Overview of Supporting Students With Special Needs

A review of research on what classroom practices most impact student conceptual understanding found two strategies: making mathematical relationships explicit and engaging students in productive struggle (Hiebert & Grouws, 2007). In addition, *Adding It Up* (National Research Council, 2001), a review of research-based practices, suggests that students are best served when attention is given to (1) connecting and organizing knowledge around big conceptual ideas, (2) building new learning based on what students already know, and (3) incorporating students' informal knowledge of mathematics. We begin this brief discussion with these important findings for all students because too often strategies for students who have special needs are the opposite of these ideas—breaking information into minute pieces such that the big idea is completely absent from the lesson, or avoiding story problems, which have the potential to connect to a student's prior knowledge as well as to the underlying concepts. In many cases, the modifications intended to make the mathematics easier play to students' weaknesses, not their strengths.

Mathematics learning disabilities are cognitive differences, not cognitive deficits (Lewis, 2014). In particular, students with special needs struggle with forming mental representations of mathematical concepts, keeping numbers in working memory, organizing themselves, self-regulation, and generalizing. Therefore, instructional strategies that support students with special needs must address these challenges while still teaching mathematics that engages students and has them thinking at a high level. Research provides strong evidence of strategies that can help students overcome their processing challenges and successfully learn mathematics (Gersten et al., 2009; NCTM, 2007). Four are briefly described here.

Explicit Strategy Instruction

Explicit strategy instruction is not the same as direct instruction, and it is not telling students how to do a procedure. The middle name of this strategy is key—*strategy* instruction. Students with special needs benefit from hearing different strategies, practicing different strategies, and having guidance on how to go about selecting a strategy. The key is that concepts, processes, and connections are made more explicit. Rather than demonstrate a strategy, you are trying to *make the decision-making visible*. Teacher-led explanations of concepts and strategies help students to make connections between new knowledge and concepts they already know. Consider the collection of problem-solving strategies (e.g., draw a picture, make a list, think of a simpler problem, etc.). Explicit strategy instruction means illustrating what each of these looks like and practicing it before moving on to having students select a strategy. Concrete models support explicit strategy instruction. But rather than have unstructured or exploratory time, the teacher might model how to use the manipulatives and then give the students a new problem to explore using the tool in the same way.

Think-Alouds

Think-alouds make thinking processes explicit, so it is not surprising that think-alouds help students to learn strategies, processes, and how to do mathematics. Using think-alouds effectively requires taking time to consider what students know and what they might think to do, and talking aloud about how they might think through the problem. This is particularly important in solving open-ended tasks and high-level thinking tasks. Assume, for example, that rather than have students compute the cost of 5 adult tickets and 3 child tickets to the movies ($9 and $5 respectively), the teacher wants to open up the task, asking how many people might be able to go to the movies if they have $100. A think-aloud might begin with this:

> *Let's see, I have $100, and I can take some adults and some children to the movies. I don't have very much information. Maybe I could just try something first with friendly numbers.*

Then, after trying this a teacher might think this aloud:

> *I need to organize this information so I can keep track of my trials.*

Eventually, roles reverse as the student thinks aloud, helping the student to process information and solve worthwhile tasks and helping the teacher to formatively assess.

Concrete–Representational–Abstract (CRA)

The **concrete–representational–abstract (CRA)** instructional process is also often called *CSA*, with the *S* standing for *semi-concrete*, but *representational* is very fitting for mathematics where representations of concepts help students to develop abstract concepts. Either way, the idea is that teaching begins with ideas that are concrete, visible, and familiar, gradually moving toward mathematics concepts. In a combination with explicit strategy instruction, this approach benefits students with disabilities (Flores, Hinton, & Strozier, 2014; Mancl, Miller, & Kennedy, 2012). It is a mistake to think of CRA as a linear progression, however, because movement toward abstract ideas should continue to be connected to concrete ideas (manipulatives and contexts), as well as related representations (number lines, area models, sketches, graphs, etc.).

Peer-Assisted Learning

Because of the need to have ideas explicit, to think aloud, and to make connections between concrete and abstract ideas, working with peers is very helpful. Students with special needs benefit from seeing how other students model and explain mathematics (McMaster & Fuchs, 2016). **Peer-assisted learning** and support provides that just-in-time assistance. Therefore, it is helpful to pair students with special needs with peers who are able and willing to use think-aloud and/or to be explicit about their strategy.

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