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# Middle School Mathematics Instructional Coaching

## OVERVIEW

Research supports the long-term use of highly trained instructional coaches for improving the teaching of middle school mathematics and increasing the mathematics achievement of students. Coaches work with teachers, both in and outside of classrooms, through goal setting, modeling, collaborative planning, observation, student data analysis, and reflection. Effective instructional coaching in mathematics has been shown to:

- Improve student learning in mathematics;
- Increase teacher knowledge of mathematical content; and
- Improve mathematics instruction.

Research indicates that effective coaching programs have the following components:

- Support from school leadership;
- Knowledgeable and skilled coaches;
- Regular interaction between coaches and teachers;
- Focus on both content knowledge and pedagogical skills; and
- Long-term commitment to coaching from district and state administration.

## THE CHALLENGE

According to the American Institutes for Research, success in middle school mathematics is a key indicator of later academic success (CCRS, 2013). Yet, greater than one out of every four 8th-grade students in the U.S. have less than a basic understanding of fundamental math skills (U.S. Department of Education, 2017).

> More than one in four 8th-grade students in the U.S. have mathematics skills that are considered below basic.

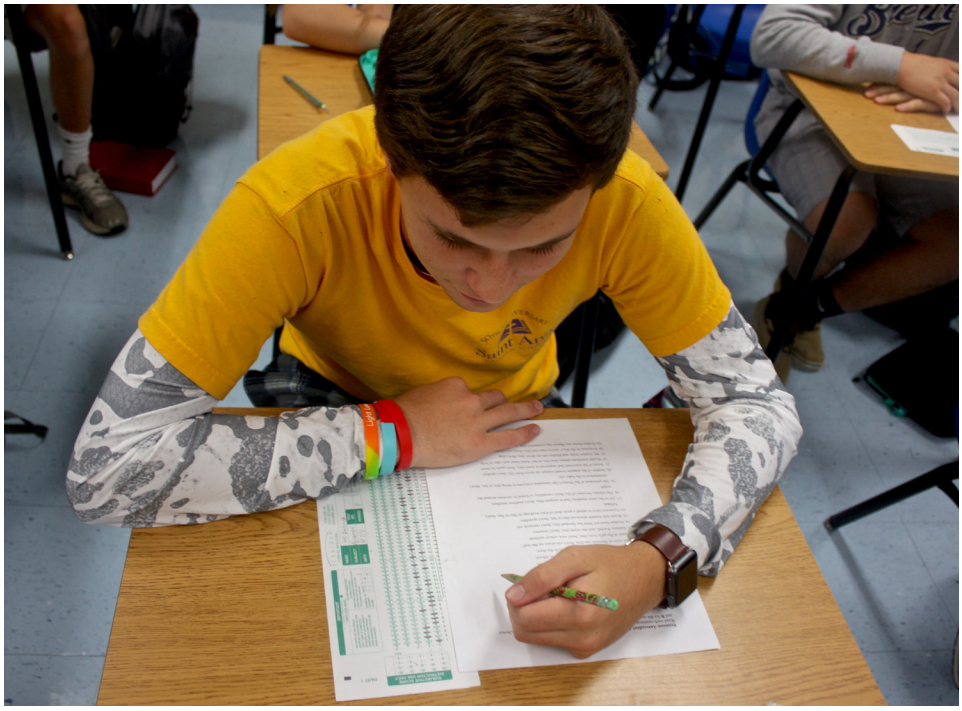
Additionally, more than half of 8th-grade students in the U.S. are performing at a level in math that is unlikely to lead to later college success (Lee, 2013; U.S. Department of Education, 2017). Mathematics performance of Delaware's 8th-grade students is not significantly different than the national average and the scores of students in 12 states. However, 26 states perform significantly better than Delaware, while 11 states perform significantly worse.

> Nearly one-third of Delaware's 8th -grade students have less than a basic understanding of fundamental mathematics skills.

Nationally, Delaware was 1 of 22 states whose 8th-grade math scores declined between 2013 and 2015 on the National Assessment of Educational Progress (NAEP; U.S. Department of Education, 2015). Further, Delaware's NAEP math performance reveals the percentage of 8th-grade students who perform below basic is over 70% higher than the percentage of 4th-grade students who perform below basic. At the same time, the percentage of students performing proficient or advanced in 8th grade is over 20% less than in 4th grade (U.S. Department of Education, 2015). That is, the percentage of students performing below basic in math increases between 4th and 8th grade, while the percentage of students performing proficient or advanced decreases between 4th and 8th grade. While elementary math performance needs improvement, middle school math performance is not sustaining even the small gains made during the elementary years.

> Grade-level mathematics performance for Delaware's students declines between 4th and 8th grade.

It is important to note that Delaware state assessment scores show a small, but consistent, increase in mathematics scores from 2015 to 2017. However, as with the NAEP data, the percentage of students scoring proficient in 8th grade is far less than the percentage scoring proficient in 4th grade (Delaware Department of Education, 2017). The largest decline in math performance of Delaware students is between 4th and 5th grades. After 4th grade, the percentage of students scoring proficient or higher in math drops to less than half, and by 8th grade the percent of students scoring proficient is under 40%. These data suggest the need for effective mathematics interventions in the middle grades.



> Delaware's state assessment scores reveal the need for effective mathematics interventions for students in 5th through 8th grades.

