

Project INSPIRE Grades 3-8 Course 4 Lesson 6

SPEAKER 1: Welcome to Geometry and Tactile Graphics for Students in Grades 3 to 8. This is Lesson 6: Systematically Teaching Graphics Literacy Skills to Students. Slide two has the objectives. Participants will be able to become familiar with the AnimalWatch Vi: Building Graphics Literacy tool and identify graphics literacy skills students need to develop in order to be efficient in locating and interpreting information.

Slide three introduces you to the AnimalWatch Vi: Building Graphics Literacy Project. Now, this was a three and a half year study that ran from 2016 to 2019. And what we did was we developed an iPad app and accompanying graphics to help students build their graphics literacy skills. We used authentic information about endangered and invasive species.

And what we wanted to know was how can we support our students with visual impairment at the pre-algebra level in building their efficiency and accuracy in gathering information from materials presented in graphs and maps. And what strategies and techniques can teachers of students with visual impairments use to increase their student's accuracy and efficiency in getting information from graphs and maps.

Slide four introduces you to the 10 units we have. And we see a student who's actually using a graph in our Cane Toad unit about line graphs. So with his right hand, he is exploring a line, and his left hand is on the key. So the 10 units are two about bar graphs, one single bar graphs, one double bar graphs, the line graph unit, circle graphs, Venn diagrams, two units about coordinate planes, one that just focuses on quadrant one, and then the second unit focuses on all four quadrants, box plots, maps. And then we give students an opportunity to learn about data tables.

Slide five shows two screens from one of the units, the one about Venn diagrams. And the animal that's the focus is the platypus. So on the left, we see a multiple-choice question. And the question reads, "How many students in all visited the Platypus Exhibit, the Tasmanian Devil Exhibit, or both exhibits?" It's a multiple-choice question with three answers, 121, 132, and 147.

There is a Venn diagram. It has three circles. The title is, "Numbers of Student Visitors." The red circle is the Platypus Exhibit circle, and the green circle, which is dashed, is the Tasmanian Devil Exhibit. And then, at the bottom, the circle is the Roar and Snore Campground. That one is blue and the dashes, it's more like a dotted.

So texturally these graphics feel different. Each of the circles in the graphic feel different, and visually they look different. And it's your typical Venn diagram, so some numbers are just for that one circle. For example, the Platypus Exhibit has an 18. The intersection between the Platypus Exhibit and the Tasmanian Devil has a 40 and a 15 and so on. So you get the idea. You've all seen Venn diagrams, I'm sure.

The other question that I have here is question A6. The multiple-choice was question A5. A6 in this unit is an open-ended question. "Imagine that the zoo stops offering the Roar and Snore Campground option. How will the Venn diagram change? What will it look like? Record your answer." And so within the app, the student records their own answer.

Let's go ahead and watch a student who uses a refreshable braille display paired with her iPad. And she reads the problems aloud. And then I will kind of interject a little bit when she is exploring the Venn diagram, which is a braille version to her right. So let's see what you think about that video.

SPEAKER 2: Problem A5, how many students in all visited the Platypus Exhibit, the Tasmanian Devil Exhibit, or both?

SPEAKER 1: She's looking at the numbers in the Roar and Snore Campground. Now, moving up to the circle for the Platypus Exhibit, reading those numbers, and using the fingers on her right hand to do some adding. She's looking at the intersection and the numbers there, adding those with her fingers. And she's continuing to add numbers. Now she is in the Tasmanian Devil Exhibit, has read the numbers, adding more numbers on her fingers. Looking at the intersection and going back to her braille display.

SPEAKER 2: 147.

COMPUTERIZED READER: Correct answer.

SPEAKER 2: Problem A6. "Imagine that the zoo stops offering the Roar and Snore Campground option. How will the Venn diagram change? What will it look like? Record your answer."

SPEAKER 1: She takes a quick check of the Venn diagram and then returns to her braille display.

SPEAKER 2: There would be less students that went on the field trip, and there would only be two circles that overlapped, not three. [BING]

SPEAKER 1: Alright, so you had the opportunity to see a student, and you saw her doing several things. So let's talk about some of the skills that students need to do here on slide 6. So when you're teaching your students graphics literacy skills, you want to think about systematic approach. How should the student go to this graphic so they're approaching each graphic the same way and they don't miss key information?

You want to think about the fact that they need to use their two hands if they're a braille reader. And often, those hands are working to support each other. So one hand may be checking to see the symbol in the key while the other hand is looking for that symbol on the map, or on the line graph, or on the bar chart. Those two hands work together. Our students need to learn how to verify information.

