

SREB

# Making Math Matter:

High-Quality Assignments  
That Help Students Solve Problems  
and Own Their Learning

Southern  
Regional  
Education  
Board

SREB.org



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The Southern Regional Education Board (SREB) works with member states to help leaders in education and government advance education and improve the social and economic life of the region. Based in Atlanta, SREB was created in 1948 by Southern governors and legislatures. More at [SREB.org](http://SREB.org)

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## Executive Summary

This report overviews the importance of mathematics instruction in improving students' understanding of mathematics concepts and achievement. The powerful mathematics practices outlined in the Mathematics Design Collaborative (MDC) framework are detailed, and their importance in shifting how teachers plan and implement mathematics lessons is discussed. Four data sources are presented to support the use of MDC in improving teachers' use of complex grade-level mathematics assignments, and improving students' understanding of mathematics concepts and achievement.

First, findings from a Southern Regional Education Board (SREB) teacher survey administered in spring 2017 are examined to better understand teacher perceptions of the MDC framework, benefits of the framework to teachers and their students and the critical role principals and external support partners play in the implementation process.

Second, results from a recent student survey are introduced. Findings from this survey were used to better understand the instructional experiences students were having in classrooms where MDC had been implemented (MDC classrooms). Additionally, feedback was collected from students in classrooms where MDC had not been implemented (non-MDC classrooms) so comparisons could be made. The differences between MDC and non-MDC classrooms are explored.

Third, student achievement data from middle grades and high schools in Alabama, Louisiana, North Carolina and West Virginia where MDC implementation occurred are presented.

Lastly, vignettes and testimonials from teachers, local mathematics trainers and principals are offered to capture the thoughts and opinions of professional practitioners who have used the MDC framework.

# Introduction

## Middle of the Pack

Rapid technological advancements in the United States have markedly altered the American labor market. As STEM (science, technology, engineering and mathematics) careers expand, traditional routine labor jobs are disappearing. Data from the U.S. Department of Commerce show that, since 2008, STEM occupations have grown 17 percent. Furthermore, the 2017 Business Roundtable Summit report indicated that three-fourths of responding chief executive officers say that fundamental mathematics skills are important and half report that their companies have difficulty finding qualified applicants who possess these skills.

At the core of any STEM field is mathematics. According to the Business Roundtable (2017), mathematics knowledge and skills are a precursor for nearly any job in the science and technology, computer science and engineering fields. The need for STEM-like thinking is a growing occupational demand, not only in traditional STEM fields but in areas such as manufacturing as well, and therein lies the problem. For several decades, U.S. students' mathematics performance has troubled educators, economists and politicians alike. So much so that many, like Schmidt, Wang and McKnight (2005) and Silver and Kenney (2000), consider the topic to be of national concern.



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*“We have been feeding children mathematical fish for hundreds if not thousands of years. It is time to teach them how to fish.”*

Alan Schoenfeld, 2015

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STEM occupations play an important role in our economy and will ultimately decide our standing on the world stage. The statistics on the outlook for STEM careers are encouraging. According to the U.S. Department of Commerce, STEM workers command higher wages, reach higher educational attainment and are less likely to experience joblessness. Some researchers like Cross (2008) believe the STEM job market is outpacing the availability of qualified workers, leading to economists' concerns over the ability of future U.S. generations to compete in a global economic market.

This concern is amplified by results of cross-national assessments designed to measure and rank the academic performance of students in developed countries. The results of one such measure, the Program for International Student Assessment (PISA), would be considered substandard at best by many U.S. educators and policymakers, as noted by Desilver (2017). The PISA is administered to 15-year-old students, primarily 10th-graders, every three years, and the most recent available results, from 2015, place U.S. students behind 37 other countries in mathematics and trailing 23 other countries in science.

## Addressing the Issue

Why U.S. students' mathematics performance lags continues to be debated. Some, such as Kramarski, Mevarech and Arami (2002), believe the problem originates in how mathematics is taught — little emphasis is placed on exploration and discourse. Cross (2008), Kramarski et al. (2002) and Schoenfeld (2015) found that many U.S. mathematics classrooms lack instruction that targets students' prior knowledge of concepts, connecting what students already know to real-world situations. Traditional

mathematics instruction largely focuses on building procedural skills and recall as opposed to problem solving. **These skill-building exercises are often antiquated, disconnected and lack opportunities for reasoning and conceptual understanding.**

Such environments are not conducive to learning and growth. When math is taught through repetition and rote memorization, students are starved of opportunities to make sense of basic concepts and strategies. As a result, teachers become the keepers of knowledge, leading activities in procedural fashion, rather than having students grapple with problems and develop their own solution paths. This absence of productive struggle may explain U.S. students' modest mathematics scores.

As noted by the National Council of Teachers of Mathematics (NCTM, 2014), it is accepted that mathematics classrooms maximize learning and achievement when students are provided opportunities to increase cognition through conceptual reasoning and understanding. Creating these learning environments requires substantial change in teachers' mindsets.

In a 2009 study, McKinney, Chappell, Berry and Hickman found that more than half of the math teachers they studied preferred traditional math instruction. Handal (2003) and Philipp (2007) noted that many teachers struggle to shift their practice and classrooms from traditional procedural-based, sit-and-get instruction followed by math drill worksheets to collaborative learning environments that promote active learning by having students apply problem-solving strategies and skills to develop their own solution paths. For students and parents to embrace struggle, teachers must accept that struggle is a valuable component of the learning process.



# Mathematics Design Collaborative

This section overviews the powerful mathematics practices comprising the MDC framework.

The Southern Regional Education Board (SREB) is committed to assisting schools, districts and states in their efforts to improve student achievement in mathematics using meaningful assignments and research-based instructional strategies. Since 2011, SREB has partnered with thousands of educators and hundreds of schools to improve students' mathematics achievement by equipping teachers with the tools and strategies of the Mathematics Design Collaborative (MDC).

MDC provides teachers a powerful framework centered on formative assessment to enhance daily instruction. Through MDC, teachers learn to use the five strategies of assessment for learning, pioneered by Marnie Thompson and Dylan Wiliam (2007), which are grounded in research and help teachers do the following:

1. Clarify and share learning intentions and criteria for success.
2. Engineer effective discussions, questions and tasks that elicit evidence of learning.
3. Provide feedback that moves learning forward.
4. Activate students as the owners of their learning.
5. Activate students as instructional resources for one another.

These five strategies are interwoven throughout MDC, helping teachers provide frequent and varied performance opportunities for students to demonstrate their understanding and recognize connections among mathematical concepts when solving complex problems.

## Key Shifts in Teaching and Learning Mathematics

The tools and strategies of MDC help teachers shift from a traditional classroom environment in which the learning centers around the teacher as the expert who gives students step-by-step instructions, to a classroom environment that focuses on students as the experts, a balance of direct and facilitated instructions, and opportunities for real-world application. As a result, students build procedural fluency and deepen their mathematical reasoning.

The teachers, local trainers, schools and districts highlighted in this publication are experiencing these key shifts in instruction and engaging their students to apply mathematical concepts to solve abstract and real-world problems. Using MDC, teachers learn to implement the following powerful mathematics practices:

1. Plan for and ensure a balanced approach to mathematics.
2. Engage students in assignments that matter.
3. Utilize questioning and feedback for deeper understanding.
4. Use formative assessment data.
5. Foster a classroom environment that supports student ownership of learning.
6. Use reflective teaching practice.

## Planning for and Ensuring a Balanced Approach to Mathematics

MDC teachers develop mathematics units, based on grade-level standards that articulate a balanced approach to mathematics. These units include an instructional plan and assessments that ensure students develop mathematical reasoning, conceptual understanding, procedural fluency and the ability to apply mathematical concepts to real-world and nonroutine contexts. Teachers use lesson planning cycles such as the Biological Sciences Curriculum Study (BSCS) 5E Instructional Model, which was pioneered by Rodger Bybee in 1989. This particular instructional model guides teachers in building lessons and instructional units that engage students through the essential areas of learning.

- Engagement – Teachers present a challenging assignment that creates a productive struggle by having students use reasoning skills to apply mathematical concepts and strategies to complete the assignment.
- Exploration – Students work individually and in groups to complete the assignment. Teachers monitor student progress by using feedback and questioning to facilitate conceptual understanding.
- Explanation – Students share their solutions to the assignment, highlighting the different solution paths. Teachers facilitate the discussion by asking questions and ensuring students are connecting learned concepts to prior knowledge.

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*“MDC is a lifestyle for the classroom that I wish had been introduced to me at the beginning of my career, and I also wish that MDC was a guiding thought for curriculum development. As I see it, moving forward, MDC has a significant chance of altering the way mathematics curriculum is developed and deployed.”*

Charles K., Nash-Rocky Mount Schools, North Carolina

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*“MDC professional development provided by SREB has been the best training I have received in my entire career as a teacher. As a teacher for 17 years, I have been through many training sessions on various topics and teaching strategies. Most of them have been great; however, MDC training sessions have far surpassed anything else that I attended.”*

Laurie D., East Orange School District, New Jersey

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*“MDC has also helped me do a more thoughtfully planned unit with more meaningful mathematical tasks. I now try to select my unit activities based more on cognitive demand, rather than for drill and practice.”*

Amy B., Pike County School System, Alabama

- Exercise – Students practice learned mathematical concepts and strategies to develop computational and procedural fluency.
- Evaluate Understanding – Teachers formatively assess student understanding. The assessment can be either informal (e.g., teacher observation of work or student oral explanations of work) or formal (e.g., a challenging mathematical assignment).

The planning stage requires teachers to establish mathematical goals to focus student learning. These goals describe the mathematical concepts, ideas or methods students will understand more deeply, and identify the mathematical practices students are learning to use more proficiently.

Each unit and lesson begins with an exploration activity that requires students to consider how multiple skills, concepts and procedures must be used together to complete a math assignment. The math assignment could be nonroutine, abstract or real-world, but it should advance students’ mathematical understanding, reasoning and application.

MDC teachers utilize a balanced approach to mathematics to ensure students develop factual knowledge, procedural fluency, conceptual understanding and the ability to apply learned skills to real-world contexts and nonroutine situations. This balance is evident in each lesson, which may take multiple days to complete.

When instruction, assignments and assessments align, teachers and students can articulate the mathematical goals of the lesson within the unit progression and can link the learning to previous instruction. Students can examine and/or use multiple strategies to solve a given problem, critique different strategies and apply the most efficient strategy to their work.

### **Engaging Students in Assignments That Matter**

MDC teachers utilize assignments that include purposefully selected nonroutine, real-world and abstract problems that advance students’ mathematical understanding, reasoning and application. Quality assignments ensure students are engaged in critical thought and problem solving using multiple solution paths.

These assignments encourage students to assume ownership of their learning, while teachers provide the appropriate supports. Teachers facilitate students’ learning with thought-provoking feedback and questioning, not by giving them



step-by-step instructions for completing assignments. Students build shared reasoning and understanding of mathematical concepts through peer discussion.

### Utilizing Questioning and Feedback for Deeper Understanding

MDC teachers develop and utilize higher-order questions that elicit evidence of students' progress toward learning and provide formative feedback resulting in improved student performance. Teachers ask targeted questions that require students to analyze, synthesize and predict, thereby deepening students' understanding. Activities are designed to promote student engagement, and questions are formulated to elicit responses from students.

When higher-order questions are asked or formative feedback is given, students are provided appropriate time to process and engage in productive struggle. Feedback emphasizes a change in conceptual understanding and encourages students to ask questions about their reasoning to better understand multiple solution paths. Teacher questioning promotes productive struggle and teaches students to persist through challenging assignments that require reasoning and problem solving.

### Using Formative Assessment Data

Essential tools of the MDC framework are formative assessment lessons (FALs). The FALs were developed by the Shell Centre in the United Kingdom, with funding from the Bill & Melinda Gates Foundation. The lessons underwent numerous evaluations to ensure alignment with state college- and career-readiness standards; they are intended to be versatile enough to insert into any mathematics course in grades six through 11.

There are two types of FALs: concept development and problem solving. Concept-development lessons focus on critical grade-level mathematics standards, while problem-solving lessons support students in applying mathematical understanding to unstructured, nonroutine problems so they can develop and refine their solution paths. Concept-development lessons are intended to support students in building deeper connected understandings. Problem-solving lessons are designed to support students in applying mathematical understanding to nonroutine problems. Problem-solving lessons differ from concept-development lessons in that all the work in a problem-solving lesson is focused on a single complex problem situation.

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*“In addition to allowing more time for productive struggle, I also give more feedback on tests by asking my students good questions. Students are beginning to understand mathematics at a deeper level.”*

John F., Wagoner Public Schools, Oklahoma

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*“MDC has made me a better teacher because I am able to predict where my students will struggle. They are gaining confidence in math, which is needed for success. As educators, we need to prepare our lessons thinking like our students. This is the best way to reach them and set them up for success.”*

Joel C., Stanly County Schools, North Carolina

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*“Our MDC teachers have seen firsthand what student-centered, aligned and rigorous math lessons look like. They've implemented the strategies alongside our local trainers, and we continue to see an increase in quality instruction and mathematical discourse in these classrooms. Students are engaged and focused on reason-making instead of answer-getting.”*

Carolyn S., Gaston County Schools, North Carolina

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*“MDC impacts my daily instruction by giving me a perspective of utilizing rigorous nontraditional assessments to engage students with mathematics. This allows for students to think outside of the box to come up with new (their own) methods of solving mathematical problems.”*

David F., Pike County School System, Alabama

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*“MDC not only allows my students to own their own learning, but it also provides me the opportunity to be a bit more hands-off as well. Through the FALs [formative assessment lessons] and tasks, students have an opportunity to explore and engage in the material without much teacher direction. I find it difficult sometimes to not lead students in a certain direction, but I notice more learning occurs when I do not lead my students to the answer.”*

Sydney B., Richmond County School System, Georgia

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*“The use of formative assessment data helps me adapt and adjust my instruction after administering a FAL. It helps me reflect on the strategies I used and how well the students understood the content. The FALs help me analyze the depth of students’ understanding of the content.”*

Vanessa W., Richmond County Schools, Georgia

In problem-solving lessons, the focus is on the construction, evaluation, comparison and refinement of the strategies used to approach the problem.

The FALs help teachers access and support their students’ emerging conceptual understanding and engagement with mathematical concepts, all the while supporting teachers’ use of effective formative assessment practices. The lessons are available for download at <http://www.map.mathshell.org/>.

MDC teachers use data from formative assessments to address student misconceptions and inform and adapt instruction to target students’ immediate learning needs. When teachers use MDC practices, they analyze student work and consider what obstacles, misconceptions and learning gaps (OMGs) students have and use this information to adjust future instruction. Using this data, teachers create a plan to re-engage students in a new assignment to aid them in learning key mathematical concepts.

Student misconceptions inform lesson plans and student learning activities, both for the immediate future as well as long term. Adjustments are personalized to students. Teachers purposefully pose problems that identify the existence of misconceptions and guide students in the exploration of those misconceptions.

### **Fostering a Classroom Environment That Supports Student Ownership of Learning**

MDC teachers create supportive classroom environments that encourage students to take ownership of their learning. Such environments strengthen students’ development of agency (the capacity and willingness to engage mathematically) and authority (recognition for being mathematically solid). Students have numerous opportunities to collaboratively share their learning and celebrate growth with their peers. Teachers provide opportunities for students to share ideas, justify approaches, critique others’ reasoning and provide meaningful feedback in nonthreatening ways that encourage deep thought.

### **Reflective Teaching Practice**

Teachers who participate in SREB professional development realize that reflective practice is built around a mindset of continuous improvement. Teachers learn to continuously evaluate data from formative and summative assessments to reflect on the effectiveness of their lessons and make necessary adjustments to expand students’ factual knowledge, procedural fluency, conceptual understanding



and advance their abilities to apply that knowledge to real-world contexts.

Teachers collaborate with colleagues, reflecting on evidence of student learning. **They rethink how concepts were taught when students do not perform as well as anticipated on assessments and re-engage students in follow-up lessons that reinforce critical concepts and close the learning gap.** Lesson and unit plans are viewed as living documents and, therefore, are in a continual state of revision.

