Project_INSPIRE_Course_4_Lesson_5

SPEAKER: Welcome to Geometry and Tactile Graphics for Students in Grades 3 to 8. This is "Lesson 5: Teaching Your Student to Create Their Own Drawings." Slide 2 has the objectives. You're going to be able to state why it's important for a students to be able to create their own drawings, name a variety of tools a student can use when they're creating their own drawings, and identify multiple ways that a student can create their own drawings. So let's get started on slide 3 and talk about the importance of drawing.

Part of the learning to read tactile graphics for a student is actually making their own tactile graphics so that that way they really understand the process and the components. So we're talking about drawing geometric shapes, the drawing process or the stages that you go through. We're talking about producing or modifying drawings and diagrams, so lots of things for our students to be able to do so that they fully can engage in STEM learning.

Slide 4 has some points about beginning tactile production skills. So in the beginning, we want our students to know how to trace inside a stencil. So they might use a Draftsman Board, or a TactileDoodle, or the inTACT Sketchpad and being able to put the film on, do the drawing, remove the film. Being able to peel and stick on textures such as foam shapes or the Graph Benders onto paper.

The good thing about this is our, many of our students struggle with fine motor skills. So this gives them an opportunity to practice those skills. Being able to use magnetic shapes or those from the Wheatly Board to make pictures on a magnetic sheet or on that Velcro of the Wheatly Board. Using their braillewriter to create pictures. And we have a really nice handout for you.

So make sure you check about drawing with the braillewriter with lots of fun things for them to do. Being able to use manipulativeness, for example, Omnifix Cubes. And being able to use graph paper along with tactile dots. Let's say to plot points on a coordinate plane.

Slide 5 talks about your role as a professional. Folks, you are not the director. You are the guide. And what I really want you to focus on with our students in grades 3 to 8 is empowering them so that they can make their own choices and figure out what works best for them.

Keep in mind, there are multiple tools that a student can use to represent any of the concepts that we're going to talk about in this lesson. They need to be able to have a group of materials available to them. So it's your job to show them what materials are there and then to let them figure out how to organize them and make sense of them.

So when you're thinking about what the student needs to have going on in the class, what's coming up, you need to know what supplies that student has so you can do that guiding and helping them figure out how they can get the job done. At the same time, you need to recognize that your student needs to be creative and come up with ways to figure out their own preferences and what works for them so that they can make sure that they are producing clear and efficient drawings so that they're getting their work done in an efficient way. But at the same time, what they're producing is clear to themselves and others who need to check their work, so to speak.

Let's go on to slide 6. And we're going to get into examples here. So how do you draw a 2D shape is a first topic I want to talk about. We're going to show you throughout this lesson examples.

This is just one way to do this particular skill. But what we want to do is show you lots of examples so you can start to build your repertoire and in turn guide your students to build theirs. So in this particular example, we're talking about using push pins and the Graphic Math Aid along with rubber bands to make shapes.

So the student will need to organize their space so that they know where their rubber bands are and where their push pins are. Recommend that you guide them to think about where on that Graphic Aid they want to put their push pins. So in my bottom example, I have a pentagon that a student has put 5 push pins into the Graphics Aid for Mathematics and then has taken a rubber band over those push pins to create the pentagon. Their push pins are in the top right corner.

And then the student has used a card that has both printed braille on it to number the problem for the teacher. So we recommend that maybe your student has a little spiral notebook of cards with numbers in print and braille as shown in my example with number 17 or a box with some file cards in it. And this way, the student can take a picture of this problem-- hey, teacher, I've done it-- and submit that picture and move on to the next problem.

Let's go on to slide 7 and talk about how to draw reflections. Keep in mind, a reflection is like a flip over a line. So what I have here is a drawing where the teacher has drawn a shape with puff paint and has put push pins in the corners, on the vertices. And so what the student needs to do is-- there's a tactual line that has been drawn. And the student needs to reproduce that same drawing on the graph paper using push pins and a rubber band so that the student is demonstrating that concept of reflection.