So if I think that I found the answer, I want to check that answer. So I might use my right hand to anchor at the top of a bar in a bar graph while my left hand goes to the y-axis to check the value and then comes back to where my right hand is to make sure that I've got it correct.

I think it's really important that we teach our students how to use surrounding information. So this may be the text that goes along with the graphic. It may be directions that the teacher is

giving. But they need to pay attention to what's being asked of them and what other information is being shared.

And then my last point is about vocabulary. This is vocabulary around the math-science concepts but also vocabulary around terms that we associate with graphics like x-axis and y-axis. So I need to know the mathematical understanding of the values in the y-axis, but I also need to know that term y-axis, so I know where to look. So they kind of overlap here as far as I need my math and science content, but I also need the understanding of the terms that describe different key parts of a graphic.

Alright, slide seven, let's talk about that systematic approach. This is where I want to teach my students to read the title and look for a key. If I do that at the beginning, that's going to help me orient. Then I want to preview the entire page. Some students want to start in the middle and work out. Some students start at the top. Some students start at the bottom.

The important thing is that the student gets what's on that page and has a way to approach it. So we want to find out what works for our students. Similarly, some students will want to read the question and then go look at the graphic. Other students will want to get familiar with the graphic and then go look at the questions.

Now, we're going to get ready to watch a video. And this is a student who is taking a pre-test before doing the AnimalWatch units. These are students before they did the unit like the girl that we just saw. So let me describe this bar graph. It says, "Number of Snacks Sold." It has a key. One texture is Cookies, and one texture is Fruit.

We also use color, so red is Cookies, blue is Fruit. The x-axis, the label is Students. And we have the four students of Carmen, Andrea, Mike, and Jasmine. And we see how many cookies and fruit they each sold. And on the y-axis, we have the label "Snacks Sold", and our values go from 0 to 14 in increments of 2.

So let's go ahead and watch this video where we're going to see a student who is going to go ahead and answer two questions. I want you to notice that she doesn't have a lot of vocabulary, such as x-axis, y-axis, or Key. But she does understand what she's looking for. So let's go ahead and watch that video.

Have you ever seen a graph like this before? Tell me what kind of graph it is. Even as I'm reading the question, she's looking at the title and the Key. Her hands move down to the bar graph.

SPEAKER 3: So, I'm feeling the different, like, things that there are on the graph.

SPEAKER 1: Okay. Do you know what kind of graph it is? She's using the two hands separately to feel the bars on the graph.

SPEAKER 3: A bar graph?

SPEAKER 1: Super. And how many cookies did Jasmine sell?

SPEAKER 3: So I'm feeling across the bottom.

SPEAKER 1: We see that once she has found Jasmine, she checks the height of each bar.

SPEAKER 3: And then I'm going up to find how much. And I'm going across.

SPEAKER 1: She keeps her right hand on the bar for Jasmine and uses her left hand to travel across the grid line to the y-axis.

BRAILLE READER: And I think it's 9 because it's between 8 and 10.

SPEAKER 1: Alright, so you got to see a student who is a good explorer and can get the information. It's really important that our students use a systematic approach. And as part of the AnimalWatch Vi: Building Graphics Literacy study, I interviewed teachers of students with visual impairments and students after the students completed the pre-test, worked with the 10 units, and then completed the post-test.

And one teacher of visually impaired students shared, "At the beginning of the study, I'd have to remind her to take her time and examine before you answer. I'd asked her, what do you think you can do differently if she got it wrong. I saw her spend more time slowing down and looking over the graphic. I hope she realizes that she needs to take time."

And I think for many of our students, this importance of taking time is a challenge. But once they understand that if they take their time, they're going to get the information they need, it clicks for many of them. An eighth grader shared, "In history, I had to navigate a map of South Africa. I knew I had to go with a system to find each country. It was easier to navigate after doing the units." So here's a student who it connected for. Let's go ahead and go on to slide nine.

Here's another student that shares about the importance of previewing the graphic. This eighth grader who says, "Especially in coordinate planes, we have to make graphs. It is helpful to know about the x and y-axis and which quadrant are positive and negative. General idea of previewing is good to help me in my classes. I preview now." So this is a student who recognized that, hey, what I'm learning by using this app I can carry into my classes. It's not only going to help me in reading graphics, but it's going to help me in designing them.

Let's go on to slide 10 and talk about the importance of that verifying information piece. Students need to think about the most efficient way to get the information. And that means checking your work after you found what you need to make sure that you've got it right. They have to be systematic. So is that going back to the key to check that I got the symbol correct? Is that how I'm going to move over to the x-axis or the y-axis?