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*“During the implementation of the FAL, students work hard to complete the activity and express their ideas using mathematical language. MDC taught me how to ask questions that encourage higher-order answers, and the students know this. They anticipate the question I will ask them and stop to think of the best way to answer it. They also like to see if they can ‘prove’ another student wrong on some of the more challenging problems. They spend more time working through the assignment so they can defend their answer, if asked to do so.”*

Christy S., Richland School District 2, South Carolina

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*“Formative assessment strategies help us structure our lessons in such a way that we begin with the end in mind and know exactly what we want our students to know, and how we want them to express their knowledge as well. Students are more comfortable with sharing their various methods of solving problems, organizing information and expressing their thoughts because of the ‘no judgment zone’ that the formative assessment strategies create for them.”*

Jaime M., Logan County School District, West Virginia

# The Impact of the Mathematics Design Collaborative on Teacher Behaviors

This section presents data from recent SREB teacher and student surveys. These surveys were administered to capture the experiences of teachers who have implemented the MDC framework and students who have received instruction using SREB’s powerful mathematics practices. The results from these surveys are analyzed and discussed in detail.

SREB regularly administered surveys to both teachers and students over the past two years to capture their experiences with MDC. Feedback from these surveys helps evaluate the successes and challenges of the initiative and improves implementation over time.

In spring 2017, SREB administered a survey to teachers completing their second year of MDC professional development with SREB. The survey asked teachers to

report on instructional practices they commonly use in their classrooms, the student behaviors they observe post-implementation and the supports they receive to facilitate implementation and professional growth.

Approximately 230 teachers across three states completed the survey. The majority reported that MDC professional development benefits them as practitioners and improves their pedagogy from a procedural focus to greater emphasis on student conceptual understanding. Furthermore, most teachers believe the powerful mathematics practices they are learning to implement help their students learn the mathematical concepts required by their state standards. Tables 1 and 2 show how teachers responded to individual survey items.

**Table 1**

## Teachers’ Perceived Benefits of Using the Mathematics Design Collaborative to Improve Instruction

	AGREE	NEUTRAL	DISAGREE
...helped me address rigorous standards.	97%	2%	1%
...made my mathematics instruction more engaging for students.	95	4	1
...encouraged me to adjust my pedagogy from a focus on procedures to a focus on conceptual understanding.	96	3	1
...helped me differentiate my instruction.	93	5	2
...helped me learn strategies to re-engage my students after formative assessment.	90	8	2
...helped me adjust my instruction to meet the learning needs of individual students.	94	4	2
...helped me know when to use formative assessment lessons in my curriculum.	97	3	<1

Source: SREB Spring 2017 MDC Teacher Survey

**Table 2**

## Teachers’ Perceived Benefits of Using the Mathematics Design Collaborative to Improve Student Learning

	AGREE	NEUTRAL	DISAGREE
...helped general education students.	92%	6%	2%
...helped students with mathematical disabilities.	64	21	15
...helped students classified as English Language Learners.	48	40	12
...helped students who tend to be disengaged.	81	11	8
...helped students who tend to be disruptive.	75	16	9
...helped students classified as gifted.	92	7	1

Source: SREB Spring 2017 MDC Teacher Survey

The survey consists of 11 categories, all of which demonstrate acceptable reliability with Cronbach alphas of .70 or higher. This means the categories were reliable measures of teachers' experiences with MDC. Table 3 shows the individual scales from that survey and their correlations.

Results indicate that when teachers believe MDC benefits their instruction, they are more likely to believe MDC is beneficial to student outcomes, which could influence long-term teacher use of the framework. Additionally, teachers' belief in the framework influences their perceptions of whether the tool is helpful in aligning their curriculum with state college- and career-readiness standards.

Teachers who reported using MDC-aligned instructional practices in their classrooms (e.g., using multistep problems, making connections to prior knowledge, productive struggle, etc.) were more likely to have classroom environments that promote student-centered learning.

Moreover, if teachers reported that their students engage in discourse and reflection, they were more likely to have seen their students take ownership of their learning and be more active learners.

Teachers reported that SREB trainers have a direct influence on the support provided by local math trainers, meaning local math trainers are more effective when they have support from another trusted provider such as an SREB trainer. More importantly, teachers with principals who encouraged use of MDC, attended MDC trainings and provided implementation support were more likely to be in schools where MDC has spread to all or most of the math teachers in the building. According to the teachers responding to the survey, principals are key in spreading MDC to all math teachers in their buildings.

**Table 3**  
**Categories and Correlations of the SREB MDC Teacher Survey**

	FALS BENEFIT TEACHERS $\alpha = .84$	TEACHERS' USE OF MDC PRACTICES $\alpha = .72$	STUDENT DISCOURSE & REFLECTION $\alpha = .75$	FALS BENEFIT STUDENTS $\alpha = .80$	STUDENT- CENTERED CLASS- ROOMS $\alpha = .75$	STUDENT OWNERSHIP $\alpha = .75$	CURRICULUM AND STANDARDS ALIGNMENT $\alpha = .86$	SREB SUPPORT $\alpha = .70$	Local Trainer Support $\alpha = .70$	PRINCIPAL SUPPORT $\alpha = .82$	MDC SPREAD $\alpha = .72$
FALs Benefit Teachers	-										
Teachers' use of MDC Practices	.26**	-									
Student Discourse and Reflection	.16*	.31**	-								
FALs Benefit Students	.42**	.15*	.24**	-							
Student-Centered Classrooms	.21**	.38**	.22**	.25**	-						
Student Ownership	.20**	.23**	.61**	.34**	.24**	-					
Curriculum and Standards Alignment	.53**	.14*	.16*	.30**	.15*	.19*	-				
SREB Support	.21**	.18**	.09	.23**	.16*	.14*	.19**	-			
Local Trainer Support	.22**	.22**	.10	.15*	.05	.09	.11	.53**	-		
Principal Support	.15*	.18*	.13	.17*	.12	.10	.02	.23**	.31**	-	
MDC Spread	.19**	.08	.13*	.13*	.05	.21**	.17*	.25**	.30**	.38**	-

Note. \* = Correlation is significant at the .05 level. \*\* = Correlation is significant at the .01 level. Numbers shaded in blue indicate strong, positive relationships between categories.

# The Impact of Mathematics Professional Development on Students' Reported Classroom Experiences

SREB also administered a student survey to assess students' experiences with MDC and the specific activities and assignments they engaged in during the 2016-17 academic year. The survey contained the following scales: Balanced Approach to Mathematics Instruction ( $\alpha = .87$ ), Assignments that Matter ( $\alpha = .80$ ), Utilizing Questioning and Feedback for Deeper Understanding ( $\alpha = .92$ ), Using Formative Assessment Data ( $\alpha = .81$ ) and Fostering a Classroom Environment that Supports Student Ownership of Learning ( $\alpha = .86$ ). Student responses were analyzed using a five-point response scale (1 = Never, 2 = Sometimes, 3 = Often, 4 = Almost Always, 5 = Always).

The survey was administered to students in classrooms where teachers used the MDC framework (MDC classrooms) and in classrooms where teachers did not (non-MDC classrooms) — approximately 11,300 students in all — so that comparisons could be made between the instructional practices used in MDC and non-MDC classrooms. **Results showed that teachers who received SREB MDC training, overall, were more effective in helping their students build conceptual knowledge of math strategies and apply that knowledge to solve real-world problems.** (See Table 4.) Furthermore, MDC teachers were more likely to have student-centered classrooms and their students were engaging in activities that promote student ownership more often than students in non-MDC classrooms.



**Table 4**  
**Mean Category Scores of MDC and Non-MDC Classrooms**

CATEGORIES	MDC CLASSROOMS MEANS	NON-MDC CLASSROOMS MEANS
Balanced Approach to Math Instruction	3.65**	3.57
Assignments That Matter	3.61**	3.52
Utilizing Questioning and Feedback for Deeper Understanding	3.80**	3.71
Using Formative Assessment Data	3.28*	3.22
Student Ownership of Learning	3.84**	3.76

Source: SREB MDC Student Survey 2017

Note. \*\* = Mean difference is significant at the .01 level; \* = Mean difference is significant at the .05 level.

Results also showed that the MDC framework is effective with math teachers of all course levels, as students in college-preparatory and basic math courses who were exposed to the instructional practices aligned to MDC rated their teachers significantly higher on all scales than did non-MDC teachers. **In fact, teachers of basic math courses received the highest ratings, signaling that MDC can be used to enhance learning experiences for struggling math learners.** This finding is of particular importance, as basic math courses are traditionally designed to focus on procedural repetition, with a heavy emphasis on worksheets that mimic common questions found on standardized assessments.

Lastly, students of teachers who had been through three years of MDC training reported that their teachers were using MDC instructional practices more often than

teachers with one or two years of training. (See Table 5.) **This provides evidence for the notion that teachers will need three or more years of MDC training before they can truly master the framework.** Although data from the survey show that teachers who implement MDC with fidelity make instructional improvements throughout training Years 1 and 2, it is not until Year 3 that they begin to make profound instructional shifts.

Districts are often seeking quick solutions to improving mathematics instruction; **yet data suggests that drive-by professional development will not result in the type of mathematics instruction found in classrooms where teachers have received SREB professional development.**

**Table 5**  
**Mean Category Scores for Non-MDC Teachers and MDC Teachers by Years of Training**

CATEGORIES	NON-MDC TEACHERS	FIRST YEAR MDC TEACHERS	SECOND YEAR MDC TEACHERS	THIRD YEAR MDC TEACHERS
Balanced Approach to Math Instruction	3.57	3.63**	3.67**	3.79**
Assignments That Matter	3.51	3.58**	3.65**	3.82**
Utilizing Questioning and Feedback for Deeper Understanding	3.70	3.77**	3.81**	4.00**
Adapting Teaching and Learning	3.23	3.25	3.29**	3.51**
Student Ownership of Learning	3.76	3.81**	3.87**	4.09**

Source: SREB MDC Student Survey 2017

Note. \*\* = Mean difference between non-MDC-trained teachers and SREB MDC-trained teachers is significant at the .01 level.

# The Impact of the Mathematics Design Collaborative on Student Achievement

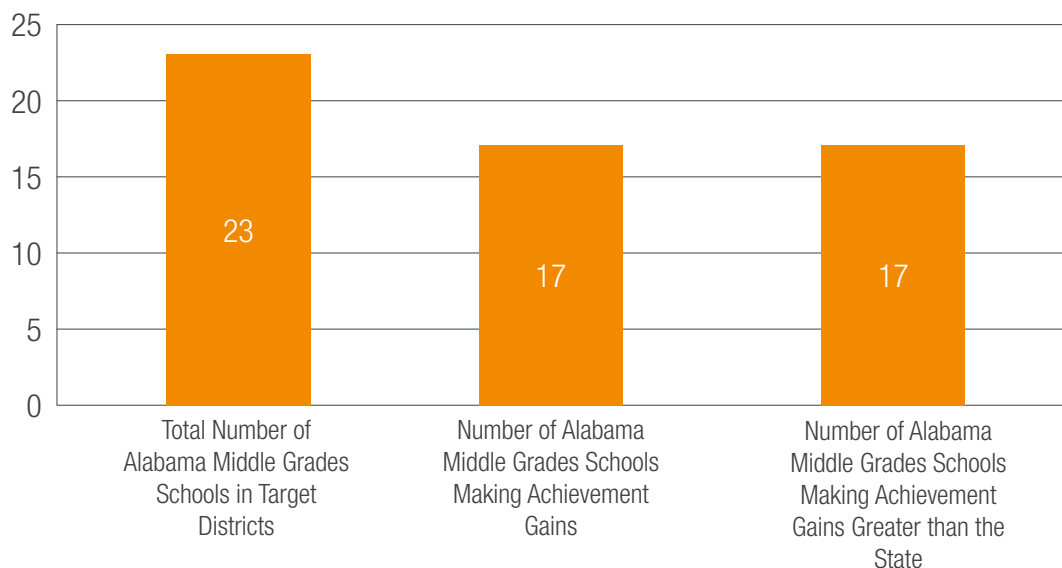
Student achievement data were collected from districts in four states – Alabama, Louisiana, North Carolina and West Virginia – that used the MDC framework in their mathematics classrooms. These schools began implementing MDC during the 2014-15 academic year, and have received ongoing implementation support through SREB. These schools have been identified by SREB as “high-fidelity” schools, meaning teachers are following all implementation requirements. Results show positive trends in student achievement based on each state’s administration of annual standardized math assessments. The data are presented by state and district, in alphabetical order.

## Alabama

In Alabama, student test results from the ACT Aspire mathematics assessment were collected to assess gains. This assessment is designed to assess grade-level college- and career-readiness in mathematics and is administered annually in grades three through eight. Data were collected from schools in five separate districts where MDC had been implemented with fidelity. All schools had implemented MDC during the 2015 and 2016 academic years. In all, data were collected from 17 middle grades schools — all of which

showed gains from the 2015 to 2016 academic years. Eleven of these schools saw more growth in the percentages of students meeting grade-level college- and career-readiness math standards from the 2015 to 2016 academic years than did the state as a whole. See Appendix A for achievement data results for each individual district. Figure 1 displays aggregated data from the Alabama districts from which achievement data were collected.

**Figure 1**  
**Analysis of Alabama MDC Middle Grades Schools**





## Louisiana

In Louisiana, state end-of-course Algebra I data were collected from the Ouachita Parish school district. Of the 14 middle grades schools in the district, four made improvements in the percentage of students meeting college- and career-readiness standards from the 2016 to

2017 academic years, five maintained their status and only two schools experienced declines. Two schools made gains that were greater than the gain made by the state. Results are displayed in Table 6.

**Table 6**  
**End-of-Course Algebra I Results for the Ouachita Parish School District in Louisiana**

SCHOOLS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER-READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER-READINESS STANDARDS
Louisiana Statewide	58%	62%
Calhoun Middle School*	96	≥99
Good Hope Middle School	≥99	≥99
Ouachita Junior High School	≥99	≥99
Ouachita Parish High School**	55	61
Richwood High School**	21	32
Sterlington Middle School	≥99	≥99
West Ouachita High School*	60	63
West Ridge Middle School	≥99	≥99
Woodlawn Middle School	≥99	≥99

Source: Louisiana Department of Public Instruction

Note. \* = The school experienced a gain during the 2017 academic year.

Note. \*\* = The school experienced a gain during the 2017 academic year that was greater than the gain made by the state.

College and career readiness is commonly referred to as a student's ability to qualify for and succeed in credit-bearing college courses leading to baccalaureate degrees, associate degrees or certificates, or career pathway-oriented training programs without the need for remedial course work. However, states may use different criteria to define college and career readiness; therefore, for the purpose of this report, college- and career-readiness standards may vary by state and the summative assessment(s) administered in those states.