It's important that our students see lots of different ways, as I said, to do this. So the student could have used the Graphics Aid for Mathematics, for example. Let's go on to slide 8 and talk about how to draw rotations.

Now, keep in mind, a rotation is like a turn. And so in my example, our student has the Draftsman and a triangular stencil. And after drawing the x and y-axis with a straight edge, the student takes and marks one of the vertices of the triangle stencil with a Wikki Stix. The reason the student is putting the Wikki Stix on the vertices of the triangle is so that the student can keep track of where the triangle is in relation to the origin.

So our student drew the first triangle in the second quadrant and then went down to the fourth quadrant, rotated that stencil, paying attention to where that Wikki Stix was, and was able to draw the second triangle in that fourth quadrant. And you can see in the bottom picture how the student has rotated or turned those two triangles.

All right, slide 9. Let's talk about how to draw translations. Now a translation is like a slide or a shift. There's lots of ways you can do this. I'm actually going to show you two here.

So in my first example, my student has their graph paper. And I've put down a triangle for the student. And the job is that the student needs to do that translation, moving the triangle 3 to the right and 2 up. So my student has an identical foam triangle and then is able to count over 3, up 2, and place their triangle. So that's my first way the student can demonstrate translation.

So in my second method, my student has a TactileDoodle and a heart-shaped cookie cutter. So with the drawing tool on the TactileDoodle, my student's going to trace that heart. And then my student is going to shift that cookie cutter down and to the right and draw the second heart with their cookie cutter. And when they remove the cookie cutter, they're able to see how they translated or shifted that heart shape.

Slide 10-- how do we draw a dilation? Now, dilation is kind of cool to me. This is where you get to magnify or reduce your shape.

So, again, we need to use graph paper so the student can count the number of squares. And in this case, I had my student use a corkboard. Corkboards are great because they're obviously very inexpensive. You'll notice, again, my student has put their push pins where they can locate them in the top right corner. And in the bottom right corner, they also have some more.

The first thing my student did was to place three push pins on the corkboard and to connect those with a rubber band to form a triangle. My student then had to multiply the coordinates of each point by 3 and then graph those new points with push pins to create a second set of points that they connected with a rubber band to make a second triangle. I had my student use two different shaped push pins, one set for each triangle, to make those triangles tactually distinct.

Slide 11-- how to draw 3D shapes is our topic here. And I have a video where I'm going to show you how we drew a cone and how we drew a cube. Students can also draw pyramids and cylinders. And so I tell you how they go about doing that. So let's watch the video of how we drew a cone and a cube using the TactileDoodle.

I'm going to draw a cube using my TactileDoodle. So I've put my stencil down. It's on the bottom left corner. My assistant here is drawing her square. Now, she's finishing this square. And she's going to pull the stencil away. And this is the important piece for your students.

They need to feel to make sure what they think they drew, they've actually clearly drawn. Okay, now, she's going to take her stencil. The square of the stencil she's going to place on the top right of her already drawn square so it overlaps and draw her second square. So she's drawing it left, the bottom, the top, and the right. Again, she's going to remove the stencil and feel what she's drawn.

Now, since we're making a video here, we're not going to make her feel each time. But it's important that your students do. So she has four lines now that she needs to draw. So she's going to use the stencil as a straight edge. And she's going to draw from the top left corner of one square to the top left corner of the second square.

Again, you would have your student feel. I'm not going to make her do that. She's going to go from the bottom left corner of the first square to the bottom left corner of the second square. Now, we're going to do the right corner to the bottom right of the other square, so connecting those two squares. And now she needs to go up to the top right of the first square to the top right of the second square.

So once she's done all that, she has a cube that she can feel. And she has drawn it herself, which is going to help her understand the six sides of the cube. Let me show you how my student can draw a cone using a circle stencil. So she's going to put her circle stencil on at the bottom right and draw the large circle with her stylus.

Once she's done with that, she's going to get that straight edge. And anywhere on that top of the circle, she's going to draw a diagonal line and then she's going to come down till she feels the circle on the right side. So she'll go ahead and use her stencil to line up.