And you want to teach students terms throughout their process working with graphics. And, for example, the term intersect, which we're going to see here in just a second. So I have another student video I want to show you. This is another student doing the pre-test.

This is the line graph that the student is looking at. It's titled, "Price of Gold and Platinum by Year." Again, we have a key. The blue dashed line is Gold. Solid red line is Platinum. They do feel tactually distinct. Our x-axis is Years, so we have 2000, 2005, 2010, and 2015. And our y-axis is Dollars per ounce. We go from 0 to 1,300 in increments of 100.

So let's go ahead and watch this video where I want you to see that the student is very systematic both in exploration of the line graph initially, and then when that student gets the question and has to answer, the student is extremely systematic in how they find the answer.

And you're going to hear the student only use one math term, and that's intersection towards the end of the clip. Now remember, the student hadn't gotten instruction from the curriculum that we developed. So we were happy to see a student using a term. So let's go ahead and watch that video, please.

And have you ever seen a graph like this before, and if so, what's it called? The student begins by reading the title. He is exploring the key. His hands go down and explore the lines on the graph.

SPEAKER 4: Oh, this is a line graph.

SPEAKER 1: It sure is. What information can you tell me about this line graph? He begins by going to the title, and then he explores the key.

SPEAKER 4: It tells you about the prices of gold and platinum. Smooth means platinum. Bumpy means gold. Down the left side, there is numbers. They range from 0 to 1,300, and they count by hundreds, and they're dollars per ounce. Across the bottom is the year that it was sold in. It ranges from-- it ranges from 2000 to 2015.

SPEAKER 1: Wonderful. Okay, in what year did gold and platinum cost the same amount? He thinks for a moment with his left hand on the x-axis and his right hand on the lines on the graph.

SPEAKER 4: So, I'm thinking about what to do right now. Now I'm looking at the lines. Actually, I changed my mind. I'm looking at the years and looking at the circles. Okay. So, the circle, one circle is above the other on 2000, so it is not that one.

In 2005, the circles are way apart, so it can't be that. In 2010, circles are apart. In 2015, the lines come together. Oh yeah, the lines come together at-- they, like, intersect at one circle, so that must be it, 2015.

SPEAKER 1: Very nice. Alright, slide 11. So I hope that you saw that our student in the video was really already beginning to build efficiency in getting information. And efficiency is so important as a TVI shares, "I liked at the end he was really exploring the whole page before he went to answer questions. He was looking for a title, key, and exploring the tactile graphic."

So that's how we build efficiency by teaching our students a systematic approach. A fifth grader, only a fifth grader, so this is pretty good. "I learned to scan left to right and look at every detail. I

learned that you have to follow the line to find things. It taught me to pay attention to everything on the page." And I think that's a really important thing for our students as well.

If I'm just feeling a whole lot of stuff, I can get really overwhelmed. If I have a systematic approach, if I understand that I need to get the information, I'm able to start to put the pieces together and not just be randomly looking at that page.

Let's go ahead and go on to slide 12 and talk a little bit about teaching our students to use a key. So first off, if you were designing maps or other graphics that use a key, it's really important that you use distinct symbols. We have to help our students prepare that some maps and other graphics that use a key are better prepared than others.

So they need to come up with some strategies on what to do when things aren't as tactually clear. And if they are allowed to ask questions, then how can they formulate their questions, so they get the answer that they need. They need to be able to fully explore that key. A lot of times, keys are in multiple columns, and our students may miss that there is a second column.

And when you're using abbreviations for your students, you want to make sure that there's two cells and that at least one of the cells has a dot 3 or a dot 6. So, for example, if I was abbreviating Atlantic City, I couldn't do AC because A is dot 1 and C is dot 1-4. So I might do AY instead so that I get a dot 3 or a dot 6.

Let's take a look at the map that we're going to see a student use in just a moment. This is a map of Gibbon Island. It has written here "Key in 2 columns." So my first column, I have Big River, which is represented by a thick blue line, Railroad, which is a dashed line, and City, which is a black circle, which is tactually distinctive from the circle that I have for Campground, which starts column two.

So there's a difference in the texture, and visually, City is a black circle, and Campground is a green circle. The Lodge is an upside down yellow triangle, and the Train Station is a red rectangle. So on this map, I also have a compass rose pointing North. There are five words. So for four of the cities, we have the name next to the city symbol. We have Branchford, Miner's Grove, Treeburg, and Leafstown. And where I have the symbol of the Big River, I also have the words Big River.

So let's go ahead and take a look at a student who is using this graphic as part of the pre-test. She understands that there's a key in two columns and that there are also some written labels, in this case, the town names and the river, as I said. So she's done some exploration. So let's look at how she does with answering two of my questions.

