Project INSPIRE
Assignment 2
Geometry and Tactile Graphics
for Students in Grades 3 to 8

Kamon is a 7th grader in Mr. Murphy's gifted math class. She is a proficient braille reader and has been increasing her understanding and ability to accurately interpret tactile graphics. This is a fast-paced class that covers a lot of material during each lesson. The class is preparing for small group projects where students will be modeling and demonstrating real life measurements of angles in triangles. The ladder graphic on the next page is a realistic example that Mr. Murphy explains to the class and then models with a ladder on the side of the school building. To promote active engagement, each group of 2-3 students will create a plan to illustrate and then demonstrate their real-life geometry problem. At the end of the week, each group will present their project to the class. You are supporting Kamon in her math class and will be making decisions on how to ensure the information is accessible and meaningful

1. Based on Lucia Hasty's Decision-Making Tree Process, how would you present the ladder graphic Mr. Murphy created for the class, considering you had at least 24 hours prior notice? If you choose to simplify, explain how you would simplify the graphic. If you choose not to simplify, justify your reasoning.

- Decision-Making Tree Process:
  Is this appropriate for a tactile graphic?
  • Is the information a repeat of facts in the text?
  (No, Mr. Murphy will explain the example and then model it.)
  • Would the information be more meaningful in text format?
  (No, each small group is expected to produce a graphic and present it. Examples are helpful.)
  • Does the graphic require the reader to use visual discrimination or visual perception?
  (*No, the graphic can be easily understood by touch.)* Therefore, produce the graphic.
  • Is the object unavailable, too small or too large to examine by touch and perceive details, or too dangerous?
  (Kamon will be able to feel parts of the wall and ladder when modeled but bringing in a smaller example would be an additional aid for understanding. That model could then be compared to the graphic.)

• Does the student need the information from a map/figure/graph to participate in classroom discussions, answer questions, etc.?
(Yes. Kamon will need to reference the graphic in order to understand the lesson.) Therefore, produce the graphic.
What information will be conveyed?
• Identify the content that needs to be included.
(*The three sides of the triangle and all measurements and labels given.)*

- Determine if the graphic requires an operation of measurement or scale. Is it necessary to show size relationship between objects?
  (It is necessary for students to realize the ladder goes to the top of the building—which is 10 m high, that it's base is 2 m away from the building and the angle needing to be measured is formed by the building and ground-<B. There is no need to actually measure, scale or compare size.)

• Simplify the drawing.

- Eliminate unnecessary parts. Determine if the objects or shapes presented in the print need to be retained, exactly reproduced, or can be replaced with simpler symbols.
  (The ladder, ground and side of the building can be represented by straight lines. The person on the ladder as well as all but one wall of the building is unnecessary for this activity. The 2 m will be added as a separate measurement instead of being put in a box.)
- Separate the graphic with too many components into sections.
  (This graphic will not have too many components.)

• Identify the components included in your graphic.

- Areas, Lines, Points, Labels, Keys and Legends. Which production method will be used?
  (The graphic will include one right triangle with the longer side labelled 10 m, the short side labelled 2 m, and <B being placed in the correct spot. I want to produce the graphic on braille paper, using computer graphics since the student's textbook contains them, with all measurements and angles labeled in braille. There is no need to clutter the graphic with anything else. My computer will not allow Quick Tac to be downloaded without first being reimaged which will

require me to be without it for two days; I will use Duxbury to create two sides of the triangle, put in measurements—including altering the way the distance from the base of the ladder to the building is shown—and label <B. I will then turn the paper over onto a rubber mat to draw the hypotenuse with a pen-checking it for readability.)

• Is there a specific method or "format" being requested?
(Model what the students will be expected to produce.)
• What resources or equipment are available to create the graphic for that production method?
(DBT, an embosser, rubber mat, pen)
• Which production method will provide the best readable graphic?
(Many methods would be readable. It depends on where the student is in understanding tactile graphics. If there are two students doing the same assignment, it might be necessary to do use two different methods.)
• Is this graphic for a one-time use or for production of multiple copies?
(One time use and reference if necessary.)
• Choices: Vacuum form, Emboss, Microcapsule, Customized
(At this point in time, my only options are embossing, customizing, or a combination of the two.)

- Make the graphic as similar to the one given to peers as I could. Either use PIAF or explore what tactile graphics are already in the data base for Tactile View to represent the building and the ladder.

