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Making Standards-Based Mathematics Education Accessible to Students with Disabilities

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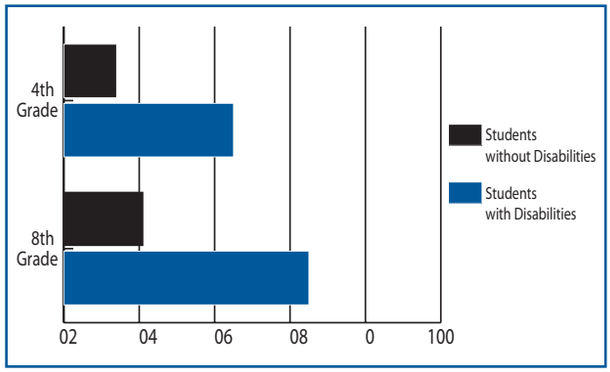
Standards-based reform holds great promise for increasing the rigor and quality of mathematics education for all students, including those with disabilities. The recently released Common Core State Standards in Mathematics (CCSSM),[1] like the standards of the National Council of Teachers of Mathematics (NCTM)[2] before them, clearly recognize that all students, including those with disabilities, "*must have the opportunity to learn and meet the same high standards if they are to access the knowledge and skills necessary in their post-school lives.*" [3]

To date, however, this promise has not been readily fulfilled. The mathematics achievement of students with disabilities has remained dismally low. On the most recent mathematics assessment conducted by the National Assessment for Educational Progress (NAEP) in 2013,[4] close to half of all fourth graders with disabilities (45%) and nearly two-thirds of all eighth graders with disabilities (65%) scored below the basic achievement level. By comparison, only 14 percent of the fourth graders and 21 percent of the eighth graders without disabilities scored below the basic achievement level (see Figure 1). As a result of their low achievement in math, the opportunities for students with disabilities to excel in an increasingly technology-based society and to pursue careers in science, technology, engineering, and mathematics have been limited, and both scientific and human enterprise have been denied the talents and contributions of these students.

Figure 1: Percent of Students Scoring Below the Proficient Level on the 2013 NAEP Mathematics Assessement



Source: NCES 2013

Even though research shows that teacher quality is the single most powerful influence on student learning,[5] teachers often are not well-prepared to

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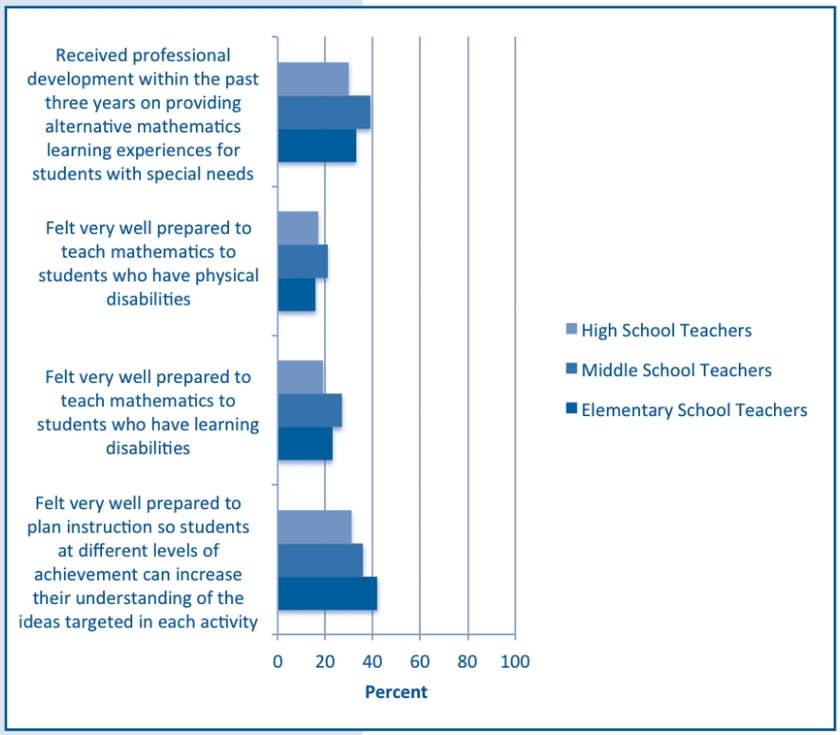
implement standards-based mathematics education with the heterogeneous groups of students that are being served in general education classrooms, including students with disabilities and students with different capabilities, needs, and learning styles. According to a recent national survey of science and mathematics teachers conducted by Horizon Research,[6] fewer than half of the teachers reported feeling very well prepared to plan instruction so students at different levels of achievement can increase their understanding of the ideas targeted in each activity. Only about a quarter of the mathematics teachers reported feeling very well prepared to teach students with learning or physical disabilities. Moreover, only a third of the mathematics teachers reported receiving professional development (PD) in the past three years on how to provide alternative mathematics learning experiences for students with special needs (see Figure 2). To achieve the full promise of the CCSS, targeted PD efforts are required to better prepare general and special education teachers for teaching high-quality mathematics to the full range of students that are being served in general education classrooms.