## North Carolina

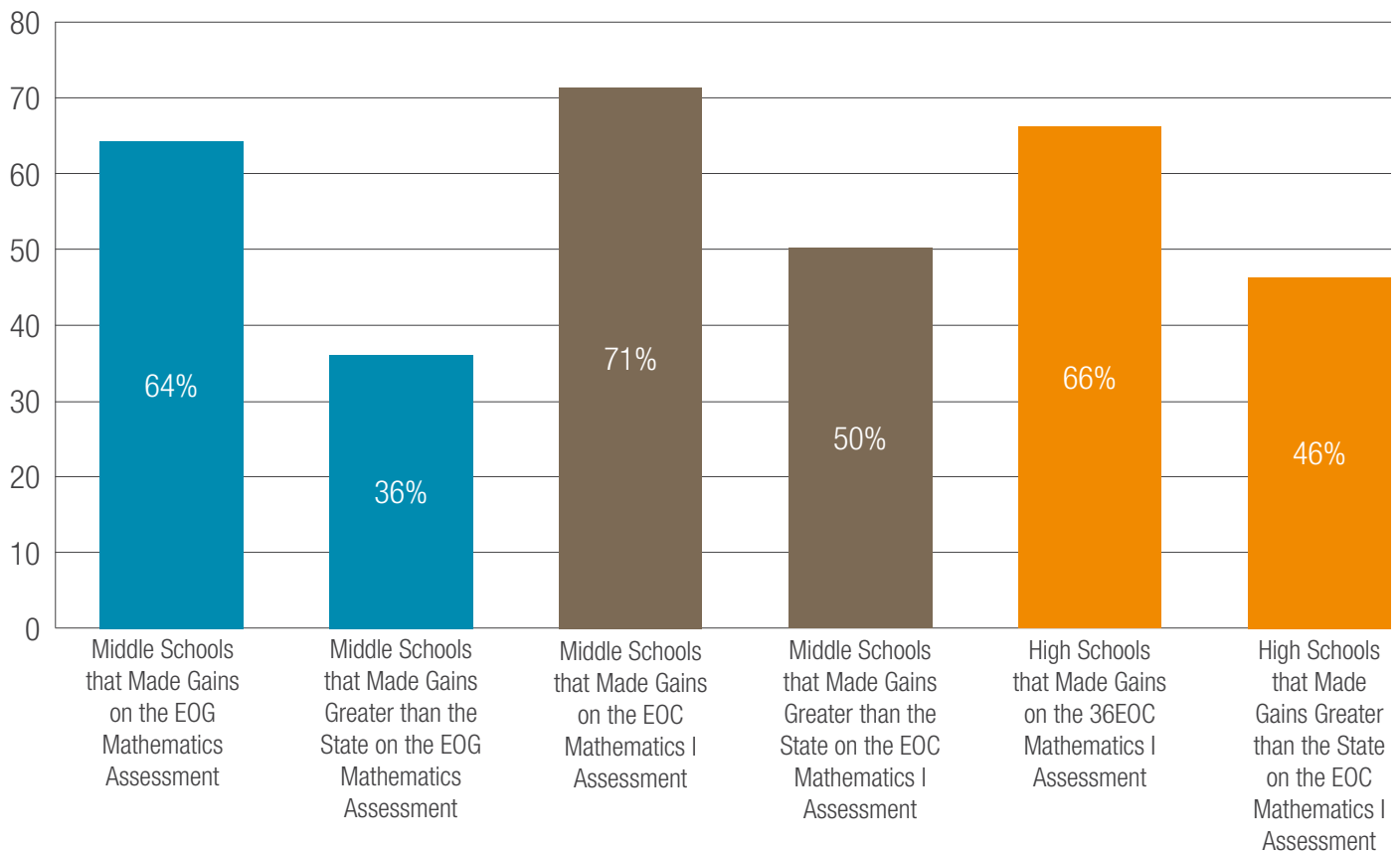
North Carolina had the largest number of schools to implement MDC with fidelity and receive support through SREB. Mathematics achievement data available in North Carolina included the state end-of-grade (EOG) mathematics assessment, which is administered in grades three through eight and is designed to assess students' grade-level college- and career-readiness in math, and the state end-of-course (EOC) mathematics I assessment, which is primarily administered in ninth grade but can also be administered to eighth-grade students.

**Data were collected from 230 North Carolina schools across 26 districts. EOG mathematics and EOC**

**mathematics I data were collected from 111 middle grades schools (grades six through eight). An additional seven middle grades schools had only EOG mathematics data. EOC Mathematics I data were collected from 112 high schools.**

**Of those 230 total schools, 180, or 78 percent, made gains.** See Appendix B for achievement data results for each individual district and school. Figure 2 displays an analysis of North Carolina middle grades and high schools that implemented MDC.

**Figure 2**  
**Achievement of North Carolina Middle Grades and High Schools Implementing MDC**



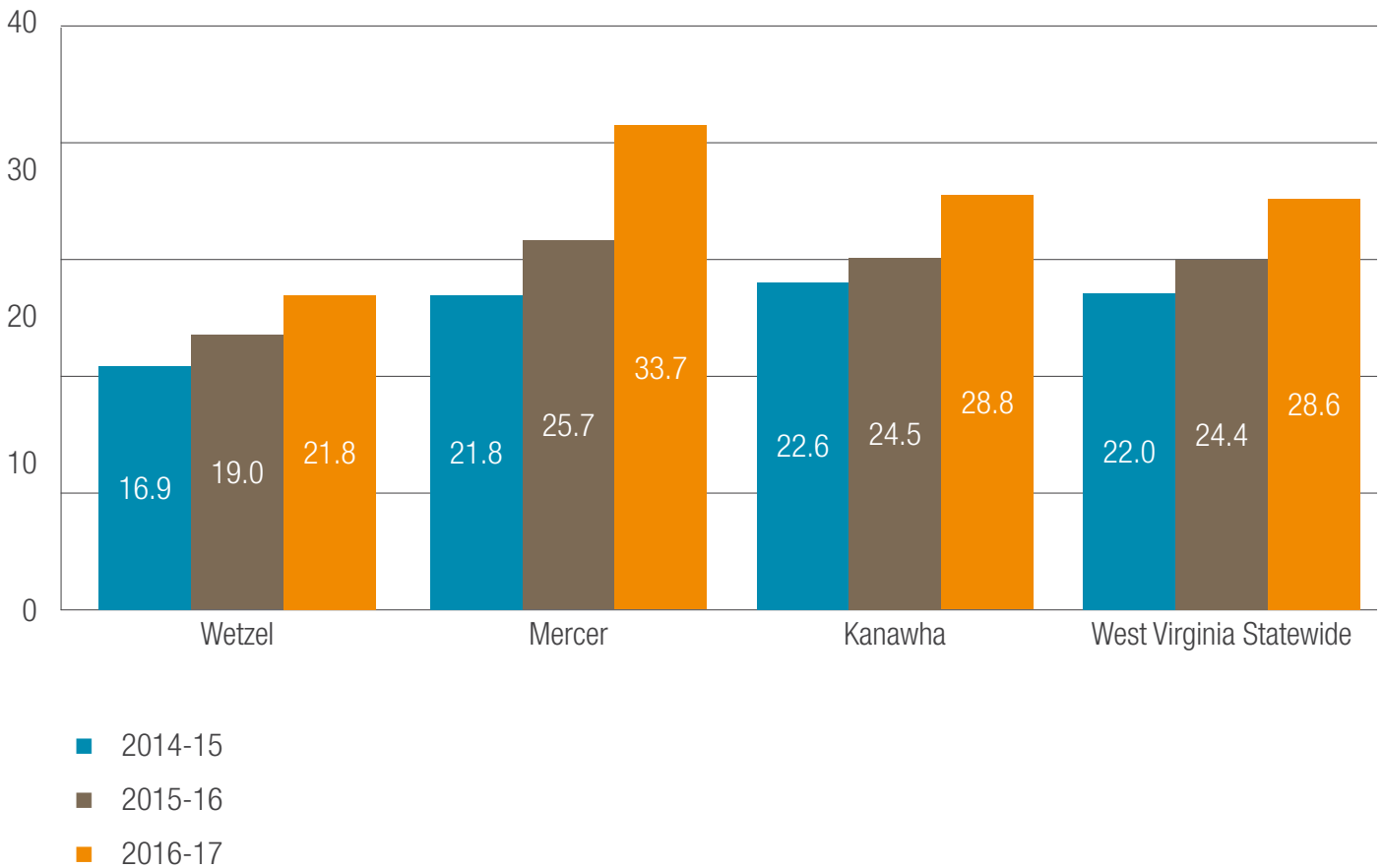
*Note. EOG = End-of-Grade; EOC = End-of-Course in 2017.*

## West Virginia

In West Virginia, state end-of-grade mathematics data were collected from three districts: Kanawha, Mercer and Wetzel counties. All three districts showed districtwide increases in the percentages of middle grades and high school students (grades six through 11) meeting college- and career-readiness standards over the last three academic years, with Mercer County outpacing the state's gains and Kanawha County matching the state's gains. Results are displayed in Figure 3.



**Figure 3**  
**Percentages of College- and Career-Ready Students as Measured by the West Virginia Summative Assessment for Mathematics**  
**Results reflect students with MDC-aligned instruction.**



# Vignettes of Success Stories

The stories and testimonials throughout this publication highlight the success stories of teachers, local trainers, and school and district leaders who are making the instructional shifts MDC brings about part of students' daily learning experiences. Students are learning to grapple with and persevere through challenging grade-level mathematics assignments, which result in deeper understanding of key mathematical concepts. SREB would like to thank the educators who shared their stories in the publication and who work hard every day to improve instruction for their students.

## Alabama

Blount County Schools  
Mobile County Public School System  
Pike County High School, Pike County Schools  
Riverchase Middle School, Pelham City School District

## Delaware

Postlethwait Middle School, Caesar Rodney School District

## Kentucky

Doss High School, Jefferson County Public Schools  
Olmsted Academy South, Jefferson County Public Schools

## Louisiana

West Monroe High School, Ouachita Parish School District

## Mississippi

Denman Junior High School, McComb School District  
Gary Road Intermediate School, Hinds County School District  
Mendenhall Junior High School, Simpson County School District  
Simmons Junior Senior High School, Hollandale School District

## North Carolina

Gravelly Hill Middle School, Orange County Schools  
Hobbton Middle School, Sampson County Schools  
Jacksonville Commons Middle School, Onslow County Schools  
Madison High School, Madison County Schools  
North Asheboro Middle School, Asheboro City Schools  
Stanly County Schools  
West Stanly High School, Stanly County Schools

## South Carolina

Carver Elementary School, Florence School District 1

## West Virginia

Riverside High School, Kanawha County School District  
New Martinsville School, Wetzel County School District

# Frequently Used Terms

## Mathematics Design Collaborative (MDC)

MDC is a framework to balance instruction so that students develop understanding of basic math concepts, fluency with math procedures and the reasoning to know how and when to apply math knowledge and skills to solve problems. MDC helps teachers understand and implement — by design and not by chance — the college- and career-readiness standards. Formative assessment lessons and the recommended lesson plan design are key MDC tools.

## Formative Assessment Lessons (FALs)

A major innovation in teaching and learning mathematics, these lessons show teachers what students understand and allow them to adjust teaching so students learn to reason with math and apply more concepts and skills to multi-step problems. FALs focus on student understanding of mathematical concepts; allow students to have successful productive struggle; help teachers determine what to change in content and instructional strategies so students can master the standards; and assess how students think with mathematics.

## Productive Struggle

MDC teachers select and develop assignments to engage students in productive struggle so they understand the hows and whys of math. Problems that encourage productive struggle require more than procedural fluency; they require students to use math reasoning to apply mathematical concepts to solve real-world and complex abstract problems. In MDC classrooms, students routinely grapple with such problems. Following the problem-solving process, MDC teachers require their students to explain and discuss their approaches to solving problems to reinforce deeper understanding of mathematical concepts.

## Obstacles, Misconceptions and Gaps in Learning (OMGs)

When MDC teachers analyze students' work, they consider what OMGs students have and then use this information to adjust future instruction.

1. **Obstacles** – A lack of understanding of which strategies, procedures or skills to apply and how those strategies work. Students do not know how to begin solving the problems, or which skills to apply.
2. **Misconceptions** – Students are unaware that the knowledge they have is incorrect. Misconceptions may originate from reliance on rules that are misunderstood, forgotten or only partly remembered.
3. **Gaps in Learning** – Lack of prerequisite knowledge. The teacher may be unaware that students lack the full understanding of previously learned concepts to advance to new topics.

## Powerful Mathematics Practices

The planning and instructional strategies taught through SREB professional development helps mathematics teachers shift their classroom focus from procedural skills and recall to solving abstract and real-world problems by deepening students' understanding of mathematical concepts. They include the following:

1. **Planning for and Ensuring a Balanced Approach to Mathematics**
2. **Engaging Students in Assignments That Matter**
3. **Utilizing Questioning and Feedback for Deeper Understanding**
4. **Using Formative Assessment Data**
5. **Fostering a Classroom Environment That Supports Student Ownership of Learning**
6. **Reflecting on Teaching Practice**

# Alabama

## Local Trainer Supports Middle Grades Teachers With MDC Strategies

**Meagan Holt**, a middle grades math curriculum coach for **Blount County Schools** in Alabama, is the Mathematics Design Collaborative local trainer for the county. She believes MDC is a catalyst for change in her district.

“I am witnessing a true shift in instructional practice for many of the teachers trained in MDC,” she says. “Students are engaged in mathematical discourse on a regular basis. Teachers are asking thoughtful questions that reveal student understanding of the content and using information gathered from pre- and post-lesson assessments, class discussions, student work samples and other formative assessments to elicit evidence of student learning and plan next steps for instruction.”

Holt sees a shift from teachers relying on the textbooks to having them locate and implement more rigorous mathematical tasks. “Students are given the opportunity to collaborate to deepen understanding and clarify reasoning,” she says.

### Building Capacity

“SREB professional development for MDC is different from other professional development because of ongoing support,” she explains. “SREB and certified local trainers meet with MDC teachers on a regular basis and provide support to teacher-leaders in each school. SREB trainers are a vital component in building capacity for local trainers and the teacher-leaders they work with.”

In her role as a local trainer, Holt meets with MDC-trained teachers on a regular basis to discuss the implementation of formative assessment lessons, student progress “and ways I can be of additional support,” she says. “I have co-facilitated lessons with teachers and provided written and oral feedback to encourage reflection, and I also create materials teachers need to implement FALs.”

Realizing that cutting up cards and running copies of the materials can be time consuming and expensive, Holt supports teachers new to MDC with ready-made materials for them to use when implementing FALs. This not only takes the stress out of doing prep work, but also allows teachers time to focus on the positive impact of the lessons.



Meagan Holt  
Blount County Schools

### Modeling Teaching

“MDC isn’t like most other programs; you are not given instructions and a login code and left to your own devices,” says **Principal Mike Stansberry** of **Susan Moore High School**. “We had actual trainers come out and work with the teachers.

“They were in the classrooms co-teaching, modeling, demonstrating and bringing manipulatives for the students and teachers,” he says. The teachers accepted the help, and things began to change for the better. “It didn’t take long before the comments from the students began to strike home. They said, ‘Class is fun now, we are learning stuff and we know what to do; I like coming in here [to class] now.’ Since the MDC program began in my school, I have seen a huge difference and am looking for positive results on test scores,” says Stansberry.

### Old-School Teachers Turn Cutting Edge

“I had several young teachers who learned from old-school teachers who loved to have desks in a row and everybody facing the front with the teacher talking and the students listening. This was how you determined if learning was going on, because the classroom was orderly and quiet,” Stansberry says.

“Well, since my teachers started working with SREB trainers, my old-school teachers are cutting-edge teachers. Now I can walk into their rooms, and desks are all unorthodoxly

arranged. Students in six different groups are talking at once. The teacher is in the front, back, middle and all over the classroom, and the students are learning,” he continues.

Stansberry says the mathematics teachers in his schools are intentionally planning, and that is having an impact on the culture in the classrooms. “[The teachers] can tell you what they are doing, why they are doing it, how they are doing it and how it will help the students,” he says. “The teachers have smiles on their faces because they know they have finally reached their calling and are making a difference in students’ lives. Students are eager about getting to class because they get to learn, and they know why it is important.”

## Students Learn to Persevere

As Blount County teachers embrace the tools and strategies of MDC, their students are learning to persevere when the work becomes a challenge. “The most surprising aspect of this whole experience is the students,” says **Heather Milner**, a sixth-grade teacher at **Blountsville Elementary School**. “At first, I really worried about how my students would struggle with the lessons, because they are challenging, but they adapted. **Students learned to apply what they already know about a subject and see whether that information can be helpful. It shows my students not to be afraid to be wrong, and that what is important is they are persevering.**”

**Stoney Beavers**, assistant superintendent of curriculum and instruction, also sees changes in the students. “We see an increase of student engagement across the district. There is a lot more hands-on learning. Students are retaining more information,” he says.

“We have definitely seen an increase in test scores in classrooms where implementation has been strong,” Beavers continues. “Also, we see the impact filtering across into other discipline areas as other teachers see the possibilities and the need for increased rigor and engagement.”

## Becoming Stronger Instructional Leaders

Beavers believes MDC professional development impacts the principals who are actively engaged in the process with their teachers.

“Our principals are in classrooms more and are observing instruction,” he says. “They are becoming stronger instructional leaders because they know what to expect and what instruction should look like.”

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*“We have definitely seen an increase in test scores in classrooms where implementation has been strong.”*

**Stoney Beavers, Assistant Superintendent,  
Curriculum and Instruction**

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## The Results

The proof of MDC’s impact in the classroom can be seen in the success rates of the students in Blount County. During the 2015-16 school year, Holt focused on strengthening the seventh-grade math classes (sixth grade is included in the elementary program). These are the statistics she reports:

- **After one year of implementation, the percentage of students in Blount County Schools proficient in seventh-grade math grew by 12 percentage points per the ACT Aspire.**
- **In the 2016-17 school year, per Renaissance Place benchmark testing, student proficiency in one seventh-grade classroom using MDC strategies grew by 24 percent in the first semester alone.**

## Mobile County Schools Show Increase in Math Proficiency

The **Mobile County Public School System** (MCPSS) is the largest school system in Alabama with more than 56,000 students enrolled in 88 schools and magnet programs. SREB has worked with MCPSS for more than a decade to address teachers' professional development in all subject areas. In 2015, SREB and MCPSS partnered to provide **Mathematics Design Collaborative** training for teachers in all 18 middle grades schools and for all fifth-grade teachers to strategically improve student achievement in mathematics and deeply implement Alabama's new college- and career-readiness standards.

