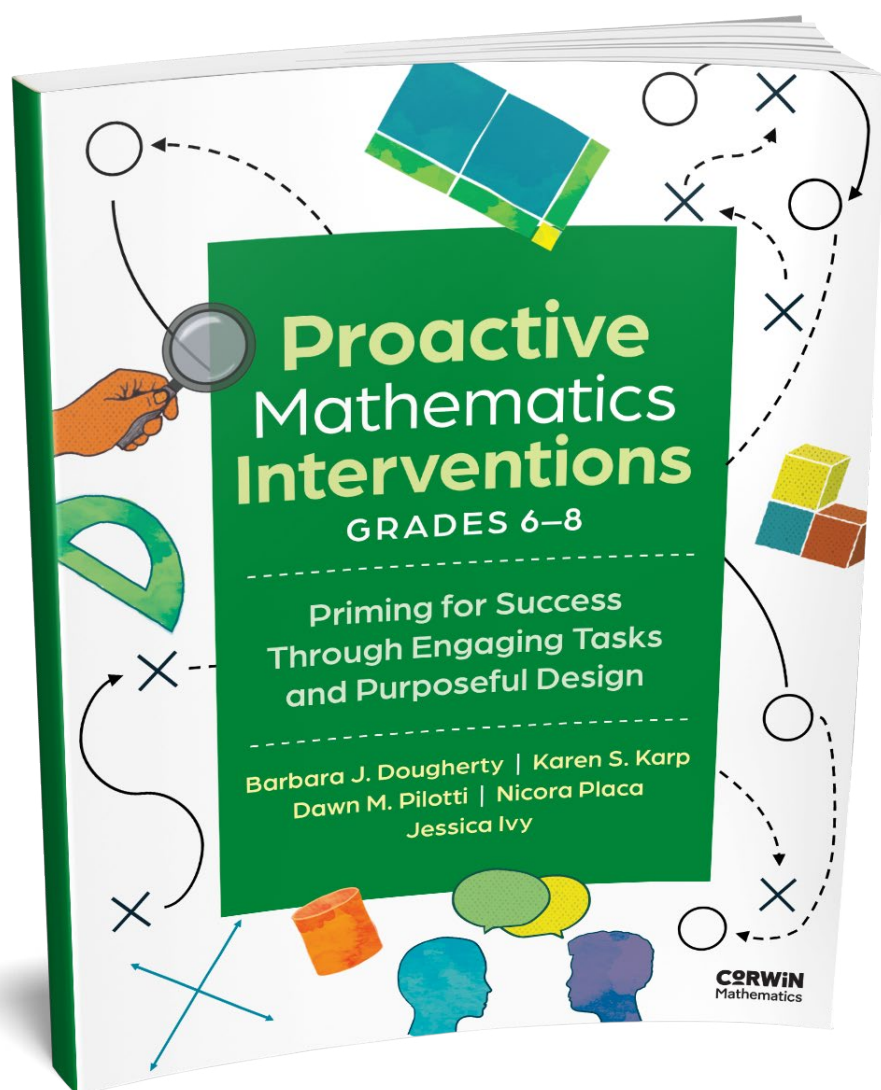


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# What Are Some Key Elements of the Intervention Instruction?

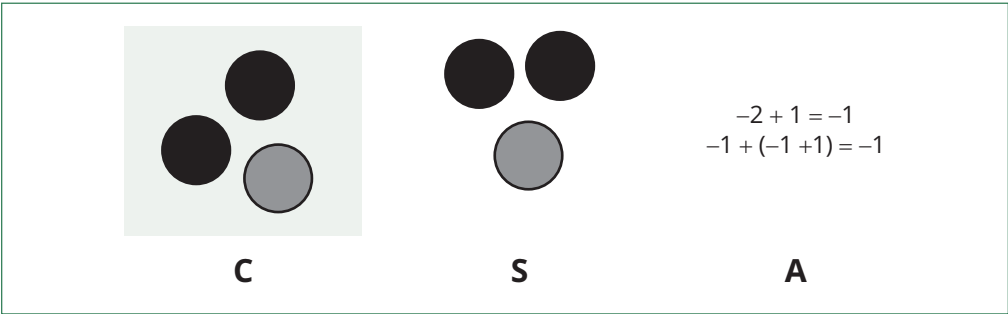
We will examine more deeply the importance of key elements to preemptive and proactive mathematics instruction during intervention. Some of these elements include engaging students in learning via multiple representations, collaborating across teams, and understanding the prerequisite concepts and skills that underpin grade-level content.