- Use a rectangle of one texture as the building, a straight line as the ladder, and a straight line of a different texture as the ground. I would use a measurement line to label the 2 m segment. I would omit the windows and the person on the ladder. I would mark the 10 m side and angle B.

- Model the real-life situation as much as possible by not making it too confusing, keeping a few elements of the graphic Mr. Murphy created, but simplifying others:
  - For the building, use a simple rectangle, filled with a brick texture, no windows.
  - For the ground, use a very thick line to represent a solid base.

- For the ladder, use just a simple line with the standard thickness.
- Exclude person climbing the ladder
- Add a line with endpoints for the ground measurement to show which part/length of the ground is needed for the problem.
- Add a key since the graphic is not a simple triangle.

2. How would you create the graphic and what materials would you use? If you would like, you are welcome to make the graphic and include a picture of it within your assignment!
    - Strip of horizontal lined paper for the ladder, a strip of smooth tactile paper for the ground, and large grid paper for the building. Include the measurements (2 m, 10m and angle B)

    - Create the graphic using a PIAF machine. Make a clean, enlarged graphic, white out the printed information, copy the graphic onto the PIAF paper, and then run it through the machine. After it was created, apply braille labels for the mathematical information.

    - Create the graphic using a combination of embossing and collage to get the best of both. This requires more planning time so that everything fits in the spaces, but emboss the title, graphic labels, and problems given first. Afterwards, create the graphic using a rectangle of fine sandpaper for the ground, a rectangle of single face corrugated cardboard or a craft foam sheet for the building, and puff paint for the ladder. Since Kamon has demonstrated some difficulty with tactile graphics and since angles of the diagram will stay the same, enlarge the tactile graphic by at least twice the size and include a key as a transcriber's note before the graphic for the three different textures and their meanings. Use the puff paint to depict the ladder as true to the picture of the ladder as possible to keep the real-life context of the problem, but if it was not tactually clear, simplify the ladder to a single line.

3. Describe how you would present the ladder graphic differently if you had to create it "on the fly" with less than 1-hour notice.
    - Use a line tool and ruler to draw the triangle and include the braille for the diagram (10 m, 2m, angle B).

- Use a Draftsman with a straight edge to re-create the straight lines. Then braille right onto the paper with the graphic for the student to use. It would not be a perfect representation, but it would work for a quick solution.

- Use Wiki Sticks on a piece of paper. After doing this, add braille labels to show the mathematical information.

- Draw a triangle with measurements, using the inTACT Sketchpad, then add labels with the Perkins Brailler directly on that paper.

- Use tactile tape to make the ladder and use a tactile sticker to represent the person climbing up the ladder. Make a key so that my student would understand that that is a person climbing the ladder.

- Use a spur wheel, closed pen, and straight edge to produce the lines. Sketch the figure on the back of the paper. Using the straight edge to get clear lines, use the closed pen to draw the ground, the spur wheel to draw the ladder, the closed pen to make the rectangle to outline the building. Mark two points lined up with the bottom of the ladder and the vertex of angle B. Use the closed pen to make a measurement line below the ground line. Use a straight pin to make dots to texturize the rectangle. Turn the paper over, put the paper in the braillewriter and add the labels 2m, 10 m, and angle B.

4. Kamon has demonstrated some difficulty reading similar tactile graphics. What strategies can you implement or recommend to help her keep up with the work flow during class?
    - Preview the assignment to make sure she's comfortable with the graphic or graphics similar to this assignment. Use the systemic approach to become familiar with the graphic. While previewing tactile graphics, have Kamon use the Think Aloud strategy (discussed by Dr. Kim Zebehazy). This would allow the teacher feedback on how they could provide additional support and it would also help Kamon become more aware of the process she is using. Remind Kamon to take her time, use surrounding information, use both hands, and find a system that works for her to navigate the diagram. Remind her that it is important to go back and check her work. Give her time to explore and get

oriented with the figure. Ask open-ended questions to allow her to think through and process her response.

- Practice similar graphics outside of the class during pull-out services. The VI teacher could also start making the graphics in a different medium until one is found that might be easier for Kamon to read. Compare how tactile images are similar and different.