MCPSS set the goal for each middle grades math teacher and fifth-grade teacher to implement at least three formative assessment lessons (FALs) each semester (six per school year). During the 2015-16 school year, MCPSS math teachers in grades five through eight implemented more than 375 FALs.

### The Results

In the spring of 2015-16, MCPSS students took the statewide ACT Aspire exam, the state assessment that maps student progress from third grade through high school on a vertical scale anchored to the scoring system of the ACT.

- **Districtwide, there was a 7 percent increase in students performing at or above Proficient in mathematics**, as compared to 2014-15.
- Approximately 70 percent of the district's middle grades schools showed an increase in math proficiency in two or more grade levels.
- Five schools, including **Alba Middle School, Calloway-Smith Middle School, Lott Middle School, Mobile County Training School** and **Pillans Middle School**, increased student math proficiency at all grade levels.
- Although **statewide ACT Aspire scores in Alabama dropped for eighth-grade math, 12 of the 19 MCPSS middle grades schools posted a gain in eighth-grade mathematics** achievement.
- **Calloway-Smith Middle School** increased its number of students in seventh and eighth grades performing at or above proficiency by 24 percent and 45 percent, respectively.
- Double-digit gains in students performing at or above proficiency were also realized by **Causey Middle School** at seventh grade (14 percent), **Lott Middle School** at sixth grade (18 percent) and **Mobile County Training School** at sixth grade (20 percent).

### A Word From the Math Teachers

Since his initial work with SREB and MDC, **John Rice**, an eighth-grade math teacher at **Dunbar Creative Performing Arts Magnet Middle School**, has become a recognized district leader by providing professional learning opportunities for district teachers through a math/science grant at the University of South Alabama.

"The biggest change brought about by my involvement in MDC is in my day-to-day classroom instruction. In every lesson, I now have frequent checkpoints, and I am constantly seeking feedback and making changes in my instruction minute-to-minute," he says.

**Monica Cleveland**, a sixth-grade math teacher at **Mobile County Training School**, believes that having students work together is a key to the increase in student proficiency. "MDC emphasizes having students work together, and the FALs engage students and generate deep discussions about the math," she says. "When working in homogeneously grouped pairs, student partners must be accountable to each other. I constantly ask students if they agree with their partner."

SREB trainer **Paige Graiser** says Cleveland's success stems from requiring her students to talk about the math they were studying in all lessons — not just FALs. "I saw this when I visited her class on a day she was not implementing a FAL," says Graiser. "It takes a while for the sixth-graders to get accustomed to talking about math. They do not appear to discuss math in their feeder schools. She does a good job of framing her lessons. I have seen her lead off a lesson with an engaging video clip that provided context to the FAL she was implementing."



## The Importance of Planning

**Angela Hall**, a sixth-grade math teacher at **Calloway-Smith Middle School**, points to the planning that teachers must go through before each lesson. **“Through my experiences with MDC, I have found out how important instructional planning is,”** she says. **“Planning is the key to any good lesson.”**

Hall initially dreaded making changes in her classroom. **“The reality is that, yes, there is some additional work, some educational refreshing, but most importantly, there is a change in mindset.** I now act as a facilitator more and more. Yes, I am still a teacher first and foremost. I have learned to step back and allow my students to explore. Mistakes are made, but the learning that comes from those mistakes is mind-blowing,” she continues. “I witness my students take ownership not only for their mistakes, but for their learning,” she adds. “I now have to do a little more prep for the units so that I am comfortable and prepared for questions and or obstacles. As a facilitator, you must be prepared to hear answers in different formats, styles and levels. You must be ready for discourse. It is ok! It pulls out the building blocks of math, and if you as the facilitator are able to utilize their prior knowledge, not only will you work smarter, but so will your students.”

“Look, MDC and FALs are not a new method of doing the math, but a vehicle by which your students can become confident about how to approach most problems,” she says.

“I had to learn how to compute the data. Data drives instruction, but data without purpose is just a set of numbers — useless numbers,” she adds. “I can now compute, better interpret and use the data to actually drive my instruction. **Stick with it, and the results will come. Don’t give up. Improvements will come.**”

*“I have learned to step back and allow my students to explore. Mistakes are made, but the learning that comes from those mistakes is mind-blowing.”*

Angela Hall  
Calloway-Smith Middle School



## Ahead for the District

Building upon MCPSS’ successful implementation of MDC in all of its middle grades schools, the district began implementing MDC in all 12 of its high schools and signature academies at the beginning of the 2016-17 school year. Stay tuned for more good news.

## Pike County Students Take Ownership of Their Learning

Students in **Melinda Defee's** eighth-grade algebra classes used to get frustrated when solving problems and pleaded with her, "Why don't you just tell me what to do?" Now, even though they still struggle sometimes, she says they enthusiastically plead "don't tell me, don't tell me" as they are working through challenging problems. **"They want to figure it out on their own,"** Defee says. **"They've taken ownership."** So, what brought about this change?

Defee, a veteran teacher of 22 years in **Pike County, Alabama**, describes her former approach to teaching this way: "I was kind of old school. I'd lecture a lot, do examples, give the kids some problems and say, 'Here practice this,' and we're done." She adds, "It was all about what I could teach them, and whether they could give me back what I had already told them."

In the fall of 2015, Defee began implementing the Mathematics Design Collaborative instructional practices in her eighth-grade algebra classes at **Pike County High School**. SREB MDC professional development helped transform her classroom into one that is more student-centered. With MDC, Defee notes, "There's no GPSing [telling students step by step how to solve a problem when they get stuck]. MDC principles greatly support student discourse — whole class and small group — such that I find myself almost always answering students' questions with questions of my own. **I realize that this is what I should have been doing all along, because they [students] always end up figuring it out in the end.**"

Students have learned to appreciate Defee's approach to questioning. Abigail, one of her students, says, "By asking further questions to prompt our thinking, Ms. Defee helps us to solve our problems without giving away the solution. This allows us to learn ourselves." Reginald feels the same way, saying, "They say Ms. Defee makes us figure things out without telling us the answer. It allows us to learn from each other and allows us to come up with our own way of thinking."

### Thriving in Homogenous Groups

One strategy that's made a difference is homogenous grouping, used for formative assessment lessons, a centerpiece of MDC. Students of like thinking are grouped. For example, Defee says students who are strong in certain topics or objectives work together, as do those who are weakest. As the lessons change, students are regrouped. She

### MDC DISTRICTWIDE

Teachers at Pike County High School and throughout the county were introduced to MDC strategies at SREB's High Schools That Work Staff Development Conference in Atlanta, Georgia, in the summer of 2015.

Administrators were so enthusiastic they enrolled teachers in SREB professional development sessions to learn about MDC tools and strategies, and they began using the strategies in fall of that year.

says the students learn a lot from bouncing ideas off each other. One student, Magnolia, says, "We may think alike, but in certain areas, my groupmates are smarter. I learn how to improve my weaknesses from them."

### Student-Written Explanations Provide Evidence of Understanding

Students do a lot of writing in Defee's class. Defee explains writing is a significant component of standardized math exams such as the ACT Aspire, so they practice it in class. "I'm surprised myself that I'm making them do so much reading and writing," she says. "I want them to tell me this is the answer and here's my evidence."

Defee uses students' written evidence as a formative assessment of their mathematical understanding and reasoning. "I can give you problems and see if you can give me answers all day, but I don't know if you understand that problem, or if you are making a good guess," she says. "If I ask you to write a paragraph explaining different things, I can easily tell which parts you know and which parts you don't know."

**This knowledge helps Defee adjust her instruction and re-engage students to bring about better understanding.** Defee notes this shift in instruction connects to the formative assessment lessons. "It's all about adapting every minute of every day. You know what to go back over. I know which students I can get to explain to others."

## Proof Is in the Data

In 2014-15, ACT Aspire data for Pike County High School revealed 10 percent of eighth-graders scored Proficient in mathematics. In 2015-16, 32 percent of eighth-graders scored Proficient in mathematics — all were Defee's students.

Defee began teaching eighth-grade math for the first time in 2015. She is the only eighth-grade math teacher in her school, and she uses MDC strategies in all her classes.



## Students Transition From “I Don’t Know” to “What if We Try...”

“The most important thing I learned since beginning MDC is the value of effective questioning,” says **Stacy Moseley**, an eighth-grade teacher in Pelham, Alabama. “Before MDC, my questions did not give learners a chance to engage in productive struggle. Now I get to see my students make connections and have ‘aha’ moments.”

Moseley has implemented at least six formative assessment lessons (FALs) with her students at **Riverchase Middle School** each year since she began her journey in January 2015. “The students really like the FALs. They have insightful conversations and debates about the math they are engaged in,” she says. **“I am most surprised by their persistence. The students have slowly transitioned from an ‘I don’t know’ mindset to a ‘what if we try...’ mindset.”**

The formative assessment strategies stressed in SREB workshops and modeled in the FALs are invaluable to Moseley, and she regularly incorporates these strategies into the lessons she creates. “I am continuously assessing my students so that I can provide feedback to move them forward. When I create lessons, I am always looking for questions I can ask that can assist them on individual levels,” she says.

“MDC has helped me become more focused on Alabama’s Standards for Mathematical Practice, which result in lessons that are more beneficial for the students,” she adds. “We discuss the math practice standards together so that everyone knows the expectations for each lesson and standard.”

### Students’ Scores Climb

Moseley attributes much of her students’ success on state assessments to MDC. Alabama administered the suite of assessments from ACT Aspire each spring to students in grades three through eight. Moseley’s students had a mean score gain of 3.2 in spring 2016, higher than the targeted gain of 2.5. **This difference of 0.7 is considered *significantly above the target gain*.**

At the same time, in a national comparison with all students with the same prior year percentile score, **31.6 percent of Moseley’s eighth-grade students were classified as having high growth. This percentage was also reported as significantly above target.**

### Dedicated Collaboration Time

**The Pelham City School District builds time into the school calendar for professional learning communities to meet and work as a team.**

Moseley works with her principal, **Susan Hyatt**, to plan times for the math department to meet. Hyatt is very supportive, frequently visiting Moseley’s classroom, interacting with the students. She also provides opportunities for Moseley to share MDC principles with parents. **“We will continue to grow and learn together as we spread MDC throughout our school,”** says Hyatt.

# Delaware

## Students Value Learning Over a Grade

“Formative assessment lessons allow students to engage in productive struggle and teachers to ask open-ended, thought-provoking questions,” says **Jen Simmons**, eighth-grade math teacher at **Postlethwait Middle School** in Dover, Delaware. Simmons and math support teacher **Sarah Potter** form a powerful team that is changing ideas about what mathematics instruction should look like in a middle grades school classroom.

Simmons feels that the formative assessment lessons, a key tool of the Mathematics Design Collaborative, guide math instruction in her classroom by identifying specific student misconceptions and strengths. “The formative process allows students to gain a deeper conceptual understanding of the math content,” she says.

### Making Shifts in Instruction

One shift evident in Simmons’ instruction involves her intentional use of mini-whiteboards. Before MDC, mini-whiteboards were only used as a quick check for understanding, but now Simmons uses them as an opportunity for students to interact with each other’s work. “Their work becomes a flow and a progression of ideas as the students build upon each other’s reasoning,” she says. “Students no longer feel locked in to what is written on their boards, but they are given time to revise their thinking based on classroom discussions. Students use each other as instructional resources.”

**Simmons sees a shift from students being recipients of instruction to students becoming owners of their own learning.** “Participation in SREB professional development in the Mathematics Design Collaborative also helps me shift the focus from assigning grades to providing students feedback that moves their thinking forward. **As a result, students value the learning instead of a grade that makes them believe learning is over,**” she says.

### Shifts Outside of Instructional Time

Shifts have occurred outside of Simmons’ and Potters’ instructional time as well. During the formative assessment lesson cycle, Simmons and Potter collaboratively analyze student work to identify student misconceptions and obstacles, which allows them to target instruction and



Jen Simmons  
Postlethwait Middle School



Sarah Potter  
Postlethwait Middle School

interventions. **They now spend time reflecting on their daily lessons and are leading the math department teachers to look more critically at each assignment they give students.**

“Mrs. Potter and Mrs. Simmons exemplify quality math instruction through strategic questioning and rich classroom discussion,” says **Derek Prillaman**, the principal of Postlethwait Middle School. “Their students are constantly encouraged to explain their thinking and defend their answers. Their inclusive, highly engaging instructional approach focuses on mathematical processes and ultimately, strengthens our students’ problem-solving skills.

**“Because of their leadership, the Mathematics Design Collaborative has started to spread throughout the department and now boasts five teachers implementing formative assessment lessons and the strategies they embody,”** Prillaman says.

### The Results

Table 7 shows the progression of student growth for Simmons’ and Potters’ students during two concept development FALs, which have a pre-lesson assessment and post-lesson assessment. These assessments are given within a day or two of each other and are separated by a collaborative activity designed to expose students’ misconceptions as well as increase their mathematical understanding. Students also

participate in a whole-class discussion in which they share ideas and give each other feedback.

The table below shows students' average end-of-unit summative assessment over the same content in the FAL. Simmons and Potter believe students' success on the summative assessment is attributable to their growth in mathematical understanding during the FAL.

**Table 7**  
**Student Performance on Unit Summative Assessment After Growth During FALs**

NAME OF FORMATIVE ASSESSMENT LESSON	PRE-LESSON ASSESSMENT AVERAGE SCORE	POST-LESSON ASSESSMENT AVERAGE SCORE	GROWTH FROM PRE TO POST ASSESSMENTS	UNIT SUMMATIVE ASSESSMENT AVERAGE SCORE
Increasing and Decreasing Quantities by a Percent	47	80	+33	87
Building and Solving Linear Equations	53	83	+30	94

At the time of this publication, state assessment data relative to Simmons' and Potters' first year implementing MDC was not available.

# Kentucky

## Movin' On Up Through MDC

**Doss High School** in southwestern Jefferson County in Louisville, Kentucky, is part of the largest school district in the state. The state has identified **Doss High**, a Title I school, as a persistently low-achieving school for many years. The Algebra II team embraced the tools and strategies outlined in the Mathematics Design Collaborative (MDC) instructional framework in the hopes of raising students' mathematics achievement.

With encouragement and support from their principal **Marty Pollio** and resource teacher **Jordan Paskitti**, the Doss High Algebra II teachers began full implementation of MDC in October 2015.

Working with SREB and local trainers, they learned the basics of MDC:

- Effective feedback and questioning
- Concept development versus problem-solving formative assessment lessons
- The role of tasks versus FALs
- Strategies for incorporating into lessons a balance of conceptual understanding, procedural fluency and application

Teachers participated in professional learning workshops and in-school coaching. The teachers found that the coaching sessions made implementing FALs less daunting. Mathematics trainer **Leslie Texas** provided on-the-spot feedback and modeling of best practices, and posed questions that helped guide the teachers and ultimately, their students.

Algebra II teacher **Scott Block** describes the in-class coaching. **“Ms. Texas has challenged me to think strategically about the questions I pose to my students. Specifically, she’s helped me develop my ability to prepare them and consider how my students will be thinking.”**

“My questions anticipate students’ misconceptions and help them think critically about what they are exploring. Strategic questioning allows me to push my students to prove their solutions are valid thorough justification and challenges them to extend their learning,” he says.



From left: Gerard Garrett, Katie Volz, Scott Block and Stacy Justus of Louisville, Kentucky's Doss High School math team.

As the teachers' comfort level using FALs rose, the students began showing signs of progression toward higher-level thinking. **Algebra II teacher Katie Volz says, “Since embracing the MDC strategies in general, I see students’ abilities and willingness to attempt to solve more rigorous problems increase.** Not only does the dedication to implementing the FALs allow me to analyze students’ gaps in conceptual understanding, but it also reveals unintended gaps in my instruction for any unit.

