Teaching Math & Science to Students Who Are Visually Impaired

- Guidelines for designing tactile graphics
- Teaching tactile graphics in math
- Teaching tactile graphics in science
Questions to Ask Yourself

- When should I introduce tactile graphics? (early)
- What’s the main purpose of this picture and what’s the simplest way to convey it?
- What is necessary and unnecessary?
- Will the graphic lead to a better understanding or is the same information provided in text?
Rule of Thumb

- Plan ahead, does the teacher consider it important?
- Simpler is better, but keep necessities
- Embossed paper vs. materials put on top of the paper
- Pay attention to contrast and spacing (Use color **contrast** if the student has some usable vision)
Rule of Thumb Continued

- Use only relevant information
- Avoid using too many kinds of symbols
- Use straightedges when possible
- Think tactile, not visual (picture borders?)
- Points (highest), outline, textures (lowest)
- Not necessarily an exact reproduction
- Cost and time not primary consideration
Paging

- If a picture presents several concepts at once, consider breaking up into several pictures (one may be an overview)
- Use keys, legends, and abbreviations when needed and have easy access to them for reference (before or after on same page, on facing page, not on back of graphic)
Labels

- Don’t break up a line for a label
- For a key, use single letters with single letter indicator or capital letter indicator or use 2-letter abbreviations. Spell out the full label in the key
- Omit capital signs in labels if not needed
- Retain the capital in titles or captions where there is more room
Graphs

- Omit grid lines if only the shape of the graph is important
- Put unit markers along the outside of the axis
- Leave space between bars on bar graph and texture bars
Lines

- Dotted or dashed lines stand out more than solid lines.
- Use lead lines (connect graphic to label) sparingly so they aren’t confused with the actual graphic (different and less prominent than graphic).
- Use different types of lines to convey different types of information.
Textures

- Use textures sparingly
- Avoid decorating the graphic
- Orient texture in the same direction or it changes meaning
- With 2 or more textures, use border lines
- Primary (rough), secondary (smooth)
- APH Tactile Marking Mat (makes crayon marks tactile)
APH Items

- Graphic art tape
- Feel and Peel Stickers
- Textured Paper Collection
- graph paper, stick-on rulers
- Draftsman board
- Braille Transcriber’s Kit: Math (rulers, number lines, protractors, thermometers, clock faces, low-relief graph paper)
Non-APH Items

- Wikki Stix
- Hot glue gun
- Foam sheets
- Sandpaper
- String or heavy thread (use of knots)
- Pipe cleaners
- Lots of other household and craft items
Puff or Craft Paint

- smaller tips help provide more control
- glitter, regular, dotted, dashed, thin, thick
- pull away from paint placement
- angle bottle away from straightedge
- leave time for drying
- careful of sharp peaks
- don't fold papers or put other papers on top of it or they tend to stick
Tools

- Tracing wheel
- Tooling
- Gum rubber pad or cardboard (softer the pad, the higher the embossing)
Kits from APH

- Tactile Graphics Starter Kit
  - Craft ink, fabrics, point symbols, slate and stylus, manual with good and bad examples

- Tactile Graphics Kit
  - Point symbol tongs, areal pattern plates, line drawing tools, slate and stylus, braille eraser, rubber embossing pad, ruler, foil sheets

- Line-Drawing Tool Kit (tools only)
Software

- QuickTac
- Tiger Software
  - Using graphics from the Internet
  - Using the drawing toolbar
  - Using Excel graphs
Higher Cost Options

- Microcapsule paper and an image enhancement device
  - TIE (Tactile Image Enhancer)
    www.repro-tronics.com
  - PIAF (Pictures in a Flash)
    www.humanware.com
  - Swell-form machine
    www.americanthermoform.com
Links

- BANA’s Guidelines and Standards for Tactile Graphics can be viewed online or downloaded at [http://www.brailleauthority.org/tg/](http://www.brailleauthority.org/tg/)

Early Learning from APH

- Setting the Stage for Tactile Understanding: Making Tactile Pictures Make Sense (transition between real objects, thermoform, raised-line drawings)
- Flip-over concept books (Line Paths, Parts of a Whole)
- Teaching Touch (tracking, searching, verbal description, use of symbols)
- Tactual Discrimination Worksheets
Teaching Tactile Graphics in Math

- Students need to understand vocabulary such as diagonal, parallel, perpendicular, intersecting, angles, symmetry, reflection, rotation
- When graphing, have axes (thicker), grid lines (thinner), and graphed lines appear differently
- Use textbooks and APH Geometry tactile graphics
Teaching tactile graphics in science

- Evaluate whether a tactile graphic or a model is more appropriate.
- Must often it should be explicitly taught before the student needs to use it.
- Use textbooks and APH basic science, life science, anatomy tactile graphics