## Employing Multiple Representations

As mentioned, the CSA approach in various forms has been an important instructional consideration in mathematics education for many years (Fuchs et al., 2021; Heddens, 1964; Heddens & Speer, 2009).

As an example, an important topic in middle school is the understanding of integers. The CSA model for integers could include the representations as shown in Figure 1.1.

**Figure 1.1** Concrete, Semiconcrete, and Abstract Representations of Integers



*Note:* Black is used for red counters while gray is used for yellow counters in the above images.

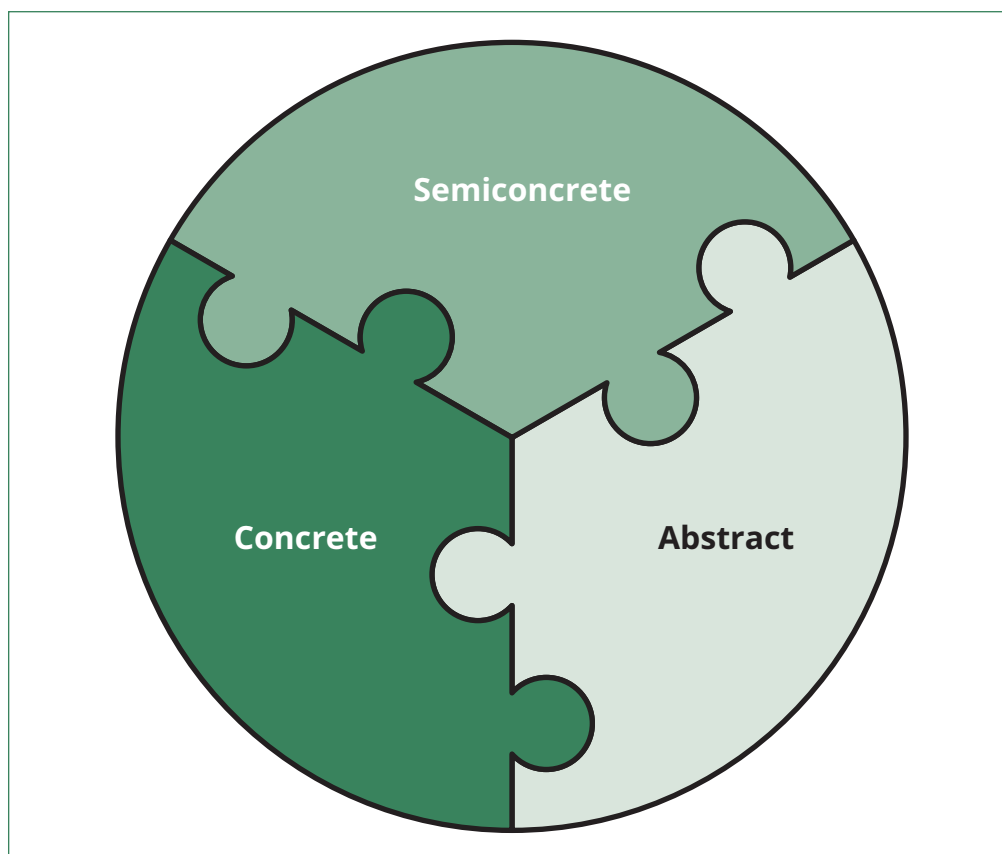
Based on Bruner’s (1966) theory of enactive, iconic, and symbolic reasoning, this model reflects simultaneous and fluent movement between an instructional focus on concrete (e.g., manipulative or physical materials), semiconcrete (e.g., math sketches, graphs), and abstract or symbolic (e.g., mathematical symbols, numerals, expressions, or equations) representations/models. The need for multiple representations does not cease as students age (Bismark & Prosser, 2024; Kestel & Forgan, 2024; Thomas et al., 2025). The use of physical models and math sketches or other visual representations must not fade away.

Importantly, this approach should not be rigid or linear, where one only moves to abstraction after the long-term experiences with the other phases. Instead, there should be concurrent, intertwined, and parallel modeling of symbols throughout this use of multiple interpretations of the situations and mathematical concepts. In this way, students can directly relate the concrete models and visual representations to the corresponding symbolic ones (see Figure 1.2; Van de Walle et al., 2023).