“The benefits for students are twofold,” she continues, “because the [MDC] strategies not only increase the rigor required of student thinking, but also the teacher’s thinking, which increases the rigor of my instruction. **Thus, the cycle of growth keeps turning.**”

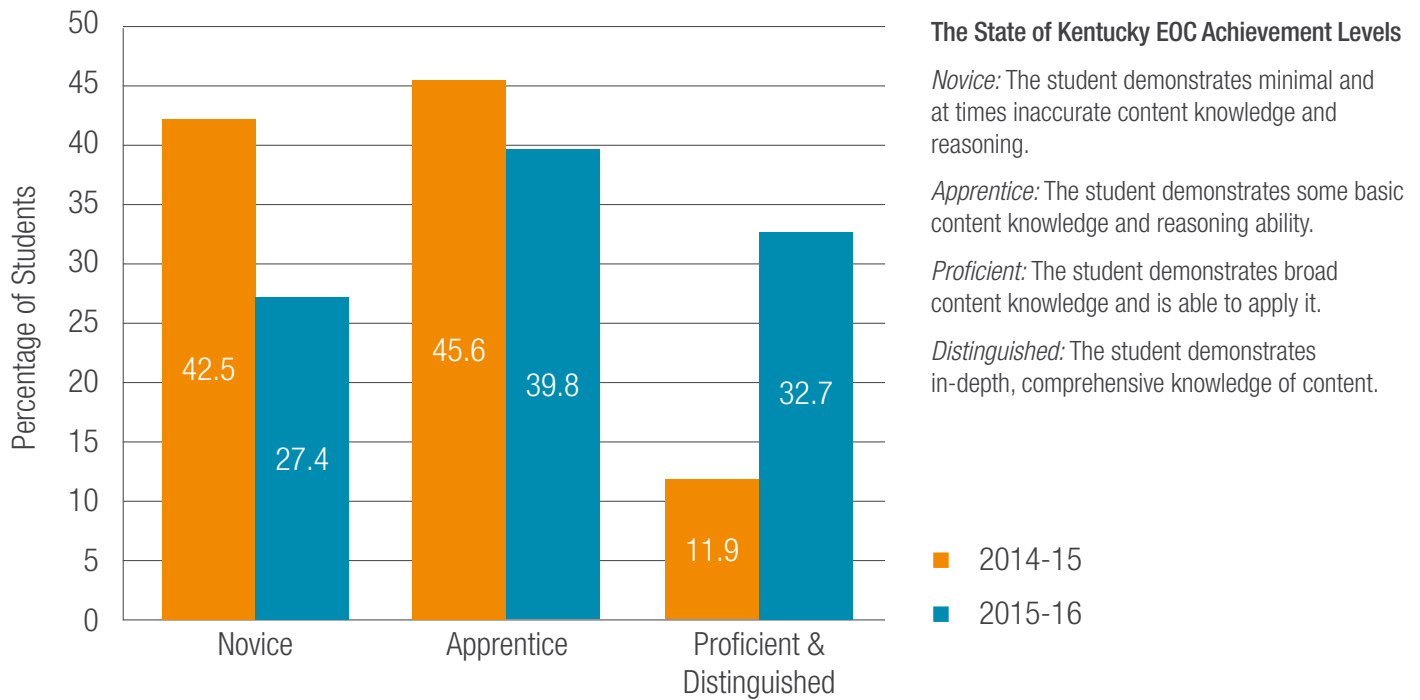
As the year progressed, the Algebra II teachers began to anticipate how well students would do on the state Algebra II end-of-course assessment. Principal Pollio expected gains, and he was correct. Figure 4 displays Doss High's Algebra II EOC scores for the 2014-15 school year and the 2015-16 school year.

The teachers are proud of the students, the gains they made and how they tackled the assessment with confidence.

One student told his teacher, “I killed that test, Ms. Justus! I knew most of it, but there were a few [places where] I had to mark out choices and just make my best guess. But I killed it.”

The students' confidence, along with the improved achievement, validates the teachers' decision that choosing MDC was the best path for their students.

**Figure 4**  
**Algebra II End-of-Course Assessment**



## Kentucky Teacher Puts MDC Tools to Work for Her Students

**Athraa Alabudy** believes that her students at **Olmsted Academy South** in Louisville, Kentucky, are worth whatever it takes to teach them. This can be seen in her approach to teaching, especially in how she puts the tools and strategies of the Mathematics Design Collaborative to work for them. During the three-year training program, she has been particularly impressed with MDC’s focus on productive struggle and the culture of high expectations. “Students get used to having teachers give them the answers; they get used to not doing anything,” she says.

The middle grades teacher credits MDC with the lack of disciplinary issues in her classes. “MDC has helped me build a positive environment,” she says. “The students feel safer and more secure with this. It’s not about who gets it wrong and who gets it right. It’s about working together. If we get it right, how do we improve it? What’s the next step?”

### High Expectations

Alabudy doesn’t waste time on math strategies that don’t benefit her students. She wants them to have a rich, conceptual understanding of mathematics. It’s important



**Athraa Alabudy,**  
**Olmsted Academy South**

that her students be actively engaged in the classroom and experience a rigorous learning environment.

“Two-thirds of the way through a unit, I implement a formative assessment lesson, after administering the pre-lesson assessment,” she says. “I then identify common misconceptions that are getting in the way of my students’ understanding. Students work in collaborative settings to combat common misconceptions, and I guide their thought processes through feedback as they work through their misunderstandings.”

## Tasks and Projects

After becoming comfortable implementing FALs with the different groups of students in her classes, Alabudy began incorporating tasks and projects into her daily lesson plans. She's a big fan of SREB professional development and the tools MDC offers, and now she can't imagine teaching without them. "They're part of my everyday lesson and teaching style," she says.

Unlike FALs, which can take up to three days to implement (with pre- and post-lesson assessments), tasks can be one-day assignments, rich in rigor that focus less on procedural fluency and more on student understanding. **"There are many rules in math, and you cannot keep up with them without building a good understanding about why we're doing this and what comes next,"** she says.

Projects are her favorite. "I love projects," she says. "We do them inside the classroom, outside the classroom and sometimes, after class. In each unit, I find a project where students have the chance to work together. If they struggle, they can come to me. I'm always available twice a week after school."

## All About the Students

A large part of Alabudy's success comes from knowing her students well. "I do everything upfront," she says, from placing groups together to knowing which questions to ask to further the conversation. "Some groups need very little; I can direct them to the resources. Other groups need a whole lot of organization – so I have a mailbox with their math notebooks, which include everything they need.

"It's not all on me. How can what we've done help? I train my kids from day one, it's all about you," she says. "I'll give you everything you need to be successful, but you have to find it yourself."

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*"There are many rules in math, and you cannot keep up with them without building a good understanding about why we're doing this and what comes next."*

Athraa Alabudy, seventh-grade math teacher  
Olmsted Academy South

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## Student Success

The Kentucky Performance Rating for Educational Progress (K-PREP) is administered each spring to Kentucky students in grades three through eight. **From spring 2015 to spring 2016, the percentage of students classified as Proficient or Distinguished on the K-PREP in Alabudy's sixth-grade math classes increased from 53 percent to 68 percent.**

Alabudy credits this growth to MDC tools and strategies and to her own ability to implement them in different ways for her different class levels. "If you take the time to do it right, have the proper resources to help and know your students, MDC works wonderfully," she adds. "All students can do it."



# Louisiana

## Teacher-Turned-Trainer Gets Attention

When students' math scores shot up in **Donna Patten's** class in the spring of 2015, it caught the attention of the school district leadership in Ouachita Parish, Louisiana. They wanted to know what the **West Monroe High School** (WMHS) teacher was doing that made such a dramatic difference in one year, and how other schools can model her success.

The longtime math teacher attributed students' achievement to the instructional strategies of the Mathematics Design Collaborative. In the summer of 2016, Patten was named the MDC local trainer for the district, helping to spread the researched-based strategies and tools to all math teachers in Ouachita Parish Schools.

Patten explains: "In 2015, when the failure rate for my algebra students dropped from 20 percent to 2 percent, and unsatisfactory end-of-course scores dropped from 8 percent to 1 percent, school and district leaders were interested in what caused such a significant improvement in student achievement. I attribute the success to my use of MDC powerful instructional practices."

It wasn't an anomaly. "In 2016, when similar data results were obtained (4 percent failure rate and zero percent unsatisfactory end-of-course scores), those same leaders were more than interested in MDC," she continues. "Like me, they were convinced that a definite cause/effect relationship existed between the use of MDC instructional methods and gains in student achievement." All WMHS math teachers now use MDC tools and strategies.

### National Recognition

As part of the competition for the Presidential Award for Excellence in Mathematics and Science Teaching (PAEMST), Patten submitted a video of one of her classes completing a formative assessment lesson. The award, given on behalf of the White House Office of Science and Technology Policy, is the highest honor the U.S. government bestows on K-12 mathematics and science teachers. It recognizes

model teachers who inspire their communities and lead the improvement of mathematics and science (including computer science).

When Patten was selected for the honor in 2016, "school and district leaders again recognized the tremendous impact of the training I received from SREB," she says.

SREB mathematics trainer **Gail Snider** worked with Patten on MDC and recommended her for the PAEMST. "I have observed her working with her students in the classroom as she motivated them to be their personal best and achieve their highest potential. Students appreciate her desire to help them become better learners of mathematics," Snider says. "She not only implements the MDC strategies with the highest level of fidelity, but she collaborates with and supports her team of teachers to do the same.

"Donna created a student-centered learning environment, where the students actually are in control of their own learning. The differentiated instruction and self-paced learning activities keep all students highly engaged ... the classroom climate is conducive to discussions where students are encouraged to share their reasoning without fear of failure," Snider says.

# Mississippi

## Athletic Coach Becomes Instructional Math Coach

**DeRandel Allen**, eighth-grade math teacher at **Denman Junior High School** in McComb, Mississippi, had experimented with the productive struggle method of teaching early in his career. A colleague told him he was too hard on the kids and this type of teaching was over their heads, so he shifted toward a more traditional style of teaching.

Allen knows a lot about motivating students. He's the school's assistant athletic director and assistant coach for track and football, as well as media director for football. So, when he was introduced to the Mathematics Design Collaborative, "I was excited to hear that productive struggle should be part of the math classroom," Allen says.

### Different Approaches to the Same Problem

After the first few training sessions, SREB mathematics trainer **Gail Snider** knew she had a very willing teacher in Allen. "I realized how coachable Coach Allen is," she says. "Everything we talked about in debriefs or training, he internalized it and made it better."

Snider says Allen focused on not GPSing his students, or telling them step by step how to solve a problem when they got stuck. He allowed students to use the approach they wanted. "This is when he actually got back to his earlier ways of teaching," Snider contends. Students' productive struggle was evident, and the results were amazing. There was so much conversation and discussion around all the different approaches to solving problems.

### Sharing and Supporting

After a successful first year using MDC strategies at Denman, the teachers in the McComb School District met over the summer, and with Allen's guidance, planned lessons for the following year. "My seventh-grade counterpart and I were already sharing and supporting the strategies with other math teachers," he says.

Allen developed a 55-minute MDC instructional model, which includes the MDC guiding principles and strategies to organize a daily 55-minute lesson by engineering effective discussions, pairing students to construct viable arguments, using formative assessment to assess student



DeRandel Allen  
Denman Junior High School

understandings, and structuring class time and activities to ensure MDC is not an "event" only done on certain days during a FAL. **"Our goal is to make MDC the way we teach every day, not just with one class, but with all our classes,"** Allen says.

Now an instructional math coach, Allen assumed responsibility for MDC training at the school by modeling and supporting lessons for math teachers. **He set up professional learning communities that meet monthly. His math team meets every Tuesday and Thursday, and MDC is a part of everything they do.**

Principal **James Brown** supported Allen and his math team from the beginning. He attended initial trainings and understood the challenges facing Allen and his seventh-grade counterpart as they set about changing the culture in their classrooms.

Brown supports the math team by regularly attending the monthly PLC meetings and providing any supplies teachers need.

The middle grades school meets with the high school team and analyzes the success of individual students who go through MDC in eighth grade and move into the MDC-trained teacher's class at the high school.

### Rising Scores

Scores are up, and students are growing in their math achievement at Denman Junior High. Leadership attributes this to the hard-working teachers using what they have learned through the partnership with SREB and MDC training.

As Allen and the other teachers became more comfortable with MDC, student achievement began to rise. Tables 8 and 9 show the average percentage correct on schoolwide benchmark assessments taken by all seventh- and eighth-grade students at Denham Junior High. During the second year of MDC implementation (2016-17), students outperformed their grade-level peers from the first year of MDC (2015-16).

**Table 8**  
**Denman Junior High Seventh-Grade**  
**Benchmark Assessment Average Scores**

	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER
2015-16	36	27	40
2016-17	50	43	44
Growth	+14	+16	+4

**Table 9**  
**Denman Junior High Eighth-Grade**  
**Benchmark Assessment Average Scores**

	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER
2015-16	27	31	37
2016-17	35	38	40
Growth	+8	+7	+3

Though the assessment scores are not quite as high as the teachers and administrators at Denham Junior High would like, they are excited to see that students are making progress. “It takes dedication and commitment. You will get a return on your investment; just trust that results are coming,” says MDC local trainer **Alex Hewitt**.

Allen adds, “Don’t be afraid to fall, but if you fall, get back up ... it doesn’t happen overnight, but if the end results are there, the kids will become independent, self-sufficient thinkers.”

**“THINK, RETHINK” RE-ENGAGEMENT STRATEGY**

Allen sometimes uses the “Think, Rethink” strategy after a FAL to re-engage students with the content. In this strategy, students “think” about the FAL they just attempted and reflect upon what problems or pitfalls they might have had. After discussing their self-reflection with a partner or teacher, students are asked to “rethink” the lesson, taking this feedback into consideration.

Students again reflect upon the mathematics, trying to make sense of it. “This strategy helps to ease students’ tension and encourages them to attack situations that at first seem out of reach,” Allen says.

## Hinds County Commits to MDC

The MDC story for **Hinds County School District** in Mississippi is one of persistence. The district is primarily African-American, and more than three-quarters of its 6,300 students receive free- or reduced-price lunch. The district began its partnership with SREB around the Mathematics Design Collaborative (MDC) in 2011. Despite changes in testing methods and high turnover of mathematics staff, student achievement is on the rise. “For the past six years, MDC has guided everything we do in mathematics,” says Superintendent **Delescia Martin**.

“From pacing to instruction to assessment, MDC allows our teachers to become facilitators, while our students begin to take ownership of their own learning,” she says. “Teachers now understand that productive struggle leads students to persevere in problem solving, which ultimately leads to increased student success.”

### Understanding Student Misconceptions

**Ashley White**, assistant principal at **Gary Road Intermediate School**, supervises the math planning at her school. She sees great value in the tools and strategies of MDC. “The formative assessment strategies have provided our teachers with a clearer understanding of their students’ misconceptions in learning as well as their ‘aha’ moments,” she says.

“The students enjoy working together to complete the activities and are able to feel a sense of accomplishment once they have completed the activities correctly. The students are always excited when their teachers mention they will be completing a FAL,” White continues.

Classrooms across the district have become student-centered as teachers discontinue GPSing, or telling students how to solve a problem step by step when they get stuck. The level of rigor has increased as teachers realize the power of collaboration. Due to the success of the middle grades and high school students during the 2015-16 school year, Martin decided to include third- through fifth-grade teachers in elementary MDC training.

**Angela Gray**, a fifth-grade teacher at Gary Road Intermediate School, is excited about using the formative assessment strategies and tasks she learned during MDC workshops on a regular basis. “MDC helps me understand how to implement our Mississippi standards and how I can best teach them with rigor so that students are able to answer assessment questions correctly,” says Gray. “I have

*“From pacing to instruction to assessment, MDC allows our teachers to become facilitators, while our students begin to take ownership of their own learning.”*

Delescia Martin, Superintendent  
Hinds County School District

some great resources, such as re-engagement plans for objectives that need to be revisited due to low scores for that particular objective.

“The most important thing I have learned is the importance of implementing FALs as a means to measure students’ conceptual understanding and allowing a productive struggle before stepping in to assist,” she says.

### Sharing and Planning

To increase the quality of teacher collaboration as well as to address teacher turnover issues, Martin requires all new administrators and all new mathematics teachers to attend MDC training at the beginning of each school year. The professional development and the on-site observations and coaching continue on a regular basis throughout the year.