- Getting Kamon involved in the creation of the graphics would help her to develop better understanding. It would also be necessary to make sure that Kamon had practice with a braille protractor. In addition to interpreting the tactile graphics, using the protractor efficiently would help her keep up with the pace of the class during this assignment. Also, parental involvement can help as well. Sending materials home for students to create them in their home environment vs. school can help provide support.

5. Kamon's group will be creating a drawing of their project to share with the class and reviewing the other group's drawings during presentations. How can you support Kamon with drawing their real-life graphic? What materials can you use to ensure she has access to the other group's information?
    - Suggest that she could be the note taker, measurement reader or presenter in the group.

    - Work with the TVI to use a tactile compass and tactile tape to create it the graphic. By communicating with the classroom teacher about other groups providing measurements and rich descriptions in their presentations, Kamon should be able to access all of the information shared.

    - Provide Kamon and her group with tactile materials to create the graphic such as: graphic art tape, tactile line making tools, a Draftsman, Wiki Sticks, yarn, glue, various textured papers with sticker backing, Wheatley, and Tactile Doodle. TVI can demonstrate to the group and Kamon that in order for them all to participate they can use these various materials. Demonstrate how to use a straight edge when making raised lines or when cutting the textured paper. Depending on the size of the graphic, each student should be responsible for some part of the graphic. These would work well in a group setting where her

sighted peers can see the data and she has the texture to feel the difference in the graphic and data they have included. The other groups could use these same tools to make their graphic a tactile that Kamon could have access to during the presentations as well. They will also have to talk explicitly as a team when they are describing how the graphic should "look".

- Kamon could add pushpins and a rubber band to her group's drawing, making a simple triangle on top of the illustration. Kamon can present the tactile drawing to her class. In order to be able to access the other groups presentation, get the information from the other groups beforehand. Create simple triangles to represent each group's drawing and she could follow along during the presentations. If not an option, draw quick and simple triangles during the presentations of the other groups on the inTACT Sketchpad.

- Provide Carousel of Textures sheets, tactile tape, and tactile stickers, to not only her group, but to all groups. Have a conversation with the teacher to make it a requirement to have the students give an oral description of their drawing when they do their presentations. Encourage the group to assign parts of what is needed to be discussed during the presentation to the class, to ensure that she is involved.

- The student should be provided a variety of materials and tools so she can create her own drawings and graphics and should have been given opportunities to learn how to use these items starting at a young age. Examples: stencils, Draftsman/Tactile Doodle, Magnet board, Wheatley, tactile graph paper, dots, stickers, Graphic Aid for Mathematics board with pushpins and rubber bands, Wikki Stiks, Geometro kits in a variety of sizes, Cubes and Stackups, Clipboard with a foam sheet/tracking wheel, tactile protractor and compass, Graph benders. The student should also know how to draw using the Perkins brailler. The student should be allowed to explore and learn to create drawings so that it makes sense to the student and is understandable to the classroom teacher. If needed, the student can take pictures of their drawing and email it to the teacher.

- Pre-teach the ways to produce tactile graphics and associated skills, including the advantages and disadvantages of each. Teach Kamon how to trace inside stencils on a Draftsman Board, TactileDoodle, or inTACT Sketchpad using special film for quick

and simple drawings. Teach her how to use peel and stick textures such as foam shapes or Graph Benders onto paper to form pictures, use magnetic shapes or those from the Wheatley board to make pictures on a magnetic sheet or Velcro board, create pictures on the braillewriter, use manipulatives, and graph using grid paper along with tactile dots. With pre-teaching, even earlier on in the year, Kamon will build a toolbox of skills for tactile graphics that she can use for this project and future projects using the methods that work best for her and work best for the specific problem. Kamon will have a variety of tools at her disposal that she can use to represent the real-life graphics. Encourage Kamon to use her creativity while producing her graphic and to use her own preferences when it comes to using textures and tools that work best for her. Kamon will learn with experience through the school year what works for her, and how to simplify graphics to maximize clarity and efficiency.

- Prior to and for the duration of the project, work with Mr. Murphy to ensure that all of the groups' drawings and information are accessible for all, even going as far as to help Mr. Murphy teach the class the importance of sharing information using a variety of levels and means. Mathematics is a universal language that should not stop at the borders of language, sightedness, prior knowledge base, or for countless other reasons. Work with Mr. Murphy to encourage the class to make their drawings tactually significant, but not too much, and including a legend for the textures while being creative in their representations. In this way, Kamon would have access to other groups' information.