Figure 2: Mathematics Teachers' Perceptions of their Preparedness to Teach Students with Disabilities



Source: Banilower, Smith, Weiss, Malzahn, Campbell, & Weiss (2013)

What kinds of competencies do teachers need to make standards-based mathematics accessible to students with diverse strengths and needs, including those with disabilities? The new standards embrace a concept of equity that recognizes that all students must have opportunities to study and learn high-quality mathematics regardless of their personal backgrounds or challenges. This does not mean that every student should receive the same instruction. Instead, the standards recognize that different students may need different kinds of support to ensure they will meet the same or similar learning goals as their peers. To provide students with this kind of individualized support, teachers will need to adapt math lessons, taking into consideration the diverse range of strengths and needs of the students in their classrooms. To do so, teachers need to draw on multiple bodies of knowledge and skills, as explained below and illustrated in Figure 3:

- Teachers need to have a good grasp of the **mathematics** they are teaching. In particular, they need to have a good understanding of the mathematical goals of their lessons and how these goals relate to what students learned before and what they will learn later. The purpose of making adaptations is to provide students with alternative means to reach the same learning goals. Teachers need to be careful not to change the goals, and perhaps make the mathematics less rigorous by doing so. For example, if the goal of a lesson is to examine patterns among multiples of a given number (e.g., multiples of 24), a teacher might provide a student with a calculator to quickly and accurately calculate several multiples and be able to see a pattern. If, however, the goal is to build fluency with multiplication, having the student use a calculator would not be an appropriate adaptation.
- Teachers also need to have a good understanding of their **students**. Understanding individual student's strengths and needs is essential

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for teachers to determine what kinds of support they need. It is particularly important for teachers to get to know students' strengths. All too often, we focus on students' weaknesses, especially when working with students with disabilities. Yet all students have unique experiences and knowledge that can contribute to learning. Building on students' strengths can be a successful strategy for helping students work on their weaknesses. For example, a student with strong visual spatial skills, but who hasn't yet developed automaticity with fact families (e.g., 5 + 4 = 9 and 4 + 5 = 9), may benefit from drawing objects that represent these fact families to better remember them.

- A third body of knowledge that is important for teachers to draw upon when adapting lessons is an understanding of a variety of **instructional strategies and designs**. Familiarity with a variety of different strategies for teaching a specific concept or skill (e.g., using different models such as area and array models, skip counting, repeated addition to teach multiplication), and techniques that work for students with different strengths and needs (e.g., strategies for supporting higher order thinking or understanding of mathematical language) will give teachers the tools to carry out lessons that offer multiple ways for students to engage with and access mathematical content.
- Perhaps most importantly, teachers also need skills in flexibly applying this knowledge when planning lessons and **making decisions** about classroom instruction. Making math accessible to all students requires teachers to engage in an ongoing process of problem solving, decision making, and reflection. Often, there is no one single approach that will work for all students. Teachers need to think about how the demands of specific math lessons interact with each individual student's strengths and needs, and carefully adapt and select materials, activities, and instructional strategies that are consistent with the original goal of the lesson and that will help make it accessible to students with different strengths and needs.

