

Project INSPIRE Grades 2-5 Course 2 Lesson 7

DIANE BRAUNER: Welcome to "Grades 2 to 5: Nemeth Code Symbols for Fractions and Spatial Problems, Instructional Tools, Materials, and Technology." This is "Lesson Number 7: Tech Skills for Math." I'm Diane Brauner, the guest for this lesson. I currently split my time between managing the Perkins eLearning website, Paths to Technology, presenting workshops, and collaborating on VI-related projects.

Today we're going to talk about the tech skills for math. We're going to talk about these objectives. One: participants will learn three critical screen reader tech skills, which are often overlooked. And two: participants will learn how these three tech skills strongly support digital math concepts and skills.

Why digital math? Digital math is fun. It's learning through gamification. Our 21st century classrooms are going paperless. That means we're using digital materials. And right now, remote instruction is a critical piece of the way we're teaching our students. Digital math works well with remote instruction. And prepare for higher ed and workforce, where braille is not always available.

Let's take a look at the prerequisites to digital math. So, on the screen is an image of a tactile bar chart. So first, our students should be familiar with an iPad running VoiceOver. They should be familiar with dragging a finger in a straight line across the iPad. Understanding a straight line is a critical math skill used when exploring spatial relationships on an iPad. Following the rows and the columns in tables and charts and how to align numbers to solve equations, that's all done with being able to drag a finger straight across a line in an iPad.

Use manipulatives to teach foundational concepts, and students should also use tactile graphics for grids, tables, and charts and graphs before they transition to digital math. These prerequisite skills should at least be familiar. They don't necessarily have to master these skills before they're introduced to digital math.

Here are the three tech skills that are often overlooked: spatial concepts and mental mapping, Earcons, and sonification. Let's dive a little bit deeper into these. Spatial concepts and mental mapping. The power of an iPad is knowing where you are physically in space. I'm in the top left corner. I'm in the bottom right-hand corner, the right side, the left side. Those are critical spatial concepts that build those mental mapping abilities.

Explore the screen with drag and split tap. When your student just swipes, swipes, swipes, swipes across the screen, they may be fast and efficient, but they have no idea where they are on the screen. When you drag your finger around the screen, and then you use the split tap. So you're going to drag your finger and drop a second finger down while you hold that first finger in place. That's called a split tap.

With VoiceOver on, if I flick right multiple times, I don't know where I am.

IPAD: [INAUDIBLE]

DIANE BRAUNER: However, if I drag my finger around the screen, I know exactly where I am.

IPAD: App Store...[INAUDIBLE] ...Double tap to open.

DIANE BRAUNER: Ahh, so now I know I'm in the top right-hand corner. Or I can drag to the bottom and know I'm in my toolbar. The power of the iPad is knowing where you are in space. So with drag and split tap, those two gestures go together. I'm going to drag my finger around,

IPAD: [INAUDIBLE] Wednesday, August 5. Double tap to open.

DIANE BRAUNER: Okay, I'm in the top left-hand corner. I can confirm by physically touching the side of my iPad. I can drag in a straight line across. I can drag down.

IPAD: [INAUDIBLE] Double tap to open.

DIANE BRAUNER: And I know exactly where I am. Now if I want to split tap and open this app, I'm going to drop a second finger. So my dragging finger is still connected. It's still touching the iPad. And I'm going to drop the second finger down on the screen. That's the same as a double tap. It will open whatever app I'm on or select that item. So I'm going to do that again. I'm going to drag over to the left-hand side.

IPAD: [INAUDIBLE] double-tap to open.

DIANE BRAUNER: I've found what I wanted. And I'm going to split tap. I'm going to drop that second finger down on the screen. And it opened up my screen. It opened up that app. For some students, the double tap is challenging. Drag and split tap is a lot easier. I can also drag with one finger and use the index finger of my other hand to tap anywhere on the screen to open up that app. That's drag and split tap

Spatial concepts, like top/bottom, quadrants, you can break the iPad into four parts, rows and columns, grids, these are all critical math skills. Listen carefully to VoiceOver information, such as what type of graph, the number of rows and columns, is also another critical skill. If the iPad VoiceOver announces that it's a grid with three rows and five columns, you can picture in your mind, you've built that mental map, of what three rows and five columns looks like.

The second skill that we don't always teach our students is called Earcons. An icon is a symbol, a visual symbol, that means something, that it represents something. Think of the icon of the little gear. The gear means "settings," or your different options.

