

Slide 1: There's a Lot for PK-5th Grade Students to Master When it Comes to Tactile Graphics and Learning Tools!

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Image description: Project INSPIRE logo

Slide 2: Our Backgrounds

- Dr. Rosenblum
 - Low vision and have always struggled with visual information
 - TSVI and personnel preparation (retired)
 - Led two Institute of Education Sciences "AnimalWatch Vi" projects (products available from APH)
- Dr. Herzberg
 - Math teacher, TSVI, and personnel preparation
 - Project INSPIRE

Slide 3: Our Questions

- What types of graphics literacy skills (e.g., vocabulary, systematic search) do TSVIs introduce to their students in PreK through 5th grade?
- When do TSVIs introduce graphics literacy skills to their students and at what grade levels is each skill introduced?
- What are the greatest challenges PreK-5th grade braille readers experience when asked to use graphics in their general education curriculum?
- What resources would TSVIs like to have developed to support their work in teaching graphics literacy skills to their students?

Slide 4: Procedure

- Developed an online accessible survey.
- Had two nationally recognized TSVIs who are certified in math education review and provide feedback.
- Survey was open in April and May 2022.
- Frequencies for quantitative data compiled.
- Themes identified in qualitative responses.

Slide 5: Participants' Demographic Information

- 68 TSVIs from 26 states
 - Highest number from TX, NY, and WA
- The number of TSVIs who worked with pre-braille/braille students at each grade level in the last 3 school years
 - Pre-K or K (n=62%)
 - 1st, 2nd and/or 3rd grade (n=87%)
 - 4th and/or 5th grade (n=57%)

Slide 6: TSVIs' Teaching and Caseloads

- Number of years worked as a TSVI
 - M=13, range 3 to 35
- 87% of the TSVIs worked as itinerant teachers.
- Number of students on TSVIs' caseloads in the 2021-2022 school year
 - Direct service students
 - M=9, range 1 to 33
 - Direct service pre-braille/braille students
 - M=2, range 0 to 6

Slide 7: When Graphical Information is Introduced

"Think about the time you have spent in the last three school years (2019-2020, 2020-2021, and 2021-2022) in general education PreK-5th grade classrooms. Select the grade level band when your pre-braille/braille students are **first expected to use** each item in the list below in their academic classes (e.g., Language Arts, Math, Science, Social Studies)." List of 45 items provided to participants.

Slide 8: Seven Choices

- Pre-K or Kindergarten
- 1st, 2nd or 3rd grade
- 4th or 5th grade
- Introduction to this item varies based on curricula and students' abilities.
- I am not sure when my pre-braille/braille students were first introduced to this item.*
- This item is not part of any curricula my pre-braille/braille students are using where I teach.*
- I do not know.*

*These choices were not included in the analysis. Number of respondents varied per item from 26 to 67.

Slide 9: Introduction: Pre-K and/or Kindergarten

- 79% Tracing dotted lines to practice writing print numbers
- 73% Dot to dot activity sheets
- 65% Tactile graphic of common objects (e.g., cup, ball)
- 65% Arrays (rows and columns) to represent multiplication problems
- 64% Tactile graphic of 2D basic shape (e.g., triangle)

Picture description: A girl is using her right pointer finger to explore a tactile graphic made on Swell paper while she looks at the page.

Slide 10: Ten Frames

- 47% of TSVIs selected Pre-K or K
- 44% of TSVIs selected 1st, 2nd or 3rd grade

Picture description: A young girl is placing a tactile token into APH's ten frame.

Slide 11: Introduction: 1st, 2nd or 3rd Grade

- 70% Fraction tiles, fraction bars, or visual fraction models
- 66% Number lines made completely in braille
- 60% Number lines made with a texture (e.g., graphics art tape)
- 59% Models of addition and subtraction problems
- 59% Pictures of pie pieces to represent fractional parts
- 58% Tactile graphics of 3D shapes (e.g., cube)
- 56% Graphic organizers
- 55% T-chart graphic organizer for comparing and contrasting
- 55% Line plot/dot plot
- 54% Venn diagrams with 2 circles
- 53% Picture graph/pictograph (graph uses images or symbols)

Slide 12: Introduction: 1st, 2nd or 3rd Grade, Cont.

- 52% Tactile graphics of more advanced 2D shapes (e.g., hexagon)
- 52% Physical model of 3D shapes (e.g., cone)
- 52% Measuring objects using non-standard units (e.g., paper clip)
- 50% Base ten blocks
- 47% Food web/chain

Picture description: A girl is using a work tray with 3 compartments and Digi Blocks to build numbers.

Slide 13: Maps: Introduced in 1st, 2nd or 3rd Grade

- 55% Simple maps (e.g., playground)
- 66% Maps with a key (e.g., neighborhood, state)

Picture description: A student is tactually exploring a computer-generated map of a neighborhood with both hands.

Slide 14: Graphs Introduced in 1st, 2nd or 3rd Grade

- 56% Bar graphs with 2 categories
- 49% Double bar graph
- 67% Bar graphs with 3 or more categories
- 64% Single line graphs
- 53% Line graphs with 2 categories

Picture description: A student is tactually exploring a line graph with two categories. She is using both hands.

