

Best Practices in Math Implementation - Hanover Research

INTRODUCTION

[Redacted] School District) is dedicated to providing high quality math instruction to students of all ages and grade levels. Specifically, the district is looking to support students as they transition between grade bands so that student learning builds from elementary to middle to high school. According to the 2022 test scores from the National Assessment for Education Progress (NAEP), students of all identities nationwide are markedly struggling with math, with average scores dropping 5 points since the pandemic. The NAEP results show that students have greater math learning needs than they did two years ago, and math teachers require increased support to help students succeed.¹ To support the district in their effort to improve math teacher pedagogy and student learning, Hanover Research (Hanover) created this best practices report with the following sections:

- **Section I District Continuity** contains guidelines for ensuring math best practices are implemented and practiced consistently districtwide, as well as recommendations for supporting students in the transition between grade bands.
- **Section II Daily Teaching Strategies** contains best teaching practices for the developmental needs of elementary, middle, and high school students.

RECOMMENDATIONS

Based on our findings, Hanover suggests [Redacted] consider the following recommendations:



Actively engage district staff and community partners when developing, adjusting, and implementing math standards and best practices. Districts can ensure engagement through creating a curriculum development committee that leads the long-term process of best practices implementation or, if relevant, curriculum change. Planning committee participants should deeply understand math best practices and how they support instruction and assessment to increase implementation fidelity.



Assess students before they transition between grade bands to ensure learning continuity. Specifically, schools should assess student strengths, weaknesses, and conceptual knowledge. Before students transition to a new grade band, teachers should ensure students can use their math knowledge flexibly to solve novel problems. Hanover's quantitative team can help the district examine academic outcomes data to identify trends and gaps in mathematical learning, and identify specific student groups in need of additional support.



Ensure students receive foundational knowledge during elementary school so that they have a foundation of math conceptual knowledge to employ in middle and high school. Teaching young students math is a complex and nuanced art, as students acquire math competencies at their own pace, and often require support with behavior regulation and higher thinking skills in conjunction with math instruction. As a first step, the district can review the following resource for [Best Practices in Math Instruction for the Upper Elementary Grades](#).



Differentiate content at the secondary level to close learning gaps as students progress from elementary education. Teachers can differentiate content at the secondary level through the use of open questions, choice boards, exit tickets, metacognitive strategies, parallel tasks, and academic competitions. Hanover can support the district in developing best practice reports, toolkits, and professional development resources to support teachers with differentiating high school level mathematics instruction.

KEY FINDINGS



Responsive Adoption (RA) actively involves teachers and community stakeholders in the process of selecting and implementing evidence-based curricula. The RA model centers teachers by giving teachers agency in the selection of materials, involving teachers in the process of integrating materials with already existing curricula, and utilizing teacher practice for piloting implementation. Using RA requires districts to train teachers in math best practices so that they can make well-informed decisions. A steering committee, lead teachers, pilot teachers, and district administrators work together to implement RA.



Many teachers impact student math growth during group discussions, where teachers can prompt students to explain their thinking, thereby allowing the entire class to expand their knowledge base. Teachers can encourage students to build off each other's ideas to simultaneously improve students' confidence and collaboration skills. Teachers can model solving mathematical equations through thinking out loud, and when appropriate, specific step-by-step explanations. When working with students in a group and individually, teachers should always prompt students to describe how they got their answer, name patterns in thinking, and build relationships with students so they feel comfortable sharing.



Early childhood mathematics instruction is successful when students use manipulatives and representations to illuminate mathematical concepts, and when learning is integrated into a variety of activities during the school day, including read alouds, play, and interdisciplinary instruction. Decades of research shows that manipulatives and representations benefit student math learning, especially when they are used consistently throughout the school year. Recent research shows that read alouds help young children develop foundational math concepts. Research shows that math games are effective learning tools when they actively engage students, are based on skill as opposed to luck, and can be differentiated for different levels.



Mathematics instruction is successful when students learn problem solving strategies and develop self-efficacy. Research shows that even if students have the math knowledge they need to solve math problems, they do not always choose the corresponding strategy. Problem solving competencies provide students with the metacognitive skills they need to think critically about what math strategy to apply to what math problem, and how to work through challenges that arise in the process. Research shows that self-efficacy is critical to student academic success in math, as it motivates students to take responsibility for their own learning.



Middle school math mastery, specifically in fractions, is predictive of successful high school math performance. Knowledge of fractions and decimals helps students comprehend algebra in high school. In order to teach students nuanced and complex math concepts, middle school math teachers also require specialized knowledge in algebra and functions; statistics and probability; and geometry, trigonometry, and measurement.



Engagement in math is vital for high school students, as their performance can affect college acceptance or the option to have a career in STEM. High school students may enter class with negative beliefs of their math ability or a general dislike of math. Common elementary and middle school strategies can help high schoolers actively engage in math, such as discussion, instructional routines, and anchor charts.