## MATHEMATICS COACHING

Statewide mathematics scores of middle school students indicate that many are not achieving at a level that will enable them to succeed in the future. Research also shows that teachers are the most important in-school factor that can improve student achievement (RAND, 2012). Effective professional development is essential for teachers to advance their knowledge of evolving standards, learn to use innovative technological tools, and continually improve their pedagogical skills. This brief reviews the emerging research on middle school mathematics coaching, a teacher professional development strategy intended to improve math instruction and consequently, increase student learning.

> Mathematics coaching is an intervention that has shown promise in improving mathematics instruction and student achievement.

Middle school mathematics coaching is an intervention in which instructional coaches work with teachers, both in and outside of the classroom. Instructional coaches collaborate with teachers on goal setting, modeling effective teaching, lesson planning, observation, reflection on practice, and using data to improve instruction and student learning.

## COACHING AND STUDENT LEARNING

Research on mathematics coaching has shown that students of teachers who work with an instructional coach have significantly higher scores on standardized tests than students of teachers who do not work with a coach (Brosnan & Erchick, 2010; Coniam, 2010; Zollinger et al., 2010). Studies have also revealed that coaching of teachers in urban schools is particularly effective for helping improve student performance across all mathematical domains (Coniam, 2010); and that the more engaged teachers are with their coaches, the more likely student performance will improve (Ellington, Whitenack, & Edwards, 2017).

> The more engaged teachers are in the coaching process, the greater student learning in mathematics.

Further, a three-year randomized controlled experiment that included more than 1,100 teachers and their students found that *experienced* coaches were particularly successful at improving student achievement (Campbell & Malkus, 2011). Experienced coaches were defined as those who had been a coach at least one year, further emphasizing that teacher coaching interventions need to be sustained in order to maximize impact on student learning.

## COACHING AND TEACHER PRACTICE

Improvements in student learning through mathematical coaching hinge on changes in teacher knowledge and practice. Research shows that teachers who are deeply engaged with a mathematical instructional coach develop the understanding that students should work through and make sense of

ideas in order to develop their own deep understanding of mathematical concepts (Ellington et al., 2017). Further, when teachers are coached in a supportive, collegial, and reciprocal manner, teachers can gain confidence in the use of more powerful teaching methods. Working with an instructional coach over an extended period of time provides teachers with the opportunity to receive feedback about their teaching, consider how they can improve, and work with their coach to make those improvements (Campbell & Griffin, 2017).

> Coaching is an important aspect of teacher professional development, fostering and sustaining improvements in knowledge and practice.

Coaching programs, while resource intensive, are a critical element of effective professional development; ongoing instructional coaching helps to create and maintain positive changes in teacher practice (Becker & Pence, 2003).

## ELEMENTS OF EFFECTIVE COACHING

Although there is no one best model of instructional coaching, five characteristics are underscored in the research on effective coaching: 1) support from school leadership; 2) knowledgeable and skilled coaches; 3) a focus on both knowledge and classroom practice; 4) regular interaction between coaches and teachers; and 5) a long-term commitment providing time for teachers to learn and improve.

> Effective coaching programs require a multi-year resource commitment to instructional improvement.

It is important for principals to work with their coaches to calibrate ideas of effective mathematics instruction; and so teachers see that the work of coaching is valued by the principal (West, 2017; Gibbons, Kazemi, & Lewis, 2017). Coaches should have a thorough knowledge of mathematical content, as well as be able to engage teachers in discussions about math concepts and how students understand and learn those concepts (Campbell & Griffin, 2017; Haver, Trinter, & Inge, 2017; Howley, Dudek, Rittenberg, & Larson, 2014; Polly, 2012). Further, frequent, consistent, and substantive engagement between teachers and their math coach help to create measurable changes in practice and improve student learning (Ellington et al., 2017). Finally, long-term state and district support is critical, giving teachers time to implement what they learn and advance their practice so improvements in student learning can be maintained.

## THE DELAWARE EXPERIENCE

During the 2017-18 school year, Delaware Department of Education (DDOE) piloted the placement of three mathematics coaches to support four middle schools. The collaborative relationship between Delaware's coaches and DDOE's Curriculum, Instruction, and Professional Development workgroup models the elements of effective coaching that the coaches are charged with implementing in their schools. This modeling has emphasized both increasing content knowledge and improving teaching practice. Delaware's coaches also work with teachers to review and use data to focus instruction. While coaches indicate that early results are promising, they believe sustained student achievement gains will only be realized through the continued coaching and support of teachers.

## POLICY IMPLICATIONS

Education, by its very nature, is a proactive venture, investing in today to build strong and healthy communities tomorrow. Policy dictates how to allocate limited resources for maximum effectiveness. With regards to math education, research supports the long-term use of highly trained instructional coaches. Building and sustaining a ***multi-year mathematics instructional coaching initiative, based on the research-supported elements of effective coaching and targeting underperforming middle schools***, and with an evaluation focused on continuous improvement, shows promise as a strategy to increase student learning and improve equity in our education system. Policies such as instructional coaching that invest in teachers are, in turn, investments in our communities and our future. ■

## SUGGESTED CITATION

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**Center for Research in Education and Social Policy**
Pearson Hall, 125 Academy Street
Newark, DE 19716-2922
Phone: 302-831-2928
**cresp.udel.edu**