Earcons are the same thing, except an Earcon is an auditory symbol that means something. So there's mainstream Earcons. Think about the "whoosh" when an email goes, or a "ding" when you get a text message in. Those are mainstream Earcons that we all know and we're familiar with. There are screen reader Earcons. A screen reader Earcon gives you information, provides information of what's happening on the screen, if you can't see that screen.

So I am going to go ahead. I have VoiceOver on. I'm on the home screen of my iPad. I'm going to use three finger double tap to mute VoiceOver.

IPAD: Speech off.

DIANE BRAUNER: Speech off, that means VoiceOver is still running, but you can't hear VoiceOver. I want you to listen to the sounds that are made. So I'm going to flick right a couple of times. Right.

IPAD: [CLICKS]

DIANE BRAUNER: You hear the clicks. Those are the clicks that tell you you've moved from one to the next, or back again. So now I want you to listen to a real subtle sound. I'm going to flick left. I'm in my top row.

IPAD: [CLICKS]

DIANE BRAUNER: There's my click.

IPAD: [THUNK]

DIANE BRAUNER: Let's listen to that again. I'm flicking left.

IPAD: [THUNK]

DIANE BRAUNER: Thunk, that thunk sound is like I'm hitting a wall. So I am at the first icon on my screen in the top left-hand corner, and I flicked left. And when I did that, I can't go any farther. So I hear that thunk, thunk. That's telling me I can keep flicking, but I'm not going any farther that way. I'm going to come down to my toolbar at the bottom. And I'm going to flick right. Let's listen here.

IPAD: [CLICKS]

DIANE BRAUNER: Click for right. Click, I flicked it right again.

IPAD: [THUNK]

DIANE BRAUNER: Oh, there's that thunk again. That means I'm at the last icon on this page, the last app. Let's listen one more time. I'm going to flick right.

IPAD: [THUNK]

DIANE BRAUNER: Let's listen to a real subtle one. Now I'm at the end of my first row, and I'm going to flick right.

IPAD: [CLICKS]

DIANE BRAUNER: And VoiceOver jumped down to the first item on the second row. But I heard a special sound. Let me go back up. Listen again.

IPAD: [CLICKS]

DIANE BRAUNER: So going up, you hear a double sound, a double beep, a double tone. When I move from row to row, if I'm moving down or if I'm moving up, one way is an ascending tone. The tone gets higher, the second tone. And one is a descending tone. The tone gets lower as we move. So let's listen once again. I'm going to flick right.

IPAD: [CLICKS]

DIANE BRAUNER: You hear the click that means I moved. Plus you hear the duh-dun.

IPAD: [CLICKS]

DIANE BRAUNER: And there it was again. Okay, so now I'm going to drag my finger around. Listen.

IPAD: [BEEPS]

DIANE BRAUNER: All right, you hear that duh duh duh duh duh duh duh duh duh? That means I'm dragging my finger in empty space. The click is when I actually touched one of the icons. So let me drag my finger in empty space again. It's the duh duh duh duh duh sound.

IPAD: [BEEPS]

DIANE BRAUNER: All right, it tells me that I'm in an area where there's nothing there. And we're going to go ahead and swipe to the next page of my home screen. So that command is three fingers swipe left.

IPAD: [CHIMES]

DIANE BRAUNER: Did you hear that? Let's go back again.

IPAD: [CHIMES]

DIANE BRAUNER: Alright, you can hear those sounds. They're very subtle.

IPAD: [CHIMES]

DIANE BRAUNER: Going one way or the other way. One more thing, I'm going to open up an app. And you can hear the sound as it is opening.

IPAD: [BEEPS]

DIANE BRAUNER: Alright, let's listen again. I'm going to open up an app.

IPAD: [BEEPS]

DIANE BRAUNER: That app has sound. I'm going to hit the "Home" button to go back. So those are Earcons. They're sounds that have meaning. And these are Earcons specifically for VoiceOver, for screen reader users.

Alright, the third tech skill that we often overlook is called sonification. Sonification is the use of non-speech to convey information often used to make graphs accessible. Sonification of charts often provides that quick overview of what the chart looks like, or the trend of a chart. This enables the user to identify the trend and the general information of the chart instantly.

I'm going to play a sonified chart. I want you to listen and see if you can tell the trend of this chart. It's going to pan from your left ear to your right ear. That's the x-axis, the horizontal axis. So as the data points go across, you're going to hear it from your left ear, to both ears, to your right ear. It's recommended that you have stereo headphones or stereo earbuds in, so you can hear that panning.