These cubes and cones look absolutely gorgeous, don't they? And this is because this is a person who has a lot of experience. Your student isn't going to draw potentially this perfectly when they do it the first time. They need to practice multiple times. And you want to give them that opportunity with you before they're required to do things like this in the math classroom.

Slide 12. Wow. How do you represent a platonic solid? Whether we're talking about a cube, which is a six square facing shape, or we're talking about an octahedron, that's a triangular facing shape, our students need to understand how to represent these. So when our students are drawing these shapes, what we really recommend you use is the Geometro kit that has the large pieces.

There's nothing wrong with the mini or the medium. But often, they don't have enough shapes for the student to be able to draw. So your student really can have the three-dimensional platonic solid in front of them to do whatever it is that the teacher is asking them to do, where the sighted students are going to have a picture of the book, which is going to be 2D if you represent it for our student. And it's just not going to be the same.

Slide 13 talks about representing nets of pyramids and prisms. So your student is going to probably need some optional materials. The Hands-on System for Learning Three-dimensional Geometry from Geometro is something that's worth checking out.

Your student also needs to understand that there's more than one way to create a net. So for example, for the tetrahedron, I can do the two ways that are shown in my picture, which is basically using those four triangular faces. In one, I make it look like a triangle. And in the other one, it's more like a parallelogram. And so our student needs to understand this.

Keep in mind, and maybe you didn't know this, because I know I did not know this, that there are 11 possible nets that you can create for a cube. Can you believe that? Those six squares, you can arrange those in 11 different ways. Give it a try for me, folks. Let me know if it works.

On slide 14, we talk about more Geometros that you can use. Geometros in the mini, medium, and large kit allow you to make regular shapes. But if you get the add-ons for pyramids and

prisms, you're then going to be able to make other figures such as isosceles triangles, rectangles, octagons, and decagons. So you do have to order these separately.

Alright. Let's go onto slide 15. And I want to talk to you about, how is your student going to do a cylinder and a cone going from 2D to 3D? So what we have here is that you can create cylinders and cones that have the same base but different heights. So to create these, you're going to use six circles, two rectangles, and two circle sectors.

And so I show you what those pieces look like flat, and I show you what they look like assembled. Your student's going to need lots of opportunity to explore these pieces and practice with these pieces before they're expected to create these things in the math class and start to learn how to measure them and those types of things. They first need to recognize them and know how to create that.

Alright. Slide 16, let's talk about how to draw 3D figures and mat plans. And for this, I actually have a video that's going to show you the mat plan and how we did this with Omnifix Cubes. And then we're going to show you how the student uses the Omnifix Cubes to create the figure in the mat plan. And I really like-- the student needs to do that creating of the mat plan to give them one inch graph paper and the braille writer and let them go at it to make their own mat plan.

[VIDEO PLAYBACK]

- So let's see how a student would use Omnifix Cubes to create this mat. So let me describe this mat. It's two rows. The top row has one and three. The second row below the three has a two and four. And this is in the student's math book. So our students can get to get the Omnifix Cubes out. And the first thing the student does is has one Omnifix Cube. And then to the right of that is going to fix a stack of three Omnifix Cubes.

SPEAKER: The student, again, is going to refer back to the drawing in the book. The student now needs to fix two Omnifix Cubes below the three Omnifix Cubes and looks back in the book and to the right and sees that she needs to put four Omnifix Cubes to the right of the two. So now our student has created a tactual representation of the mat that's in her book.

Let's see how my student goes the opposite way. So my student has a figure that's been created with Omnifix Cubes. And using one-inch square graph paper from APH, my student's going to create the mat. So my student checks out the first row in the figure that has been created with the Omnifix Cubes and sees that on the left she's got two and on the right she's got one.

So she's going to go to a graph paper, she's going to braille a two in the first square and a one in the second square, go down to the next line on her braille writer, make sure she's lined up. And now she's going to go back and explore her figure and again see, wow, she's got the same pattern, a two and a one. So she's going to go back to the braille writer and braille her two right under the first two and her one right under the first one, because that's the way the figure is.