MDC tools and strategies are shared with other mathematics teachers during grade-level planning and with all teachers during staff meetings. White collaborates with teachers during their planning periods.

“The formative assessment lessons can be very time consuming for the teachers to prepare because of all of the cutting out and organizing of the materials, so teachers must prepare ahead of time,” says White. “Teachers should read the lesson in its entirety before giving it to their students so they can create questions to check students’ understanding and to make certain they have all required parts for the activity to be a meaningful learning experience for the students.”

Lead teachers for MDC have been selected in each school, Martin says. These teachers assist during district and school

professional development sessions and facilitate team meetings at their schools. “They lead PLC (professional learning community) meetings to discuss FALs, analyze student data and plan for future instruction,” Martin says. “A group of lead teachers attends SREB’s summer conferences to continue training.”

Teachers also use online teacher communities to share ideas, resources and MDC strategies learned. Martin remains committed to focusing on MDC tools and strategies throughout the year. At the end of each school year, she begins to plan for next year with a focus on implementing MDC.

### Proof of Success

The data for the Hinds County School District has been difficult to compare and analyze the past six years due to teacher turnover and changing state assessments. Students have taken three different end-of-grade assessments during the past three years. However, students whose teachers have attended MDC workshops for multiple years have found success on the current state assessment.

Table 10 shows the percentages of students scoring proficient or higher on the Mathematics Assessment Program exam, which students in Mississippi take in grades three through eight and in Algebra I. In Hinds County, one sixth-grade teacher and one Algebra I teacher at Carver Middle School and one fifth-grade teacher at Raymond Elementary School embraced the tools and strategies of MDC and have attended MDC workshops for two years.

Martin believes the growth in student achievement is due to MDC. “I’ve been here for 17 years. This is the first time since I came to Hinds County that all of our schools have a score of C or better [on the state report card],” she says.

### Planning for the Future

Since a significant number of teachers are new to Hinds County Schools each year, Martin plans to train the new math teachers on the tools and strategies of MDC. The Algebra I teachers in the high schools, which are often an entirely new group of teachers, will receive targeted professional development. Martin’s professional learning plan for the district includes the following:

- All new math teachers will receive MDC professional development during the beginning teacher work days. Due to the number of new math teachers, Year 1 professional development will be conducted throughout the school year.
- Follow-up rounds consisting of observations and coaching will be conducted in all middle grades and high school math classes six times during the year. Professional development will follow all observation/coaching cycles.
- Algebra I teachers in the high schools will receive MDC professional development specific to their course.

**Table 10**  
**Percentages of Students Scoring Proficient on the MAP Assessment in 2015-16**

SCHOOL	GRADE LEVEL	HINDS COUNTY	STATE
Raymond Elementary	5	41%	30%
Carver Middle School	6	52	33
Carver Middle School	Algebra I	100	26

## Mendenhall Junior High Embraces MDC

Math was a weakness for the students at **Mendenhall Junior High School** (MJHS) in Simpson County, Mississippi, so Principal **Kirby Craft** went looking for instructional strategies and professional development to help. “The goals (of the Mathematics Design Collaborative) seemed to align with the strategies we were targeting to improve,” says Craft.

In January 2014, two teachers at MJHS began MDC training. By the end of that semester, Craft and MDC local trainer **Deia Sanders** were encouraging all math teachers at Mendenhall (fifth through eighth grades) to embrace MDC tools and strategies. “(MDC) seemed like the direction we wanted the teachers to go,” Sanders says, “but we weren’t able to get teachers there. We like the fact that it is research based.”

According to Craft, who has been an active participant during the workshops and school coaching visits, MDC was a great opportunity he couldn’t pass up.

### Impact on Instruction

Both Craft and Sanders believe MDC is influencing the way teachers are asking questions. They write questions to a higher order while preparing for their lessons. Teachers use formative assessment lessons that engage students in productive struggle. Teachers no longer dominate classroom discussions.

Fifth-grade teacher **Audarshia Flagg** says, “MDC has encouraged and taught me that, as a teacher, I am a learner and facilitator who can change the outcome of engagement of a student by asking effective, higher-order questions.”

Teacher-leader **Shirley Gowan** shares “...when I look for other activities, I have better knowledge of the kind of tasks I should look for.”

As part of their efforts, teachers have professional learning community meetings twice a month explicitly devoted to MDC. In addition, the principal facilitates a half-day session for the math department once per semester. They observe and collaborate in colleagues’ classrooms, periodically refining units and formative assessment lesson placement.

Craft and Sanders say teachers are now growing in their comfort level with MDC. They operate more student-centered classrooms and continue to work to embed the MDC strategies daily.



Teachers’ professional learning community meeting

### Impact on Students

According to Craft and Sanders, the quality of student work has improved. Students are going deeper as teachers’ expectations increase. The level of student engagement has increased in group work and explanations. Students’ confidence level in discussing mathematics is improving.

“Letting students struggle is where I’ve really grown,” says Gowan. **“I learned that I can group students with like misconceptions, and they are still engaging in the lesson instead of complaining that they don’t understand.”**

“While MDC and productive struggle might be new and uneasy at first, the level of student engagement and learning is so much more revealing than traditional learning environments,” says Sanders. **“In a society where we are so quick to reward kids for every little thing, it’s nice to see them feel an intrinsic reward for hard work. This just happens to be engaging and meet our math standards as well.”**

### The Results

In 2015-16, Mississippi began using the Mississippi Assessment Program (MAP) to monitor student achievement, and the results are impressive. Gowan, the sole eighth-grade math teacher at Mendenhall Junior High School, is the only MDC teacher-leader who remained in the same grade level each year of MDC implementation. **Thirty-seven percent of her students scored Proficient or Advanced on the MAP, which is 6 percentage points above the state average and 14 percentage points above the district average.** (See Table 11.)

**Table 11**  
**Mendenhall Junior High School Eighth-Graders' 2015-16 MAP Scores**

ORGANIZATION	LEVEL 1	LEVEL 2	LEVEL 3	LEVELS 4/5
Mendenhall Junior High School	9%	28%	26%	37%
Simpson County	12	33	33	23
State	8	29	32	31

Comparable scores for 2014-15 are not available because the state used the PARCC assessment that year.

**Students receive a score on the MAP as outlined below:**

*Level 1 (minimal)* – A student inconsistently demonstrates the knowledge or skills that define basic level performance in the grade or course in the content area.

*Level 2 (basic)* – A student demonstrates partial mastery of the knowledge and skills in the grade or course in the content area.

**Level 3 (passing)** – A student demonstrates general mastery of the knowledge and skills required for success in the grade or course in the content area.

*Level 4 (proficient)* – A student demonstrates solid academic performance and mastery of the knowledge and skills required for success in the grade or course in the content area.

*Level 5 (advanced)* – A student consistently performs in a manner clearly beyond that required to be successful in the grade or course in the content area.

## Rural Mississippi Students Take Ownership of Their Learning

**Carl Lucas** is both the Mathematics Design Collaborative local trainer and a full-time mathematics teacher at **Simmons Junior Senior High School** in Hollandale, Mississippi. Now in his third year of MDC training, Lucas implements MDC in his own Algebra I classrooms and coaches other mathematics teachers in grades seven through 12 on MDC tools and practices.

Hollandale is a small, rural community in the central Mississippi Delta. The community is economically disadvantaged, having a median household income in 2015 of less than \$24,000. Motivating students is always tough, Lucas says, so he is pleased with the results he’s experienced with MDC.

“Before starting the MDC initiative, most students that I observed in my classroom didn’t seem engaged or motivated. We were leading and instructing to the best of our abilities

and still not much engagement. After our first FAL, I noticed a difference,” he says.

“My first FAL was Representing Quadratics Graphically. I was skeptical at first, but my students surprised me with their depth of knowledge and engagement. All they needed was a student-led platform, and they took ownership of their learning. I was excited, and they were, too,” Lucas says. **“The FALs offered them a platform to speak rather than listen to me all day.”**

### Productive Struggle

Though Lucas gives credit to MDC for helping to engage his students, he had already established a learning environment with rich mathematical discourse on grade-level content in his classroom. Students were willing and able to provide

reasoning and justifications for their thinking in both whole-class and small-group discussions. His students exhibit the conceptual and procedural knowledge necessary to have a productive struggle with grade-level lessons.

As a local trainer, Lucas served as a mentor for other teachers to learn the skills to be facilitators and give voice to their students. One first-year middle grades teacher progressed in a short time from having a multitude of classroom management issues to leading a well-behaved, student-centered class.

Lucas says, “Her first FAL didn’t go so well, but she got the hang of it and has had excellent results ever since.” **Through practice with the structure of the FALs, this teacher discovered that trying to “lecture over a high noise level” can be replaced with an environment where students respectfully share ideas, justify approaches and provide meaningful feedback to one another.**

In 2015-16, 80 percent of Lucas’ Algebra I students passed the Mississippi Assessment Program (MAP) exam compared to only 64 percent statewide.

## Meeting Students’ Needs

MDC helps Lucas and the other math teachers at Simmons Junior Senior High meet the needs of individual students and use questioning strategies to deepen student understanding. “Before starting the MDC initiative, I had issues with differentiating instruction and assisting my colleagues with differentiating,” Lucas says.

“The FALs and the questioning techniques open the door for all learners. With homogenous grouping and pre-determined questions for all lessons, MDC has equipped my department with a type of differentiated instruction technique that prompts student engagement and learning.”

Lucas believes a questioning chart shared during one SREB workshop was a good visual that helped him and the other math teachers at his school improve their questioning. (See Figure 5.) **“While participating in the MDC professional development sessions, I was able to network with other teacher-leaders, and we were able to brainstorm ways to use a Higher-Order Thinking Chart,”** he says. **“This chart enables us to ask challenging questions rather than recall questions.”**

Figure 5

**Q-Chart**

Teacher: \_\_\_\_\_ School: \_\_\_\_\_

Date: \_\_\_\_\_ Time In: \_\_\_\_\_ Time Out: \_\_\_\_\_ Course: \_\_\_\_\_

Where do your questions fall on the Q-Chart?

	Is	Did	Can	Would	Will	Might
Why	Analytical (Level 3)			Synthesis (Level 4)		
How						
When						
Where	Factual (Level 1)			Predicting (Level 2)		
What						
Who						

\* As questions move up the line, higher-order thinking is required from students.  
 \*\* Levels of Thinking are based on Bloom’s Taxonomy and Webb’s Depth of Knowledge.

Comments:

Adapted from <http://nelearn.mylearning.org/mod/page/view.php?id=371> and <http://www.paffa.state.pa.us/PAAE/Curriculum%20Files/7.%20DOK%20Compared%20with%20Blooms%20Taxonomy.pdf>

It challenged us to ask analytical, synthesizing, factual and predicting questions — all questioning types that are needed in productive classrooms. Instead of asking ‘What is?’ the chart gears me to ask, ‘How might?’ It’s an awesome chart and I really benefit from it in my classroom,” he says.

Lucas found this tool so helpful that he shared it with teachers outside of the mathematics department. “During a schoolwide professional development, teachers were asked how we can provide differentiated instruction and higher-order questioning techniques,” he says. “I introduced the Higher-Order Thinking Chart, and my principal loved it. She even made it mandatory that all teachers post and use the chart daily.”

## The Results

Lucas is encouraged by the results he has seen since implementing MDC with his Algebra I students. In 2015-16, 80 percent of his students passed the Mississippi Assessment Program (MAP) exam, compared to only 64 percent statewide. Comparable scores for 2014-15 are not available since Mississippi students took the Partnership of Assessment of Readiness for College and Careers (PARCC) assessment that year.



# North Carolina

## Middle Grades School Sees a Transformation in Mathematics Instruction

Teachers at **Gravelly Hill Middle School** (GHMS) in Orange County, North Carolina, say the instructional strategies of the Mathematics Design Collaborative are shifting the teaching and learning experiences in their mathematics classrooms.

With the help of SREB professional development, which they began in August 2015, teachers are learning to identify what students know and don't know, and tap into how students make sense of problems. **They've come to realize quick memorization tricks won't help students with conceptual understanding of mathematics. MDC changes how GHMS teachers approach teaching math, and that is changing how students learn.**

### Teachers Relate Common Themes

When teachers from different classrooms talk about how MDC is changing their teaching and learning, some common themes emerge:

#### Theme 1: Teachers have a deeper understanding of content and practice standards.

As part of SREB training, teachers learn how to implement formative assessment lessons. FALs align strongly with college- and career-readiness standards. Teachers report that these lessons help them make better sense of their states' content and practice standards for mathematics, and design lessons based on best mathematics practices.

*"FALs help me design lessons that put math learning in context. Students need circumstances that hook into real-life learning."*

Caroline Smith  
Gravelly Hill Middle School

FALs are rigorous for students and teachers, leading to a deeper understanding of what rigor looks like. The essential ingredient for students is productive struggle. Teachers and students take a journey toward the implementation of high-level tasks, pushing both out of their comfort zones.

GHMS teachers credit FALs with giving them a better understanding of rigor. **Audrey McBride** shares, **"We understand now that the standards are the floor. When we get our benchmark assessment results back, we start digging and pulling things apart. We zero in on questions. We try to meet the needs of every student, and consider how we can push students further."**

Teachers also see how important it is to contextualize the learning for students. **Caroline Smith** says, **"FALs help me design lessons that put math learning in context. Students need circumstances that hook into real-life learning. Learning can't be isolated to math class; it needs a broader context."**

#### Theme 2: The student learning experience is shifting.

Not only are teachers moving toward deeper awareness of state content and practice standards for mathematics, the student learning experience is changing for the better. Teachers think more about planning and where student learning should be at the end of the unit. They use pre-assessments not only to group like-minded thinkers for a FAL, but also as they plan higher-level assignments for students.

Teachers see positive results because of productive struggle. Students who sometimes lack basic computational skills are having rich mathematical conversations, making conjectures, seeing patterns and forming connections. "As a result of MDC, we no longer shy away from giving students complex assignments that result in a productive struggle," says **Stacey Boyer**. "We now say, 'Let's spend some time on this and see how we can move learning forward.'"

Students also engage in productive struggle when they critique another student's reasoning. The problem-solving FALs create a structure for student error analysis, requiring students to reflect on each other's work and then consider their own work with a new eye.

**Beth Newman**, the MDC local trainer for Orange County Schools, attributes student learning to this. **“When students are given time and space to connect their learning to the way another student thought about the same task, students are stretched in a good way and begin to make connections to their own learning.”**

“Another interesting outcome is that students see other students’ mistakes faster than their own, which helps them make sense of their own misunderstandings. These outcomes are so helpful in moving student learning forward,” Newman says.

### **Theme 3: Teachers and students are learning to ask the right questions.**

The seventh- and eighth-grade math teams at GHMS agree that the most important thing they learned through SREB training is strategic use of skilled questioning in the classroom.

Their questions were initially weak, but they learned to write and ask probing questions such as, “How might you go back and do things differently?” or “How would you change your thinking now that you understand differently?”

**Teachers are learning to not give away answers, but instead answer questions with other questions. They take time outside of class to create higher-level feedback questions.**

Students are also better at asking the right questions. During FALs and other formative assessments, students collaborate with like-minded peers. Teachers credit the grouping of students as like-minded thinkers as one reason students are growing more confident.

### **Theme 4: A culture of community leads to mathematically powerful students.**

Newman is witnessing an evolving community of learners at GHMS. When a student in the back of the room asks a question, teachers allow students to act as instructional resources and think through the question together, which advances student learning.

Teachers group students so they learn through collaboration and questioning. Teachers ask questions that provoke deeper thinking. According to Newman, transformation continues as teachers foster learning experiences that enable students to see themselves and their peers as mathematically powerful.

For the 2016-17 school year, 39 percent of Gravelly Hill Middle School’s seventh-graders were expected to have a 50 percent chance of getting a Proficient score. As it turned out, 46 percent of the seventh-graders achieved a Proficient score or higher.

Similarly, 42 percent of the eighth-graders were expected to have a 50 percent chance of getting a Proficient score. In the end, 55 percent of the eighth-graders achieved a Proficient score.

## **Exceeding Expectations**

The North Carolina Department of Public Instruction uses EVAAS (Education Value-Added Assessment System), a prediction modeling program, to determine whether students and schools meet expected growth.