Slide 15: Measurement Tools Introduced in 1st, 2nd or 3rd Grade

- 65% Rulers to measure actual objects
- 66% Rulers to measure 2D drawings
- 66% Yard stick or meter stick

Picture description: A student is using a large print/braille meter stick to measure a box.

Slide 16: Item Introduced in 4th or 5th Grade

- 65% Protractor to measure angles
- 58% Venn diagram with 3 or more circles
- 54% Box and whisker plots
- 49% Circle or pie chart with 4 or more categories
- 46% Histogram

Picture description: A student is learning to use a protractor.

Slide 17: Variation in Responses

- Pictures of dice or dominos
- Geometros (3D representation of nets)
- Area model to represent multiplication of 2-digit numbers
- Line graphs with 3 or more categories
- Timeline chart
- Circle or pie chart with 2 or 3 categories
- Scatter plot/cluster plot

Picture description: A student is tactually reading a computer-generated circle graph with 3 categories.

Slide 18: Three Questions to Consider by Grade Band

- Select the **five** items that your Pre-K and/or Kindergarten pre-braille/braille students **use the most**.
- Select the **five** items that are most challenging for your Pre-K and/or Kindergarten students when asked to **locate information** on a tactile graphic.
- Select the **five** items that are most challenging for your Pre-K and/or Kindergarten students when asked to **interpret information** on a tactile graphic.

Due to a glitch in the survey logic, data were not collected for the 4th and 5th grade band.

Slide 19: PreK and/or K: Items Used the Most

- Tactile graphic of 2D basic shape (e.g., triangle) (n=36)
- Physical model of 3D shapes (e.g., cone) (n=36)
- Tactile graphic of common objects (e.g., cup, ball) (n=26)
- Number lines made with a texture (e.g., graphics art tape) (n=17)
- Measuring objects using non-standard units (e.g., paper clip) (n=15)
- Simple maps (e.g., playground) (n=15)

Slide 20: PreK and/or K: Items Most Challenging in Which to Locate Information

- Tracing dotted lines to practice writing print numbers (n=21)
- Tactile graphics of 3D shapes (e.g., cube) (e.g., cone) (n=19)
- Graphic organizers (n=17)
- Dot to dot activity sheets (n=16)
- Measuring objects using non-standard units (e.g., paper clip) (n=15)
- Picture graph/pictograph (graph uses images or symbols)(n=15)

Slide 21: PreK and/or K: Items Most Challenging to Interpret Information

- Bar graphs with 3 or more categories (n=21)
- Graphic organizers (n=16)
- Measuring objects using non-standard units (e.g., paper clip)(n=15)
- Tactile graphics of 3D shapes (e.g., cube) (n=13)
- Dot to dot activity sheets (n=12)

Slide 22: 1st, 2nd and/or 3rd Grade: Items Used the Most

- Physical models of shapes (n=21)
- Number lines made completely in braille (n=20)
- Fraction tiles, fraction bars or visual fraction models (n=20)
- Rulers to measure actual objects (n=16)
- Simple maps (e.g., classroom, playground) (n=15)

Slide 23: 1st, 2nd and/or 3rd Grade: Items Most Challenging in Which to Locate Information

- Maps with a key (e.g., neighborhood, state) (n=16)
- Line plot/dot plot (n=14)
- Bar graphs with 3 or more categories (n=13)
- Dot to dot activity sheets (n=12)
- Rulers to measure actual objects (n=11)

Slide 24: 1st, 2nd and/or 3rd Grade: Items Most Challenging to Interpret Information

- Line plot/dot plot (n=16)
- Graphic organizers (n=13)
- Histograms (n=13)
- Maps with a key (e.g., neighborhood, state) (n=11)
- Line graphs with 2 categories (n=11)
- Food web/chain (n=11)
- T-chart graphic organizer (n=10)
- Circle or pie chart with 4 or more categories (n=10)

Slide 25: How TSVIs Pre-Teach or Introduce a New Type of Graphic

- I support the student in systematic exploration of the entire graphic, then address individual sections/features. I ask the student which information they think is being conveyed through each part and provide labeling and clarification as needed.
- If possible, a real object is introduced and compared to the tactile graphic. Student is given time to explore the graphic, make comparisons, explain understanding and ask questions.

Slide 26: How TSVIs Pre-Teach or Introduce a New Type of Graphic, Cont.

- I pre-teach the graphic by pre-teaching (or making sure the student understands) the concepts that the graphic will represent.
- I let the student explore the tactile graphic at least a day before he will use it in the classroom. I orient him to the features/formatting of the graphic, where the information is commonly located on the graphic and where to look first for the headings on the graphic.

Slide 27: How TSVIs Pre-Teach or Introduce a New Type of Graphic, Cont. 2

- Explore graphics together. Talk/sign about what we find. Point out salient details. Create graphics about topics that student is interested in.
- I begin with a tactile representation of the graphic that is blank we talk about the function of how it can be used to collect data or share information. We create one first with something they are interested in. We reread what we created. We look at data and plot it. Then we read data that we are not already familiar with.
- I also work with the para on the graphic, so that she knows how to provide the best in-class support.

