involving the rearrangement movable parts) may also be more motivating and provide additional information about a concept; again, however, care must be taken to guide the student through the purpose and handling of the interactive elements.
- Provide careful sequencing when moving from 3 dimensional (concrete) to 2 dimensional (symbolic) presentations.

- Use a logical sequence of simple to complex displays (e.g. diagrams with single lines before double lines, simple symbols before complex symbols, simple concepts before more difficult concepts, etc).
- When selecting models to represent actual items or concepts, insure that the critical features of that object or concept are present in the model to be used (e.g. wheels that move on a car, animals that are not hollow and open and that have feet that are separate and not attached to a platform or "ground"). Furthermore, when introducing your student to models or tactile graphics, emphasize the critical features and relationships first; if additional information is appropriate, it can be addressed secondarily or in succeeding displays.
- Teach students to develop a systematic search pattern for exploring tactile displays. Research suggests that this skill is one of the most critical for success in handling tactile graphics. This should include using one or both hands to scan the entire field to get a gestalt for the type of information presented, the layout and format of the information, or the location of a key or other descriptive information. While students may use vertical, horizontal or circular search patterns, a vertical approach is often most efficient because it involves fewer sweeps to cover more area more quickly with less overlapping. Using a systematic search pattern will also insure that the entire field was examined and will prevent the student from missing important information.
- Work with students on discriminating types of lines (horizontal, vertical, diagonal, parallel, intersecting, angles, shorter/longer comparisons), areas, spaces, and symbols (matching, comparing, same/different, noting directional differences).
- Work with students on tracking lines (single, double, intersecting, embedded in areas).
- Teach students to orient themselves to the display efficiently, including critical cues (e.g. title, key, scale notes). Have students read the key or other descriptive information before looking for details or attempting to solve problems; this will help to focus attention on "key" points and make important information more immediately recognizable.
- Create a simple graph using raised line graph paper obtainable from the American Printing House for the Blind and place it on a small bulletin board that can be used at the student's desk; the child can record data points with pushpins. If the graph needs to be preserved for future reference, remove the pins and squeeze a dot of puff paint over each pinhole.
- For younger children, two strategies for comparing distance or space between symbols are a) using the width of the finger to "measure" distances between symbols, and b) estimating the relative ratio of one distance to another (e.g. "about half as long", or "only a little longer").
- Teach students and their classroom teachers how to produce their own graphic displays.
- Provide a short list of Nemeth Code symbols in both braille and print to accompany tactile graphs; this could be helpful to both the student and the classroom teacher.
- Familiarize students with the types of graphics used on standardized tests so that they will not be penalized by a lack of ability to read tactile diagrams.

Examples of teaching aids

Paper folding, or origami, can be a fun and motivating technique for teaching a variety of concepts. It actively involves students in discovery and helps their understanding of basic constructions. It also supports the learning of such concepts as fractions, angles, line segments, area, altitude, and more complex geometric concepts. Examples of using origami in geometry can be found in Tinsley's (1972) "The Use of Origami in the Mathematics Education of Visually Impaired Students"

Some things to keep in mind when using this technique:

- Use paper with enough body to make a good crease but not so heavy as to make it unmanageable; braille paper is a good choice, but brown wrapping paper is also effective and is less expensive, more flexible and offers greater possibilities regarding the size of the shapes.
- Pre-fold creases for students with motor impairments; pre-score for students who might be able to use the technique independently.
- Have an abundance of pre-cut shapes readily available, since students may use many in a short time.
- As an example, use a square piece of paper and follow these steps:

Fold in half, 2 halves = 1 whole.

Fold in half, then in half again, 4 quarters = 1 whole.

Continue the process

You can use this technique to illustrate such mathematical concepts as perpendicular line segments and altitude of a triangle.

Another commonly used tool is a geoboard. Geoboards are boards of wood or masonite with nails placed at regular intervals much like a pegboard; some have line segments like grids displayed while others do not. Line segments, shapes or other designs can be made by arranging rubber bands or string or other appropriate materials. Numerous games and activities can be carried out on a geoboard to teach such concepts as shapes, positional concepts in two dimensions, patterns, area, perimeter, and fractions.