Let's actually find the town of Leafstown and trace the railroad for me. So start at Leafstown and trace the railroad. She is looking at the key with her right hand. She's found Leafstown with her left hand. She's moving along the railroad. She checks the train station. She's moving along the railroad past the City, and she's now gotten to the end. Excellent. On this map, can you show me where the lodge is located?

She is back down at Leafstown. Now, she's reading the names of the other towns, so she's looking at the third city. She's going up with both hands towards the key. She's found the symbol for Lodge in the second column with her right hand. With her left hand, she's searching on the map. Now her right hand has come down, and she's located the Lodge. You found it? All right, way to go.

Alright, I hope that you were able to see how efficient this student was when tracing the railroad and that you saw how she went back to the key and then verified. So the students who use the AnimalWatch Vi Building Graphics Literacy curriculum as part of our research study really have a lot to say about the key. So we had a seventh grader who said, "I sometimes had a hard time differentiating the textures. The key really helped me practice telling them apart."

And that's why it's so important that the student looks at all the textures in the key and then makes sure that they can identify them in the graphic. A sixth grader shared, "I learned to look at the key of the graphs or maps because it gives you a lot of information." And we saw for our students who didn't go to the key, that they were missing big pieces of information.

So students who understood that you needed to check for a key were able to be more successful. And finally, a seventh grader pointed out that you should, "Start at the key and familiarize yourself with the symbols and then do a light scan to orient myself and then after that, I can go back in and look for specific things." So this student had a very clear systematic way to get an overview of the information and then to drill down.

On slide 14, I talk about what you need to think about as you work with tactual readers. You want to give your students many opportunities to engage with graphs and maps. And you want to start this way before third grade. Our preschoolers, our kindergartners, our first-grade students should be having opportunities to do basic graphing, to see maps very simplified of areas that are familiar to them. They also should have the opportunity to make their own graphs and maps.

Students need time to explore and get oriented before being asked to respond. So this is why it's so important that maybe in your one-on-one time with your students, if you know that there's some graphs or maps coming up, especially if it's a new concept, that you preview with the student and help them come up with strategies they can use if they're taking classes in the general ed curriculum.

And you want to teach your students to use those two hands. And for those two hands to share the responsibility, meaning that one hand may be checking the key while the other hand is confirming the texture, where one hand is anchored on a point or the top of a bar while the other hand is checking the value on the y-axis.

And students who are systematic in their approach are typically more efficient and accurate. And when you can help your students understand this and internalize that when I'm systematic, I do do better, I do get more information, you're doing your students a big favor.

Slide 15 is a student who talks about the importance of taking it slow and thinking it through. So this is a seventh grader. "Now I know you have to pay attention. You have to pay attention to

how the graph or map is laid out and what the question is asking you. You have to know if there are data points and if you have to go to the left and look slowly to find the value."

This need to check the question to know what I'm being asked for, it helps me in understanding what it is I'm looking for in the graph. And I love this seventh grader, "Hearing myself talking about the graph out loud made me focus and think about what I am doing."

And so in a general ed class, yes, we don't want our student, you know, talking to the whole class, but if we can get them to start doing self-talk, to think through the process, that is really going to help them in the long term. And that's actually what Lesson 7 in this unit is about. So we'll get to that in just a moment.

So my last slide, slide 16, is that through the Animal Watch Vi project students, increased their confidence. As a TVI shared, "In math class, she was able to push herself to read the tactile graphics and be methodical." A fifth grader shared, "Now I feel more successful in the math class because I can do math more fluently. I can work with graphs more fluently. I think if I had gone to math class before with a bar graph, I wouldn't know what to do, and now I really can see the difference."

And when we see a student at this young recognizing that if I get some instruction in these skills and can learn my approach, I'm going to be more successful. And that's why exposure to graphics literacy is so important for our students beginning at very young grades. And we loved hearing from the seventh grader who shared, "On state testing this year, I felt a lot better. Last year there was a bar graph with 2 different bars, and I was 'how does this work,' and this year I got it."

We also heard from students who talked about how they felt they did much better on the charts and graphs on the Braille Challenge regionals and/or nationals because of getting the systematic instruction. So I encourage you when you're working with your students to give them lots of opportunities to help them develop strategies that are efficient for them, to help them recognize the parts of the graph, to learn the vocabulary.

And your students are going to be more successful when it comes to locating and interpreting data. So thank you so much for taking part in Lesson 6. As I alluded, Lesson 7 is going to introduce you to Dr. Kim Zebehazy, who's going to talk to you about self-talk and questioning techniques. Thank you.