The y-axis, the vertical axis, is represented with pitch. The higher the pitch, the higher on the chart that data point is. The lower the pitch, the lower that data point is on the chart. Let's listen to these sounds as it goes from your left ear to your right ear. And let's listen to see if the chart is high, low, if it curves, if it's jagged. You want to identify the trend of the chart by listening to the pitch.

IPAD: [ASCENDING TONES]

DIANE BRAUNER: This chart progressively stepped in an ascending pitch, indicating an ascending line. Here is an image of this chart. It's a diagonal line from the bottom left to the top right. This graph had approximately 16 data points. Let's listen to another chart.

IPAD: [DESCENDING AND ASCENDING TONES]

DIANE BRAUNER: Sample number two is a curved line. It started at the top on the left-hand side. And it progressively went down and back up again. So it was curved like a U shape. And you'll notice the line is a straight line. It's not jagged, because it was progressive in sound. And again, this chart had about 16 points on it. Let's listen here for the third audio.

IPAD: [VARYING TONES]

DIANE BRAUNER: This one had numerous points on a general ascending line. It panned left to right. There were numerous random jumps, so it was not progressive. It went up and down and up and down and up and down and up and down. But the overall trend ended up higher on the right-hand side than where it started on the left-hand side. This is a series plot. There were too many data points on this one to count, weren't there?

So now you kind of have an idea of how you can listen for that trend of a chart using sonification. I would like to encourage you to infuse your math class with dynamic digital math games. And in order to do that, you have to teach the tech skills so that students can access these math games. So 21st century students will be using digital math. Help your students with visual impairments learn math concepts through these dynamic math apps.

The image is a screenshot of the CodeQuest app, showing planet Kratos, level three. It is a three-by-five grid with an astronaut in row one, column one. And a rocket ship in row three, column three. Squares in row one are open, and squares in column three are open, forming a t-shaped pathway. All other squares are blocked. Now you see row three, column three tells me that that rocket ship is at the bottom of the grid in the middle. I have a mental map. And now I can figure out how to move my astronaut to find his rocket ship. I'd like to show you one of my favorite apps for teaching young students grid concepts. Let's watch the video.

This is one of my favorite apps to teach young students that are visually impaired about grids. So when I open up the first game, VoiceOver is going to announce the grid, how many rows and how many columns. So be sure and listen to that announcement. All right, Ballyland Sound Memory is played with VoiceOver off. And it is self-voicing.

IPAD: The Ballyland matching grid is two rows, three columns. Start to drag when I say now. Now.

DIANE BRAUNER: So the app automatically told me there's two rows and three columns. In my mind, I have a mental map of what that looks like. Now this is a matching game, so I'm going to drag my fingers across. Listen to where I am.

IPAD: Row one, column two.

DIANE BRAUNER: Row one, column two, that means I'm on the top row in the middle. I'm going to drag down.

IPAD: Row two, column two.

DIANE BRAUNER: Ah, now I'm in the bottom row in the middle. All right, let me see where I am now.

IPAD: Row two, column one.

DIANE BRAUNER: Row two, column one, so I'm in the bottom left-hand corner. And I'm going to select, I can select any of these, so I'm just going to select a random two, and see if they match.

IPAD: [BELLS]

DIANE BRAUNER: That one was the bell sound. Okay, let's see what's beside it.

IPAD: Row two, column two.

DIANE BRAUNER: And I'm going to select it by double tapping.

IPAD: [BELLS] Oh, yes.

DIANE BRAUNER: Okay, so those two matched. Let me go ahead and start.

IPAD: Row one, column one.

DIANE BRAUNER: Alright, I'm in the top left-hand corner. I'm going to double tap.

IPAD: [SQUEAKS]

DIANE BRAUNER: Alright, that was the squeaky. So row one, column one is squeaky.

IPAD: Row one, column two. [BALLOON DEFLATES] Oh, no.

DIANE BRAUNER: Oh, that sounds like the balloon going. Alright, I'm going to drag again to--

IPAD: Row one, column three. [SQUEAKS]

DIANE BRAUNER: Alright, so row one, column three is a squeaky one. And I remember that row one, column one is also squeaky. So I just tapped on row one, column three. Let's go back.

IPAD: Row one, column one.

DIANE BRAUNER: And these should match.

IPAD: [SQUEAKS] Oh, yes.

DIANE BRAUNER: There we go. So in this short time, we've talked about some important concept students in grades two through five need to develop to use an iPad efficiently, so they can access math apps and other learning opportunities. These skills translate to other technology tools. You can learn a lot more about technology used for students of all grade levels and abilities on the Paths to Technology website. The website is PerkinseLearning.org/Technology. It's been great to be a guest for Project INSPIRE.