EVAAS establishes testing patterns based on individual students’ previous end-of-grade assessments. It then correlates those testing patterns with the patterns of students who performed similarly in the past. These data are combined to predict, on average, how students will perform if they are to meet expected growth the following year.

**For the 2016-17 school year, 39 percent of Gravelly Hill Middle School’s seventh-graders were expected to have a 50 percent chance of getting a Proficient score. As it turned out, 46 percent of the seventh-graders achieved a Proficient score or higher.**

**Similarly, 42 percent of the eighth-graders were expected to have a 50 percent chance of getting a Proficient score. In the end, 55 percent of the eighth-graders achieved a Proficient score.**

GHMS teachers far exceeded the North Carolina growth model for both student cohorts. Teachers credit their growth to the SREB professional development on using, designing and engaging students in more challenging math assignments, says Newman.

## Teacher More Conscious of Higher-Level Questioning

An enthusiastic participant from the beginning of her Mathematics Design Collaborative training, **Marcelle Powell** embraces the process fully and is more cognizant of the questions she asks. “I am conscious of higher-level questioning. I do my best to pose questions that require students to brainstorm with their neighbors to develop solutions to assigned problems,” says Powell, an eighth-grade math and Math I teacher at **Hobbton Middle School**, Newton Grove, North Carolina.

“SREB professional development encourages teachers to incorporate higher-order questioning skills throughout their units of instruction,” she says. “This, in turn, results in students learning to ask questions that lead to mathematical understanding and development. The conversations heard around the classroom center on the mathematical objectives as students learn to support one another.”

### Multiple Opportunities for Mastery

Powell has used backward design for some time in planning her units, but since beginning MDC, she has fine-tuned her process. “I always began my unit planning with the final assessment to gear my assignments toward the preferred learning outcome. Now that I am involved with MDC and use the formative assessment lessons, I also look for the FALs that fit the needs of the students and help them develop the thinking skills necessary for the specific objectives being addressed in the unit. This instructional strategy has become a major tool in my instructional repertoire,” she says.

The use of formative assessment lessons and other MDC tools allows students multiple opportunities to master key mathematics content throughout a unit. Once students’ misconceptions have been revealed, Powell uses a variety of strategies to re-engage her students in the learning.

“When I notice a specific skill that is weak for several students in class, I create a math scavenger hunt,” she continues. “The scavenger hunt helps reinforce those skills so students can build upon them later. I also use the Kahoot! app to re-engage students on specific skills.

“My favorite strategy is using structured peer-tutoring sessions,” she says. “Those students who exhibit mastery of a concept assist another student who is still struggling. They both gain deeper understanding. Once students learn the material through these engaging strategies, it is not likely to be forgotten. The student can claim ownership of his/her learning, and it cannot be taken away,” adds Powell.



Marcelle Powell  
Hobbton Middle School

### Unique Professional Development

Powell favorably compares SREB’s approach to other professional development. “**The trend in my district is to provide professional development through online modules,**” she says. “**It is so refreshing to collaborate with other teachers and be instructed by a presenter who is so passionate about the program and about student learning and development in general. The materials given and developed during intensive professional development sessions are resources I can return to my classroom and utilize immediately.**”

“The topics addressed are student-friendly and so very engaging,” Powell continues. “**MDC is not your ordinary staff development. The sessions push me to think outside of the box and to plan math assignments that help my students do the same.** The activities are well thought-out and presented in a sequence that enables teachers to grow and expand their teaching toolkit.”

Powell credits the powerful math practices around MDC with helping her shift the nature of the assignments she provides for students. “I incorporate more interactive assignments that bring opportunities for students to collaborate and engage in a productive struggle as they discover new concepts in mathematics. I believe that this mathematical discovery is vital to student ownership of the concepts they are learning,” she says.

### Outperforming Peers

After a full school year of training and coaching, Powell’s students outperformed their grade-level peers across the state. Table 12 shows the percentage of Powell’s students scoring Proficient on the North Carolina end-of-grade assessment for eighth grade and the end-of-course assessment for Math I in 2015-16.

## The Student Perspective

Powell's students agree that FALs help them grow as learners. "FALs allow students to go beyond the basic understanding of a lesson. It makes us think more than just what the answer is, but how we get to the answer. It allows us to cooperate with others and learn from our groups," says student **Kristy C.**

**Table 12**

### Percentages of Students Scoring Proficient on North Carolina State Assessments for 2015-16

COURSE	POWELL'S CLASS AVERAGE	STATE AVERAGE
8th-Grade Math	48%	39%
Math I	91	50

Source: North Carolina End-of-Grade and End-of-Course Assessments

"I like the FALs because I work with others who think the same as me and are on my learning level," says student **Anna-Cate.** "They also help me to grow in my understanding of math concepts. Mrs. Powell allows me to take a step farther into what we are learning by using the FALs."

And from student **Carlos A.,** "Working with a partner to finish a FAL helps me with something simple that I don't get about a lesson. It also makes it not boring, because when we don't get it, we discuss it. It makes me responsible for my own learning because I control the pace I want to go. I can make it simple or hard, fun or boring."

Powell has witnessed an increase in student engagement because of her work with MDC. "Students are eager to complete each FAL and are excited to collaborate with their classmates," she says. "They are actively engaged in the mathematical process. Students become excited when they make a discovery and can share their learning with their peers. They are learning to ask leading questions that help their classmates make their own discoveries."

According to student **Madelyn H.,** "Learning with a FAL helps me get involved in what we are learning by making me really think about the problem that is presented and by engaging me in the lesson, all while having a lot of fun."

## Looking Forward

In the upcoming school year, Powell plans to expand her repertoire of mathematical "discovery" activities and transform her classroom into a "math lab" setting where students can explore mathematical principles.

"I will strategically select or create, hands-on activities that elicit questions leading to the targeted skills taught throughout the school year," she says. "This will help students develop ownership of their learning and will embed the knowledge into their understanding, providing a variety of experiences and tools to use as building blocks for future learning."

## North Carolina Teacher Discovers the Art of the Assessment

**Amanda Allen**, eighth-grade math teacher at **Jacksonville Commons Middle School** in Jacksonville, North Carolina, says that the Mathematics Design Collaborative has opened her eyes to a more effective and rigorous method of teaching and assessing her students.

“I no longer follow a pacing guide, textbook or a general plan for all students,” she says. “I now pre-assess my students to find out what they know. From the pre-assessments, I identify the obstacles, misconceptions and gaps (OMGs) in learning for each student and class.”

“Formative assessment lessons provide me with an overall understanding of how my students think when asked particular questions. They also allow me to see common OMGs that may need to be addressed if a large percentage of students are missing the same types of questions,” says Allen. This lets her provide differentiation within her classroom instead of teaching a one-size-fits-all lesson.

“Students are more aware of their needs and are paired homogeneously during MDC lessons to encourage academic discourse and be responsible for their own learning,” Allen notes. “This shift in student responsibility gives me more time to work with students to guide them toward those ‘aha’ moments and make sure their OMGs are eliminated.”

### Meeting Post-Assessment Needs

Allen uses students’ work on the FAL post-lesson assessment to adjust her instruction following the lesson. “I use student answers from the post-assessments to drive my instruction and re-engagement following a FAL,” Allen adds. “Often, these might be in the form of a chalk-talk, student-to-student peer tutoring, or if it is a large or the whole group not understanding a concept, I incorporate a lesson that is designed specifically toward the problem area(s).”

**“I try to incorporate lessons that allow for peer discussion and encourage productive struggle and recall of prior learning,”** she continues. “All lessons include an essential question that focuses the learning so students know what they are doing, as well as a means to assess themselves to see if they have grasped the concept.”

For those students who still need help conquering their OMGs, Allen works with them in small groups or pairs with mini-lessons tailored to their specific needs. “One re-engagement lesson that I did following a FAL on scientific



Amanda Allen, Jacksonville Commons Middle School

notation was focused on multiplying and dividing with numbers written in both scientific and standard notation. During the assignment, students figure out how many times greater their height is than that of different objects. This was a problem area for students during the FAL, and therefore, it needed to be revisited,” she says.

FALs also “aid me in lesson planning for the next year, making sure I rethink ways to engage students in learning experiences in their areas of difficulty more in-depth. I can communicate with other grades to let them know where there are gaps in specific skills that are prerequisites for eighth-grade math and Math I,” she says.

### Sharing and Collaborating Bring New Ideas

Allen says the MDC professional development SREB provides is different from other sessions she has attended because it allows her to see how students learn best.

She feels that FALs align with North Carolina state standards, making it easy to include them in her lesson planning. She has learned how to create questions related specifically to the learning needs of her students and to use formative assessment data frequently to re-engage students in learning concepts with which they are struggling.

Because of her work with MDC, Allen now more readily collaborates with other teachers to see how they teach a skill or share ideas to include in her lessons. She says MDC encourages reflection in instruction, planning, grouping and skills, which can be discussed during collaborative team meetings.

## Increased Student Interaction

After experiencing formative assessment lessons, Allen says her students are more engaged in their learning. She encourages them to take risks and does not do all the “teaching,” instead she’s more of a facilitator, encouraging students to explore possibilities while providing specific feedback to her students. They readily participate in discussions and are more willing to try a method to see what will happen. This increases student motivation, participation and retention of material.

## The Results

In the overall average on a district benchmark assessment during the 2016-17 school year, Allen’s students scored significantly higher than the other math teachers’ students at her school and in the district. (See Table 13.) The standards addressed on this benchmark are the eighth-grade geometry standards listed in North Carolina’s course of study. They include understanding congruence and similarity of figures, applying the Pythagorean theorem and solving real-world problems involving volume.

Allen’s resource class is roughly 10 percent students who need more assistance than average special needs students. These students spend only 30 percent to 80 percent of their day in classes with regular education students. The rest of the class includes regular education students who significantly struggle with math.

Allen’s inclusion class is about 50 percent special needs students and about 50 percent regular education students.

## STUDENTS REACT TO MDC STRATEGIES

“I got a better understanding by working in groups because we could compare and contrast our answers. With the discussions, it helped me to retain the rules for exponents.”

“When discovering things on our own, we understand them better than from a lecture.”

“I think that doing things ourselves makes learning more fun.”

“I personally like hands-on work because it helps me to see what needs to happen. Doing it on paper allows you to see it instead of just writing the numbers.”

“Working in groups really helps because if you don’t understand what the teacher was teaching, someone in the group can help explain it. Using the vocabulary in our discussions makes it easier.”

**Table 13**  
**Average Student Scores on Eighth-Grade Benchmark #2 for 2016-17**

	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	OVERALL AVERAGE
Teacher 1	49.9	41.9	74.6	45.5	52
Amanda Allen (Teacher 2)	<b>80</b>	<b>46</b> (inclusion)	<b>78.6</b>	<b>40</b> (resource)	<b>61</b>
Teacher 3	56.8	49.6	N/A	N/A	53.2
				<b>School Avg</b>	<b>53</b>
				<b>District Avg</b>	<b>54.4</b>

Source: Jacksonville Commons Middle School

## Teacher and Students Hooked on MDC

When **Hannah Worley** was first told about SREB professional development for the Mathematics Design Collaborative she was scheduled to attend, she was unsure the workshop would benefit her and her students. “The first two-day training that I went to was far enough away from our school that we had to spend the night in a hotel. I refused to get a hotel room until I went the first day and checked to see if I thought it was something that would work for me and my students,” she says.

**“By lunch time, I knew that I was getting a hotel room that night,”** Worley continues. **“The first formative assessment lesson that we participated in was one with transformations, and I was hooked.** The professional development provided by SREB for MDC uses strategies that engage teachers to work toward a common goal: improved student achievement!”

Worley, who teaches at **Madison High School** in Marshall, North Carolina, is an enthusiastic participant and active in sharing the strategies she had learned with fellow teachers since that first workshop. “From the beginning, we were encouraged to work with each other as colleagues to improve student learning in our classrooms,” she says. “Not only are we collaborating within our department, we have other departments asking us to explain what we are doing.

“Two of our teachers combine their classes and work in the library where other teachers can walk through at any time and see what is going on. Teachers were amazed at the level of student engagement and discussion,” Worley says.

### Facilitating Productive Struggle

Getting her students to embrace productive struggle and persevere when the work is challenging used to be difficult. “MDC immediately gave me new resources that I can use in my classroom. I love the card sorts and the idea of productive struggle. While I always encouraged students to do their best and improve, **I don’t think I really got the idea of productive struggle across to them until after we started using formative assessment lessons and other math strategies,**” she says.

“Once you explain what productive struggle is to students — and that we are focused on improvement — they get it. Life is so much easier for the students and the teacher. They truly buy in to what you are doing,” Worley continues.

*“I had kids in this class who were looking at being kicked out of high school and put in the alternative school because all they did was get in trouble and not participate in class. Not true in my class ... this included three boys who worked in my class all the time and got their work finished. One of them was my top student.”*

Hannah Worley  
Madison High School  
Marshall, North Carolina

### Improving Mathematical Understanding Together

During the FALs, students are grouped in pairs of like-thinkers. Worley believes grouping students this way has a positive impact on her students. “I love the idea of homogeneously grouping and lifting a groups’ understanding; this way, everybody has the chance to improve,” she says.

“When we started MDC, I had a class of Math 1 repeaters and in that group, the students were separated into an “us” and “them” class. One-half of the class clearly did not like the other half and vice versa,” Worley explains.

“They did not want to be paired together and would beg to work alone when paired with certain individuals in the classroom. After I explained that they were paired with someone who had ‘like’ thinking based on their pre-lesson assessment from the FAL, they went with it. Social gaps were narrowed as well,” she says.

## Assessment for Learning for All

Worley believes that using the FALs can help teachers, even those who do not teach math, learn the value of assessment for learning. “Multiple times, I presented MDC lessons when our school was participating in instructional rounds,” she says. **“When teachers visited my room, there was always conversation that included ‘They are all working!’ ‘They are trying!’ ‘That student did not work like that in my class!’ ‘Wow, I can’t believe you got him to work!’”**

Worley says teachers in her school were often surprised by students who would work in her class. Often these were students with behavioral concerns. “I had kids in this class who were looking at being kicked out of high school and

put in the alternative school because all they did was get in trouble and not participate in class. **Not true in my class ... this included three boys who worked in my class all the time and got their work finished. One of them was my top student,**” Worley says.

Worley credits the use of research-based formative assessment strategies she learned in MDC workshops. “I feel like the different approach to teaching helped greatly in this situation,” she says. “MDC works for me!”

MDC also worked for Worley’s students. **After her first year using the tools and strategies of MDC, her student pass rate for Math III rose from 38 percent in 2014-15 to 61 percent in 2015-16.**

## North Carolina Teacher’s Obsession Pays Off

**Claudia Rodriguez** sums up her excitement about SREB professional development for math teachers with one word – obsessed. “I’m obsessed with the FALs,” the **North Asheboro Middle School** mathematics teacher explains, referencing the formative assessment lessons she learned how to implement during SREB MDC training. “The FALs are really rich in content – in math content and precision – I love it!”

Rodriguez has implemented at least six FALs each school year since attending the initial training for MDC in August 2015; not all were designed for middle grades schools. She recalls experiencing the Interpreting Algebraic Expressions FAL during her initial training. “This is for high school, but we did it in the training. So, when I was doing it in the training, I saw the distributive property,” Rodriguez says. She decided that though her students were seventh-graders, she thought they could do the lesson. “And they were really, really into the math — the algebra. They felt smart and capable.”

### Shift in Instruction

Rodriguez believes the tools and strategies she learned during MDC trainings have shifted her instructional practices. **“I thought I was good,”** she said. **“I thought I was doing a good job. But I felt like something was missing. When I started the FALs, I thought ‘Oh, my gosh! This is what I was looking for!’”**

“The FALs allow students to build conceptual understanding and the ability to inquire and become independent learners and thinkers,” she continues. “I would say there is no single best way to teach math, but FALs are one of the best

activities that I find productive not only for my students, but for me as an educator.”

Rodriguez says the FALs helped her see how effective questioning strategies can have an impact on students’ learning. She notes prior to MDC, she struggled with what type of questions to ask students to move their thinking forward.

Her questioning strategies also have an impact on student behavior. Students now look to each other more as instructional leaders in the class. “The kids always say, ‘Don’t call her; she’s not going to give us the answer. She’s going to ask another question.’”