**CSA** stands for the concrete, semiconcrete, and abstract approach that presents these models to show the concept from a connected set of representations. The integrated model suggests using various representations at the same time to highlight the linkages between and among them.

**Concrete representations** are physical materials such as fraction tiles, two-color counters, algebra tiles, and cubes that model mathematical ideas. **Semiconcrete representations** are sketches of the physical representations or other representations such as tables, graphs, charts, and number lines. We refer to drawings that show mathematical relationships as math sketches to highlight their difference from an illustration. **Abstract representations** are mathematical symbols such as numbers, variables, relational symbols ( $=$ ,  $<$ , and so on).

**Figure 1.2** Interwoven Concrete, Semiconcrete, and Abstract Model



The CSA approach often centers on seeing and communicating relationships between the forms of physical or manipulative materials, math sketches, and symbolic representations on the same concept. The use of CSA representations aims to develop a concept and equip students with thinking strategies and skills needed for more independent learning. The model initially emphasizes conceptual understanding as it blends with procedural knowledge (Skemp, 1978). In this way, it honors that both are critical components to students' mathematics proficiency (Findell et al., 2001).

This model should be aligned across the general education classroom in Tier 1 and the interventions in Tier 2, Tier 3, or special education. Aligning instructional interventions with the CSA approach in general education classrooms provides continuity. No matter what CSA may be called (e.g., concrete, representational, and abstract [CRA] or concrete, pictorial, and abstract [CPA]), results of studies indicate that interventions and whole-class mathematics lessons regularly using the CSA instructional representations are successful with students struggling with mathematics (Jitendra et al., 2023). We do prefer CSA, as the other abbreviations do not capture the nature of the critical components that should be taught. For example, the word *pictorial* confuses a drawing or illustration when we are looking for a math sketch as a solution strategy, and the word *representational* is a misnomer as all three components are representations.

Another way to build connections between representations of mathematical ideas to shore up conceptual understanding is by using literature. Recommended literature for children and young adults may be included in the tasks found in Part 2 of this book. When woven into instruction, storytelling linked to mathematical contexts has been shown to positively affect achievement, positive attitudes toward mathematics, and the ability to make connections between representations (Koellner et al., 2009). These opportunities can help students consolidate their previous knowledge and use that foundation to develop new ideas (which are precisely aligned with the direction of our intervention approach). Excerpts or situations found in literature can provide a context that allows students to better understand the problem and be motivated to engage in the solution process.

In addition, these stories and literature provide examples and realistic situations of how mathematics is a human endeavor. Such connections are important to honor. They connect with the students' lived experiences,

thus rehumanizing mathematics (Abdulrahim & Orosco, 2020) and bringing a personal relationship to the learning process. Some may think that time is a barrier to using literature, but incorporating situations or contexts from a story can provide new perspectives to a problem.

For example, *A Grain of Rice* (Pittman, 2018) is the story of a Chinese farmer who desperately wanted to marry the emperor's daughter. The emperor would not give permission for him to do so, but when the farmer saved the daughter's life, the emperor granted him one request. The farmer requested one grain of rice on the first day, but each day after, he requested the amount of rice be doubled from the previous day for 100 days. Rather than reading the entire book, you can present this brief introduction, followed by asking students questions like, How many grains of rice would the farmer have at the end of 100 days? If one grain of rice weighs 0.025 grams, what would the weight of the farmer's rice be at the end of 100 days? How many pounds of rice would this be if there are 453.592 grams in 1 pound?

## Collaborating Across the Team

When the intervention teacher thinks the general education teacher is responsible for teaching the mathematics content and the general education teacher thinks the intervention teacher is responsible for supporting the students who struggle, these students sometimes become invisible. Who is responsible for mathematics instruction? Yes, it's both people (Blanton et al., 2018; Karp, 2013); this must be a partnership. Collaboration is critical, and planning and implementing should be a reciprocal activity.

We know from research that the results are powerful when teachers consciously enter a professional learning opportunity, whether within a formal professional learning community (PLC), a partner PLC, a small group, or a self-selected thought partner. "Communal supportive structures" (Pilotti et al., 2023, p. 15) build shared leadership and collective learning. They lay the groundwork for personal growth. What may begin as a group of individuals with somewhat "siloe practices" can eventually move to "joint responses" and a shared vision—characteristics of a team (Pilotti et al., 2023).