So she's feeling like she's got one. And then she's going to put a one underneath that two. And so she has created a mat to go with the figure. What's really kind of fun in math class is if students

create figures for each other and then they create mats and swap and check to make sure that they've each done it correctly.

[END PLAYBACK]

SPEAKER: Alright, slide 17, the orthographic views. How do students draw orthographic views? This is where you're getting the top view, the bottom view, the side view. So what I need to do here, I have found, is to give my student the StackUps kit. And when I give my student the StackUps Kit, that includes the Velcro cubes, the mat plan cards, the 3D figure cards. And what I really love are these grids. So I'd like to show you a video where we demonstrate how to use these so that the student can do the orthographic views.

[VIDEO PLAYBACK]

- I want to use my StackUps now to show you how a student would draw a figure doing the orthographic views of the front, the top, and the sides. So I've got three things on my work surface. I've got my figure that has been created with the Velcro blocks. I've got the grid that comes with the StackUps. It's a five-by-five grid. It's got Velcro fasteners, so that I'll be connecting my pieces. And then I'm just using a little container to keep things in place for my students that have the little cube pieces that also have Velcro on them, so they'll attach to the grid.

So the first thing my students are going to do is explore the figure that's been made with the StackUps blocks. And student's looking at the top of this figure and seeing that she has two on the left and two on the right, so she's going to create that on the grid. So she's taking one of her Velcro pieces, and she's putting it on the top left and making that basically a four square grid, so two on the top row, two on the bottom row, right underneath each other.

So she's created the top. So she's going to move that grid sheet away, and she's going to get her second grid sheet. So she's going to explore the front and see that she has three on the left and one on that right. And the one on the right goes next to the bottom of the three. So again, she's going to use her pieces, she's going to do her top left, her middle, and her bottom, so that left side.

And now she's going to put a fourth one right next to the one on the bottom so that those two are next to each other just as they are in the actual figure. And she'll take that sheet away. And she's got her third grid sheet she's going to bring out now. So now my student is going to do the side view. And she's going to do the right-side view.

So she's got her grid sheet. She's going to explore. And you're going to see that she has three going down. So she's got two columns of three. And now she's going to go to her grid sheet, get her Velcro pieces out. And basically, she's going to create what looks like a braille cell. In that first column, she has three pieces going down. And in that second column, she has three pieces going down.

So the great thing about the StackUps is it allows a student to manipulate with the different pieces to create those three orthographic views of this figure. Now, not all students want to deal with these manipulatives. So it's real easy for the student to do the same thing with braille graph paper. So they could use a full cell to show, hey, this is one of the squares that I am filling in. And on a piece of graph paper, they could do the three views. So different options for different students.

[END PLAYBACK]

SPEAKER: Okay. So you got to watch a video and I'm sure have a much better understanding of orthographic views at this point. Alright. How do we have our students draw a parallel and perpendicular here on slide 18? What I want my student to do is really simple. And sometimes, folks, simple is better. You're going to see in this video how I have my student use a clipboard, a foam sheet, braille paper, a ruler, and a sewing wheel to be able to draw a parallel line. So let's go ahead and watch that video.

[VIDEO PLAYBACK]

- Now, the reality for our students is they don't need a lot of fancy stuff. And so part of what you can have your student do is to have a clipboard and a piece of foam. So I have my blue clipboard here. I'm going to put a piece of foam on it. It doesn't matter what color it is. Because what I'm going to do with that piece of foam is cover it up with my piece of braille paper, which is actually what my student's going to be drawing on. And I happen to have just a plain old ruler and a sewing wheel. Very cheap, very easy. And my student is going to draw parallel lines.

So she's placed her ruler on the clipboard, and she's going to draw on the bottom part of the ruler. She's going to draw her line with her sewing wheel. And on the top part of the ruler, she's not going to move the ruler at all, she's going to draw another line with her sewing wheel. And when she removes that ruler, she's going to have two parallel lines. She can take it off of her clipboard and then flip it over to feel those lines to ensure that she has drawn them as parallel lines.