To help teachers develop these competencies, researchers from the Education Development Center, Inc. (EDC), and teacher educators from Bank Street College have been collaborating for the past 10 years to develop PD materials and a model for in-service PD. This model draws on research[7] and best practices and incorporates the following elements:

- **A focus on content**. Participants in the PD are introduced to a neurodevelopmental theory of learning[8] and use this framework to formatively assess and consider how students with different strengths and needs learn.[1*] Teachers' learning about how to differentiate math lessons is deeply embedded in standards-based mathematics content. Participants analyze the neurodevelopmental demands of mathematical activities and consider the mathematical learning goals and their trajectories across multiple grades in the context of different math lessons (videotaped case lessons and teachers' own lessons).
- **Opportunities for active learning**. Participants analyze and reflect on mathematics lessons and student work presented in videotaped case lessons. They also collaboratively plan, execute, and reflect on adaptations to mathematics lessons, and receive feedback on their lesson plans and reflections.
- **Coherence with other learning activities**. The content of the PD is aligned with the Common Core State Standards, the standards of the National Council of Teachers of Mathematics

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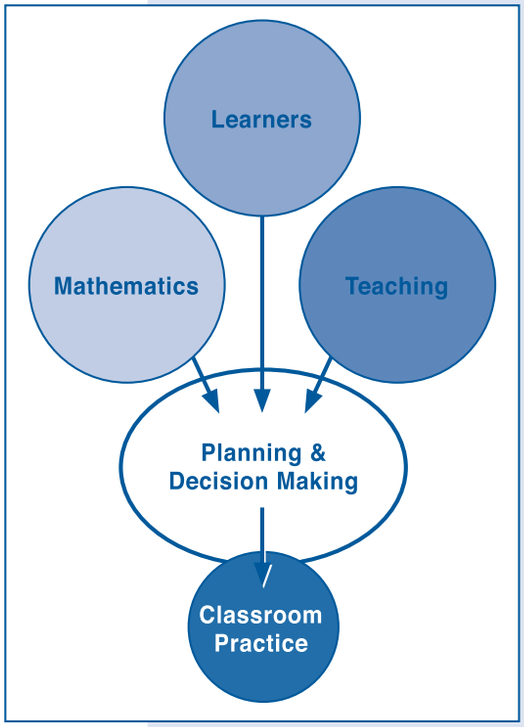
Figure 3: Key Competencies for Planning Accessible Math Lessons



"Making math accessible to all students requires teachers to engage in an ongoing process of problem solving, decision making, and reflection."

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(NCTM), and the mandate to include students with disabilities in high-quality education. The PD is not tied to any particular mathematics curriculum, but rather supports teachers in adapting math lessons from the particular curriculum they are using to increase the accessibility of these lessons for students with different strengths and needs.

- **Extended duration**. In addition to 30 hours of PD, teachers receive 20 hours of classroom-based assignments, all of which are conducted over the course of a school year.
- **Embedded in teaching**. As part of each workshop session, teachers apply the content they are learning by collaboratively planning and carrying out adaptations to math lessons they are teaching in their classrooms. Teams of general and special education teachers engage in a process of lesson study to develop, implement, and reflect on adaptations to math lessons that build on each individual student's strengths and needs while maintaining the rigor of the mathematical learning goals.
- **Collective participation**. General and special education teachers who serve the same students work in teams to plan, carry out, and reflect on mathematics lessons.

This professional development model has been extensively field-tested in more than 30 school districts in 10 different states. Results from the research attest to the feasibility of using the model in a variety of settings and its promise for impacting teacher and student outcomes. Our research showed that the model has a significant effect on teachers' knowledge and classroom practices regardless of whether it is implemented by the EDC and Bank Street program developers or district-based staff developers, a finding which attests to the scalability of the program. EDC and Bank Street College encourage school districts to adopt this model.

To learn more about free online information sessions about this PD model for teacher leaders, staff developers, and school and district leaders, contact Babette Moeller at bmoeller@edc.org.

(Endnotes)

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2 National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

3 Common Core State Standards Initiative. (2010). *Common core state standards for mathematics*. Washington, DC: National Governors Association & Council for Chief State School Officers. Retrieved from www.corestandards.org/Math

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7 Garet, M. S., Porter, A. C., Desimone, L., Birman, B., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal*, *38*(4), 915–945.

8 Barringer, M-D., Pohlman, C., & Robinson, M. (2010). *Schools for all kinds of minds: Boosting student success by embracing learning variation*. Hoboken, NJ: John Wiley & Sons, Inc.