Math Manipulatives:
Tools to Help All Students Become Effective Problem Solvers

[Music]

[Narrator:] Many students struggle with math. The thought of juggling algebra, geometry and fractions is enough to make them anxious. But for students with learning disabilities – LDs – math may be more challenging.

Students with LDs may have trouble learning number facts, doing calculations, understanding visual-spatial relationships or solving math problems. These difficulties mean that on paper, math often looks like a bunch of abstract symbols.

[Jeff Richardson:] When they try to solve a problem, they're trying to pull out of their memory which procedure do I use and they can't so then they go blank. If they have understanding instead and realize that math is based on concepts, then they can try to attack the problem in a variety of different ways and they are much more likely to come up with a solution or at least get themselves started down a certain path.

If the numbers hadn't worked out where they were identical on the top, what tool could you use to solve this?

[Narrator:] Teachers at Sagonaska Demonstration School are using manipulatives – concrete materials like algebra tiles, snap cubes and coloured rods – to help students at all grade levels improve their mathematical reasoning and problem solving.

[Student 1:] 15 to get these ones then it won't take 25 to do these ones.

[Jeff Richardson:] Looking at symbols doesn't really have any meaning for them. So if they look at a series of numbers, that doesn't have any kind of meaning for them. So manipulatives really give the kids conceptual understanding so math isn't this big, magic mystery.

[Narrator:] Moving away from paper and pencil learning, manipulatives allow students to demonstrate their thinking. They don't have to hold as much information in their working memory which allows them to focus on the task at hand.

[Andrew Brown:] We see such an amazing benefit to using math manipulatives because it provides the students with that concrete awareness and that hands-on experience of actually touching and feeling manipulatives, instead of just seeing them symbolically. But now they can manipulate them literally and move them around and explore.

[Narrator:] Many students with LDs have strong visual reasoning, so being able to see math concepts right in front of them helps them build a deeper understanding of the math.

[Andrew Brown:] I think that anytime that we can access multiple senses – so they can see it, they can feel it, they can speak to it, they can touch it – is really, really important cause we know that students with learning disabilities can have or usually do have deficits in their working memory. And anytime they need to hold onto information and manipulate it in their brain, if they can do that using hands-on skills, then they're able to show their learning and that just maximizes their ability to show their understanding with manipulatives.

[Narrator:] Combined with manipulatives, students at Sagonaska also use tablets in math class to help convey their understanding of math concepts.

[Emma:] Mr. Brown showed me how to do dividing and multiplying with the integers and adding. I found it harder to do that with pen and paper and show my work. I understood it, but I didn't know how to show it. And using the iPad, I can do videos and voiceovers and then he can still look at that and grade me on what I know cause I couldn't show my work properly on pen and paper, and using the iPad and manipulatives, it makes it a lot easier for me to show it.

[Narrator:] Students are encouraged to try different approaches with the manipulatives and take risks to discover the answers for themselves.

[Jeff Richardson:] The nice thing about manipulatives too is that as they're exploring, they might be slightly going down the wrong path and they're able to just rearrange the manipulatives and that doesn't feel the same as if you're using paper and pencil and having to scratch something out.

[Narrator:] Manipulatives also allow students to start thinking of themselves as problem solvers which helps them gain confidence in their abilities.

[Jeff Richardson:] I've seen students who come in not liking math, feeling like math is just a bunch of tricks. They need something else. They need to have some other ways of showing their thinking because they're bright students, but they just haven't had the opportunity to do that. And so if everything is given to them symbolically, if they don't have good number sense, they're not gonna recognize patterns and they're not gonna be successful. So they need to have opportunities to show what they know as well.

[Zeb:] I'm a very hands-on guy, so you gotta it's easier just to touch it and then actually like move them around. Like take it apart and put together. And then actually count and touch and see.

[Narrator:] At Sagonaska, all students have a digital portfolio where they can document their learning and work, which in turns helps them, their teachers and their parents see how they're improving.

[Zeb:] Technology has helped me a lot. Like using Book Creator for work and handing in assignments and stuff like that, it's so much easier than doing it all on paper. Mr. Richardson handed out like a format, and then we just have to fill it all in. So here's like a blank one. And then you have to go in and answer all the questions. And he can put audio in there so we just listen to it.

[Narrator:] Using manipulatives and tablets or digital tools in math class doesn't only benefit students with LDs. Hands-on exploration means that students don't need to rely on math tricks and memorization.

[Jeff Richardson:] What I find is students have a really fragile understanding of the math then. And as soon as something gets changed, they're not able to change with it, they're not flexible thinkers because of all a sudden the procedure is broken or they've forgotten it. We all know students who freeze on tests. And I think a lot of the reason they freeze is because they've memorized everything and then come test day, they've forgotten it and they can't regenerate the procedure cause they didn't really understand it in the first place.

[Narrator:] Sagonaska recently hosted a workshop where students demonstrated how they're using manipulatives and tablet applications like Book Creator, See Saw and Algebra Touch in math class.

[Student 2:] X is equal to 45.

[Narrator:] At the workshop, educators learned how to incorporate manipulatives in math class to help students with LDs.

[Educator 1:] You have to add three red in so you have them to take away.

[Narrator:] Using manipulatives, educators worked in small groups to solve math problems while visually representing their thinking.

[Educator 2:] So add this all together we have 100 plus.

[Narrator:] By putting themselves in their students' shoes, educators familiarized themselves with manipulatives and deepened their own understanding of how manipulatives could be used to support their students' learning.

[Jeff Richardson:] Sometimes teachers are going to be uncomfortable using manipulatives because you're never sure where they're going to go with students and that's okay. We have to make sure that we model that.

[Narrator:] For students with LDs, manipulatives like algebra tiles, snap cubes and coloured rods are effective learning tools that can improve their mathematical reasoning and problem solving. For more information about manipulatives, visit our website at LDatSchool.ca.

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