[END PLAYBACK]

SPEAKER: Alright. In slide 19, let's talk about, how do you actually draw parallel and perpendicular lines on a 3D shape? And what we have here is the Geometro cube. So either I've assembled the cube or my student's assembled the cube. And we have the material rods that you order separately. So let's watch that video real quick.

[VIDEO PLAYBACK]

- So often in the textbook, in the print textbook, there's a picture of a cube and the student needs to show the parallel and perpendicular sides. So the way our student, who is a braille reader, is going to do this is I've already assembled for that student a cube using my Geometros. Then I'm going to give my student the hook material rods. So these are red rods that are going to fix to the Geometro Velcro, and my student is going to use these to demonstrate parallel and perpendicular for the teacher.

So first I'm going to let my student show us parallel. So she's going to lay one rod at the top and one rod at the bottom. Your student, if they need to show their work, they can take a picture. Then I want my student to show perpendicular. So she's going to leave the top rod, and she's going to move the bottom rod to the left. And now she's able to explore and see that she has perpendicular.

[END PLAYBACK]

SPEAKER: Slide 20. How do we draw lines of symmetry? Your student already obviously needs the tactual shape. And what you're going to have your student do is to draw a line dividing that shape. One really easy way to do that is with Graph Benders. And I really like these, because they're easy to pull apart, they're easy to manipulate, they stick on, and your student can do that demonstration of a line of symmetry very quickly and easily for the teacher.

Alright. Slide 21. How do you divide a segment in half? Now, this is a good example of just one way that you can do it using a piece of braille paper, a rubber mat, a sewing wheel, and a ruler. Then the student uses the compass. And in this case, my student is going to use the beam compass. So let me show you that video.

[VIDEO PLAYBACK]

- I want to show you how a student can divide a segment in half. So my student has the rubber mat from APH, which, by the way, you can buy separately with a piece of braille paper over it. Now, she's going to take with a ruler, and she is going to draw a line segment with her sewing wheel. So she's drawing her line segment going across the page. And when she's done, she's going to flip over that braille paper to make sure she can really tactually feel her line segment.

Now she's going to take her beam compass. And I want to talk to you for a minute about the beam compass. It's got a point at one end and then a wheel that adjusts. So I can unscrew the top of the wheel and move that wheel to wherever I need it. So she's going to go ahead and turn it and lock it into place.

And when she does that, she's going to put the point at the left end of her line segment, and she's going to draw an arc going down. And then she's going to draw an arc going up from the line segment. Now she's going to take the point of the beam compass and put it on the right end of her line segment and repeat that process of drawing an arc that goes down and an arc that goes up.

Once she's done, she's going to go ahead and turn over her braille paper, and she's going to feel those two arcs to make sure that they intersect. And sure enough, they do. So now she's going to take her ruler and her sewing wheel, and she's going to draw the line segment to cut them in half. Now I want her to feel and make sure that she flips it over and feel to make sure that she's done it properly.

[END PLAYBACK]

SPEAKER: Now, there are different kinds of compasses out there. You saw one in the video. But there are rubber tip compasses that are more like the kind of compasses that their peers currently use. There are other kinds of compasses. So I'd like to go ahead in a second and show you a video recognizing that not all the compasses you're going to see in this video are currently available. And we see in the picture a student using a compass.

Regardless of what kind of compass your student is using, your student really needs to practice with a compass and get comfortable with how to use it before they need to do specific drawings in class. So Sara Larkin's going to talk to us in this video about the different kinds of compasses that you may find just laying around. Because some of them are not currently available for sale. Let's watch that video.

[VIDEO PLAYBACK]

- We are going to look now at some of the different types of compasses. You have already seen one of the compasses. That was the tactile compass for math and art, which was a beam type of compass, meaning that it has a beam that goes between the pointed part and the scrolling part. Now we are going to look at a few others.