We suggest beginning with the interventionist and the mathematics general education teacher regularly co-planning at least 4 weeks ahead of the next instructional unit in the general education classroom. Everything revolves around the instructional planning to prepare for the upcoming mathematics content by refreshing students' prior knowledge or constructing or reconstructing needed foundational knowledge. The general education teacher partners in this work by using the opening launch of the new lessons based on the intervention content that just occurred. They will ask questions extending the precise prior knowledge targeted and developed during the intervention (i.e., Liljedahl, 2020). We suggest the following aspects to agree on:

- Consistently co-planning and co-teaching the mathematics content, with teachers co-owning and co-orchestrating the content delivery.
- Capitalizing on the strengths of general education teachers, special education teachers, interventionists, and math coaches, compounding the power of the instructional design with jointly made contributions.
- Working together to avoid repetitive intervention goals (i.e., needs to learn multiplication facts) that travel from year to year.
- Avoiding intervention goals that emphasize low expectations by focusing on narrowly defined arithmetic skills, instead focusing on conceptual understanding of grade-level content and the mathematical practices.
- Agreeing as a team to practice "never say anything a kid can say" (Reinhart, 2000, p. 20), and vowing to ask purposeful questions to prompt thinking. This includes when a student is working on a strategy that the teacher won't interrupt, erase what they've done, move the concrete materials for them, or use brief questions that are closed (factual) rather than open (require reasoning and justification) (Jacobs et al., 2014). We also know that "teaching as telling" does not reach an outcome of long-term learning (Lobado et al., 2005).

- ▮ Addressing the role of administrators, coaches, and supervisors—as to what should they look for in this new collaborative arrangement. Do they know that CSA and “doing math” are the focus? How can they be supportive in providing time and resources to these teams?
- ▮ Aligning paraprofessionals and teaching assistants with the intervention goals and methods and providing them with experiences related to learning more mathematics content and pedagogy background to deliver instruction.

## Using a Preemptive and Proactive Approach

We repeat this here because it is essential to the success of our instructional model. This paradigm shift away from reactive responses can “switch the script” and “change the narrative” for many students who may feel that they are not a “math person.” Rather than consistently using interventions to work backward or repetitively reteaching the unit that was just taught as a reaction to a student’s failure, we suggest working proactively to prepare students to engage with upcoming course content in Tier 1 classes.

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Proactive interventions require a do-over of approaches that have been practiced for several decades. They instead utilize a strengths-spotting approach (see Chapter 2), in which students’ assets are identified and intentionally developed (Kobett & Karp, 2020). What students know and what they can do—their strengths—become the starting point for the intervention provided.

Thus, interventions provide a preventative approach to prime students for what is coming mathematically in their core course with a carefully choreographed set of preparatory sessions. Interventions are reoriented away from a reaction to classroom performance where the student isn’t showing grade-level growth on a standard. Instead, by unpacking the standard and anticipating foundational understandings that allow access to the grade-level content, the interventions can lay the appropriate groundwork for upcoming lessons. This preemptive approach uses the strengths-based, learning trajectory-based instructional approach (Suh et al., 2022). The approach proactively provides the language, representations, and actions so that they become familiar and known to the student (Bahr et al., 2024). Interventions are a way of working ahead of time to anticipate and then provide the perfect underpinnings for upcoming units and lessons.

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Delivering a solid background early on generates student confidence. It builds competence in students’ mathematical ability so that students can feel and experience the agency to say, “I am a math person.” In a study that interviewed secondary students with disabilities, rather than receiving sessions of reteaching content they were learning, they preferred a model of teachers presenting what they had as unfinished learning in advance of the new content (Munk et al., 2010). Students said this approach built their self-confidence and made them feel they could participate actively in class. These are important reflections to consider and act upon.

Preloading foundational material during intervention sessions is a teaching turnaround that aligns with a strengths-based instructional theme. Through this proactive approach, students gain knowledge and can contribute to their grade-level mathematics lessons. By now, they will already be equipped with the background knowledge that ensures success in connecting to the mathematics. Let’s look at the planning model in Figure 1.3.

By capitalizing on what the teacher knows is coming up instructionally, students’ best qualities as learners are fueled by prior knowledge. That “on-ramp position” leads to greater success than prior approaches that chase perceived deficits or weaknesses. Applying strengths-based approaches early on opens the chance for familiarity with the materials and, ultimately, higher performance. We will discuss more strengths-based approaches in Chapter 2. We will go deeper into the planning model in Chapter 4.