Slide 28: More Ideas for Pre-Teaching/Introducing

- I always keep in mind what the classroom teacher wants the children to get out of the lesson to make sure that is part of my teaching about interpreting the tactile graphic.
- I will "layer" the graphic. For example, present a plain x,y graph, label the x axis, then the y axis, next number the quadrants, plot x,y values in each quadrant, etc.
- I will introduce the student to the materials with "free exploration" and asking to describe the materials (prior knowledge).
- I try to make comparisons to items that they already know and have a reference to.

Slide 29: What 54 TSVIs Believe a Braille Reader Should Do When They Receive a Graphic

Table that is 3 columns and 6 rows. Column 1 heading is Item, Column 2 heading is First, and column 3 heading is Second. Row 1 item is read the title, first = 13, second = 20. Row 2 item is look for key, first = 0, second = 6. Row 3 item is scan full page (10-15 seconds), first = 13, second = 7. Row 4 item is systematically explore page, first = 23, second = 13. Row 5 item is ask for a verbal description of content, first = 5, second = 8.

Slide 30: TSVIs Want a Curriculum That Includes...

- Can be integrated into the class for support staff to reference when the TSVI is not available, include materials, video tutorials, etc.
- A resource that states the teaching techniques for the varies types of math/science graphs
- Activities to help young students learn how to interpret tactile graphics information
- Alignment with core content standards for when to introduce items

Slide 31: More That TSVIs Want in a Curriculum

- A break down of skills by grade level so that their students are better prepared for what is coming.
- A script like in the "Tangible Graphics" curriculum
- Downloadable graphics
- A "library" of resources which could include videos, literature, materials/where to purchase
- An app like "AnimalWatch"

Slide 32: Challenges for Students with Tactile Graphics in Books or on Standardized Tests

- Many students struggle with interpretation of irregular shapes or raised pictures because they are not easily discriminated without additional information about the angle from which the image is portrayed.
- I usually frontload expectations before beginning. I monitor more new/challenging curriculum for frustration and try to change it up to ensure they do not become too overwhelmed.
- All graphics are NOT created equal. If the graphics presented are created with the BANA guidelines, then my students have a better chance of understanding the material. However, if the graphic has not been thought out or formatted correctly then my students have a difficult time in gathering the information needed to respond to questions.

Slide 33: More Challenges

- The hardest part is when teachers give homework or tests that require a very detailed tactile graphic picture to be used when the student does not have that skill level yet because they do not see the print version.
- Low relief graph paper is hard for some students to read as a background for coordinate planes, translations, etc.
- [For my 1st grader] it's a challenge to make sure there is not too much information and at the same time all the information that is needed.

Slide 34: Overcoming the Challenges with Tactile Graphics in Textbooks or Standardized Tests

- For my students to have success with diagrams and maps they must have experience using them.
- Most of my braille students hate the slick material that tactiles are often reproduced on. We try to incorporate it into as many "daily" tactiles as possible.
- Many of the tests are digital. That is difficult. We overcome it by creating tactile graphics on the fly, or by getting the hard copy of the test and having our transcribers create the graphics.

Slide 35: Challenges with Tactile Graphics Made Quickly On-Site

- Time!
- Many times students are not able to independently make connections to the images represented.
- Communication with classroom teacher is the key to having the time to make quality graphics.
- The biggest challenge is knowing the "goal" of the lesson to ensure you are highlighting the correct areas.

Slide 36: Overcoming the Challenges with Tactile Graphics Made Quickly On-Site

- We work on systematically scanning, following different kinds of lines, and I describe what they are feeling.
- Knowing what is expected with the curriculum and making sure the student gets the materials at the time they are working on that subject.
- I encourage multiple read throughs of the graphic or will sometimes provide a verbal description of the data as well.
- I often teach new concepts using the Wheatley, manipulatives, or a homemade magnet board. The challenge comes in moving to graphics produced on a computer.

Slide 37: We Agree!

"I think that the earlier we expose [our students] to the use of tactile graphics the better!"

Picture description: A student is tactually exploring a computer-generated bar graph with both hands.

Slide 38: Almost Hot Off the Press

Herzberg, T., Rosenblum, L. P., & Wild, T. (in press). Tactile graphics literacy: Expectations for pre-kindergarten-5th grade students, *Journal of Visual Impairment & Blindness*.

Picture description: A student is tactually exploring a fuser generated bar graph with both hands. An abacus and Perkins brailier are on the table.

Slide 39: Where to Find Us and Our Projects

- Dr. Rosenblum: rosenblu@email.Arizona.edu
- Dr. Herzberg: Herzberg@uscupstate.edu
- AnimalWatch Vi: Building Graphics Literacy
- <https://www.aph.org/product/animalwatch-vi-building-graphics-literacy-for-ipad/>
- Project INSPIRE on Paths to Literacy
<https://www.pathstoliteracy.org/project-inspire>
- National Research Agenda for STEM
<https://u.osu.edu/nationalresearchstemvisualimpairment/>