The next type is the Howe Press compass. This also has a pointed part. And it has a scrolling wheel. So it's also going to be used on something like the rubber pad that has braille paper over it or the clipboard with the foam on it. It is also going to be just like that tactile compass for math and art. You're going to have to turn the paper to be able to feel those lines. The problem is that's been discontinued. And so you can't find that available. So it would be just something that might be laying around that you might see. And it is a bow type compass.

Another type of bow compass that I really like is the Fiskars compass. The reason I like this Fiskars compass so well is because of the fact that it has a little wheel that scrolls. And what's nice about that is I can actually-- this is in the nonpointed part. It actually will hold the tool for the draftsmen right into it.

So I can tighten that down, and I can use that regular draftsman tool with the compass. It's rubber tipped, so it is not going to damage that draftsman board. Whereas with that scrolling wheel, I had to turn the paper over, this works with that draftsman. So as I make the arcs, I automatically can feel what I've just made and don't have to turn that paper over.

The problem is Fiskars also no longer sells these. So again, it would just be something that might be laying around. Now, I got all excited a little bit ago because Fiskars came out with another rubber tipped compass. It had a little place for the pencil to come in and out. The problem is it will not hold that tool. It's still not big enough that that tool will fit in there.

And that's the way most compasses are. They're meant for just a golf pencil, so that opening is really small. Whereas that old Fiskars compass is able to hold that tool. They're using something very close to what their peers are using. And it is not going to cause the student to have to turn over the paper. They could instantly feel what they've just drawn.

[END PLAYBACK]

SPEAKER: Slide 23 is about drawing an angle with a specific measure. So this is where our student is going to have to actually produce an angle. And one of the first things is making sure your student understands how the protractor from APH works. Your student can then draw their angle on any type of tool that we've talked about.

In this video, I'm going to introduce you to the inTACT Sketchpad. So I want you to watch the video to see how we use the compass, recognizing that your student can draw all different kinds of angles, acute, right, obtuse. You name an angle, your student has the ability to draw it if they know how to use the APH protractor. So let's watch that video.

[VIDEO PLAYBACK]

- So the last video I want to show you today is how to draw an angle of a specific measure. So a tool I haven't shown you yet is the inTACT Sketchpad. I really like this, because when I open it up, so I'm going to pick up the handle, my drawing tool is inside. So it gives me great storage. This is also magnetic when I close that handle. So it's easy for some students who might have trouble with the clipboard type of thing.

Now, let me get out my APH protractor. And let's walk through how this actually works for a tactual user. Because it's different than what we think in print. So let's look at how this protractor is actually set up. I have one dot at every five increments and two dots at every 10 increments. And then when I get to 45, I have three dots. So my student first really needs to make sure they understand how this protractor is set up before they try to draw with it.

Let's say I have my student needing to draw a 55-degree angle. What I want my student to do is to line the blue wand up with 55. So a quick way for my student to find 55 is to count by 10s with those two dots, so 10, 20, 30, 40, 50. And then one dot more is 55. And that's where my student is going to move the blue wand to.

Now, you're saying, how does my student draw with that plastic? I know. It does look weird, doesn't it? But it's actually the angle at the bottom of the protractor, between the bottom edge of the protractor and the blue wand, that's the 55-degree angle. So I'm going to have my student flip over the protractor and lay it on the inTACT Sketchpad, take the drawing tool and follow along the blue handle and draw that line segment and then the line segment along the bottom edge of the protractor. And that, folks, when she pulls it away is a 55-degree angle.

[END PLAYBACK]

SPEAKER: So you got to see our last video of this lesson. And we're actually done with Lesson 5. So we've given you a lot of information about how students can draw. I want you to think about what you have available to share with your students. I want you to remember that it's your job to be a guide, not a director. And so give your students lots of opportunities to explore and figure out what works the most efficiently for them. Thank you so much for taking part in Lesson

5. In Lesson 6, we're going to talk more about tactile graphics. So when you're ready, head on that way. Thank you.