Rodriguez says **her students now talk to each other and problem solve together. They no longer look for her to give them the answer. Instead, they struggle to figure out the solution to a problem.**

### Data-Driven Assignments

Rodriguez also uses FALs to guide her future instruction. “Data drive my instruction and after FALs, we analyze the data to enrich or reteach the concepts,” she says. “Most of the time, I assign enrichment activities on the computer and reteach students using other strategies like graphic organizers or just going over some problems. Most of the time, reteaching after a FAL is not that big. I wish we had a FAL for each topic in math class.”

Using data to guide her instruction helps Rodriguez set the tone of high expectations in her classroom. “I set high



expectations for [my students] from the beginning of the year. By giving challenging problems to solve, I have created a strong culture of group work and engagement; otherwise using the powerful math practices is not possible,” she says.

### Impact on Student Achievement

Students across North Carolina in grades three through eight take the state end-of-grade exam each spring to assess their understanding of the North Carolina Course of Study, which defines what students should learn each year. **Data for Rodriguez’s class demonstrate that 100 percent of her students passed the exam with a Level 4 or 5. “I never have 100 percent of them pass this test with that growth,” says Rodriguez.**

Rodriguez believes her instructional decisions greatly impact whether students learn and are engaged in her classroom. **“That’s my motto – If the kids don’t learn, it’s my fault,” she says. “It’s the way we deliver the lessons that matters.”**

**Candace Call**, the principal of **North Asheboro Middle School**, believes Rodriguez’s instructional practices increase student engagement as well as help Rodriguez grow professionally. “MDC helps increase the level of cooperative learning within student engagement,” Call says. “I believe MDC provides Mrs. Rodriguez with the motivation to push herself harder, even though she was just recognized as the district’s Teacher of the Year.”

## Stanly County Schools Finds Its Math Niche

**Stanly County Schools (SCS)** was struggling to find a strong support system for its math teachers. **Two years later, school and district leaders are boasting of positive gains in student achievement on the North Carolina end-of-grade (EOG) and end-of-course (EOC) assessments.**

They credit these gains to SREB professional development for the Mathematics Design Collaborative and teachers’ commitment and willingness to learn new strategies and transform their teaching. **Sandra Carter**, associate superintendent of SCS, became aware of professional learning opportunities offered by SREB that center around the research-based tools and strategies of MDC. SCS leadership determined the MDC model aligned with district needs, and Carter believes this was a turning point in the quest to move the district forward.

### NORTH CAROLINA STATE STANDARDS ARE DIVIDED INTO FIVE ASSESSMENT CATEGORIES:

Level 1 denotes limited command of knowledge and skills.

Level 2 denotes partial command of knowledge and skills.

Level 3 denotes sufficient command of knowledge and skills.

Level 4 denotes solid command of the knowledge and skills.

Level 5 denotes superior command of the knowledge and skills.

“The SREB professional development for MDC allowed teachers to explore student engagement in a new light because it is a student-centered approach that focuses on effective teaching strategies that can be applied in everyday mathematics instruction,” says **Julienne Fallen**, assistant principal of North Stanly High School. Rather than lecturing students and showing them how to solve problems, teachers ask more questions of students and encourage them to figure out answers on their own. MDC uses formative assessment lessons, which engage students in productive struggle. Often the “light bulb” moment and the real learning result from the struggle.

“Students were unsure of answering open-ended questions and were skittish when teachers do not tell them whether their answers are right or wrong,” says Fallen. **“Teachers tell**

us that ‘taking the pencil out of their hands and keeping it in the students’ hands’ is the most altering experience for them,” Fallen adds.

### Immediate Results

Table 14 shows the average scores for sixth- through eighth-grade EOGs and the Math I EOC for the school district. **After only one semester using MDC instructional strategies in classrooms (spring 2016), all average scores increased.**

Carter is pleased with the progress being made in Stanly County and anticipates that scores will continue to rise. “I cannot speak highly enough of the support given to the teachers and district facilitator teams by SREB,” she says.

### The Professional Development Journey

Finding the professional development and the support system to transform math teaching and learning was a journey that began in 2015. SREB offers a three-year, multi-prong approach to supporting schools and districts which includes providing MDC professional development to teachers; developing local trainers who provide coaching and support to teachers; conducting classroom observations and providing teacher feedback; expanding MDC schoolwide and districtwide; and supporting principals.

Eight Stanly County schools participated in the initial MDC training in January 2016 and began implementing the strategies in schools in the spring semester of the 2015-16 school year.

Stanly County developed a collaborative model for the implementation of MDC by forming a facilitator team comprised of four local trainers, including high school and middle grades school curriculum directors or assistant

### THE BIGGEST CHANGE

**Teresa Morton** is currently the middle grades school curriculum coach for Stanly County Schools. Before that, she was a teacher who used the tools and strategies of MDC and realized how they changed her instruction and her students’ attitudes. **“The biggest change, however, was in me.** I began to use effective questioning in my everyday instruction,” she says. “I stopped asking ‘what’ and began requiring students to tell me ‘why.’ I relinquished my desire to control the students’ education to make them responsible for their own learning.

“While they were reluctant at first, they soon began to realize, as I did, that they were equipped with the tools and thinking skills to accomplish challenging tasks,” she says. “The FALs became a normal part of our units, and the students became accustomed to the non-negotiables (e.g., higher-order questioning, timing, collaborative pairing).

“Students became familiar with the fact that I would be a guide, instead of directing them through the problem-solving process step by step,” she continues. “I am a firm believer in the process and recognize that FALs are a support resource in learning to engage students in challenging math assignments. My students actively engage in productive struggle with the knowledge that I will support them if they are willing to be risk takers.”

**Table 14**  
**Percentages of Students in Stanly County Scoring Proficient on the North Carolina EOG/EOC Assessment**

	SIXTH GRADE	SEVENTH GRADE	EIGHTH GRADE	MATH I
2014-15	48%	42%	44%	58%
2015-16	50	46	47	62

Source: North Carolina Department of Public Instruction

principals. This team was tasked with observing classrooms, examining teaching strategies and providing formative feedback to teachers — all designed to move learning forward.

“In the beginning, we went to each of the eight county schools to observe each teacher who participated in the math training,” says Fallen. The SREB trainer joined them for each observation and debrief.

“Each local trainer brings a different set of eyes to the observations and notices different details in the implementation of formative assessment lessons. This allows the local trainers to recognize what is needed to provide support to teachers. In turn, teachers can implement the FALs with greater fidelity,” she adds.

## North Carolina Teacher Looks to Help Students Reach Highest Learning Potential

**Christi Edwards** is a veteran teacher at **West Stanly High School**, in the small town of Oakboro, North Carolina. “The math professional development has taught me so much about myself as an instructional leader both in the classroom and as department chair,” she says. “I am now aware of areas that can be improved for my students to reach their highest learning potential.”

Between the formative assessment lessons (FALs) and the professional development offered by SREB, Edwards says her types of questions and style of questioning have changed drastically because the lesson plan of a selected FAL provides examples of exactly what to ask. She adds that the scripted lessons make the process of implementing a FAL in her Math II classes stress-free.

“The professional development was different,” Edwards says, “because it provides support and FALs for teachers based on core standards and mathematical practices. The lesson plans allow teachers to feel confident and give them time restrictions for each part of the lesson.”

The professional development provides teachers with tools and strategies to create a classroom culture in which students own the learning. “I have become a teacher-leader, fostering a classroom environment that supports student ownership of learning by encouraging and supporting students as they learn to become accountable for learning mathematics,” she says.

### Shared Responsibilities

Stanly County is pleased with the team approach. Since coaching responsibilities are shared, teachers receive constructive feedback right away, and principals are informed within a week of the observations about what’s working, what needs work and the next steps that will be taken by the local trainers and teachers. Teachers are “buying in” to the MDC process, implementing the teaching strategies in their everyday classroom instruction.

“Walking into a classroom where the teacher is utilizing proven math strategies, you will see a change in the ownership of learning,” says Carter. “Teachers are relinquishing the ownership of learning to the students. **Critical thinking is now commonplace and not the exception in the classes.**”



Christi Edwards  
West Stanly High School

### Shift in Instructional Practice

Since implementing the tools and strategies of the **Mathematics Design Collaborative**, Edwards notes she **has made several shifts in her instructional practices, including creating FAL-like lessons for her calculus and precalculus students.** “I have improved a slope field card sort that I used in the past by adding a pre-assessment activity to help with grouping (students) and identifying potential obstacles, misconceptions and gaps in learning that I can address with feedback questions,” she says. “I have created a modified script to follow by allocated times for each portion of the activity. That provides my students and myself with structure and prevents us from spending too much time on any one activity.”

Math II students' average report card grades increased from 78 percent to 83 percent, with exam grades increasing from 68 percent to 75 percent.

Edwards no longer worries if every student does not complete this type of activity. She focuses on the purpose of the lesson, which is to assess where each student is in the learning process. "We may not always get the entire activity complete, but what is most important are the connections that are made along the way," she says. "The whole-group discussion at the end is my favorite part because students share their 'aha' moments and own their learning.

**"I also created a post-assessment like the pre-assessment to measure growth," Edwards adds. "This allows me to identify how I need to adjust my instruction and re-engage students in learning experiences that target their gaps in understanding."**

Edwards also changed how she teaches her students new content. For example, "previously I have 'proven' the Pythagorean theorem by showing them the connection between it and the distance formula. Notice I said, 'showing them'," she says. "Today they are in control of their learning and discoveries, and I am simply the navigator that guides them through questioning without telling them if they were correct or not. **I witnessed light bulbs turning on, one right after the other.**"

## Change in Student Behavior

The math training not only impacts Edwards' instructional practices, but it has a profound impact on her students. "My students have changed drastically in their approach to questions that are difficult," Edwards says. "Before, they would raise their hands and wait on me to give them an answer. Now they know I will not give them the answer, but will guide them with questions that require more than just a 'yes' or 'no' answer.

"They have learned that I expect them to engage in mathematical discourse with their peers. The FALs improve students' levels of confidence, and students ask higher-order thinking questions of me and of each other," she concludes.

## Student Achievement Rises

Edwards believes MDC also impacted student achievement in her Math II classes. In the fall of 2015, before she began training, her Math II students had an average first-quarter report card grade of 78 percent with an average exam grade of 68 percent. She taught Math II again in the spring of 2017. **Students' average grade for the same content was 83 percent with an average exam grade of 75 percent, an increase of 5 and 7 percentage points respectively.** Edwards is hopeful she will see continued increases in her students' achievement.

## Overwhelming Administrative Support

At West Stanly High School, the teacher-leaders provide resources and model effective implementation of the FALs and are given overwhelming support by the administrative facets of the school and the county. "Support is key in making teachers feel they are capable and confident in the process," Edwards says. "A positive attitude is always a key factor in making a new strategy successful. If teacher-leaders illustrate an attitude of support and believe that MDC is making their own classrooms better, teachers are much more willing to try their best."

## Teacher Observation and Feedback

**Stanly County School System** is unique in its observation process of MDC. At the beginning of the professional development, Stanly County appointed four local trainers – two assistant principals, the county director of high schools and the county director of middle grades schools. These local trainers and the SREB consultant initially observed and debriefed as a group with the teacher-leaders. **After three rounds of SREB coaching and training, the local trainers were strong enough to break into pairs of observers.**

Edwards says it is important to observe teachers new to the math professional development to identify areas of strength and weakness in the implementation process. The feedback provided to teacher-leaders by the team of local trainers is constructive and specific. This provides support and suggestions for improvements, as well as validation of correctly implemented strategies.

## Student-Centered Design Promotes Independent Learners

**Suzanne Clanton** moves fluidly among groups of math students, wearing a “poker face,” as she prompts them with feedback and rapid-fire questions. Instead of divulging whether their answers to problems are right or wrong, Clanton strategically asks open-ended questions until students find the correct answer on their own.

Clanton teaches Math I at **West Stanly High School** in Oakboro, North Carolina, and began Mathematics Design Collaborative training in spring 2016. “There is more work involved for teachers (prepping) in the beginning, but the strategies force the students to be more independent learners.”

She says that using formative assessment lessons fosters a classroom environment that supports student ownership of learning “by encouraging questioning that helps the student retrieve the information. Teachers do not ‘GPS’ (give students step-by-step instructions), but allow the students to discover the answer.”

Clanton knows that MDC is contributing to deeper student learning in her classroom. “My questioning has improved. It helps my student discover the necessary information and subsequent connections,” she says.

“My students know that I am not going to give them the answer, so they will talk among each other to get to the answer. They work better in groups because they rely on each other to get to the answer by thinking things through.” She adds, “MDC is definitely student-centered.”

### Teacher Collaboration

Formative assessment lessons are MDC’s primary tool for improving teaching practices. Basic implementation of a FAL involves a pre-lesson assessment, a whole-group introduction, a collaborative activity and a whole-group plenary discussion, followed by a post-lesson assessment. FALs place emphasis on teacher-to-student and student-to-student feedback and questioning.

At West Stanly High School, the teachers are learning to collaborate along with the students, says Clanton. “The teachers get together as a department and plan for the implementation of the FALs. We also debrief after each FAL to see how we can engage students in deeper learning so they can do better the next time around.”



Suzanne Clanton  
West Stanly High School

What happens when students still have questions after the FAL? Clanton re-engages students on the standards in each lesson through daily warmup and quizzes. She keeps her own notes on the success of each FAL, detailing the approaches that worked and those that didn’t work, with an eye on improving the next time around. “From the pre-test and post-test data, I can evaluate what the students know or where they need more practice,” she says.

### Student Achievement Grows

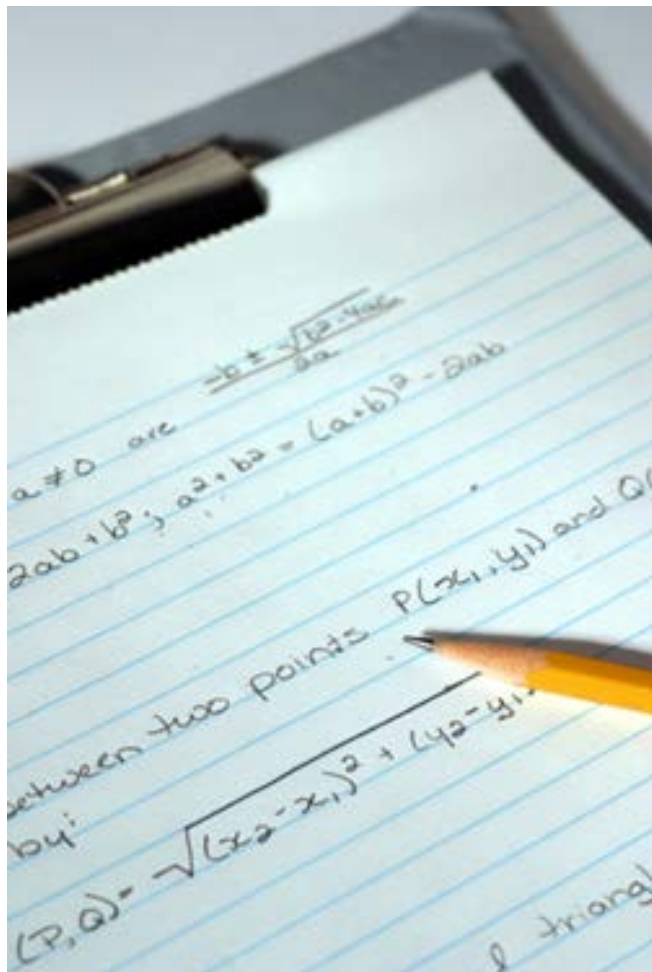
As Clanton completed her first year of math training, she became more comfortable with MDC, and her students’ overall grades improved. In the fall of 2016, her Math I students had an average first-quarter grade of 74 percent. In the spring of 2017, a new group of students took Clanton’s Math I course and earned an average grade of 86 percent for the same content.

### Leadership Involvement

Principal **Kim Page** is highly invested in the MDC learning strategies. She sees the evidence of growth in her teachers’ practices as well as the students’ learning, and offers encouragement as they work through new ideas.

Math I students’ average first-quarter grade increased from 74 percent in spring 2016 to 86 percent in spring 2017 for the same content.

Clanton appreciates this support and the tools the administration provides to help the teachers implement the FALs with fidelity. Assistant principal **Natasha Krueger** has even completed the requirements to be an SREB certified MDC local trainer.



## RE-ENGAGING STUDENTS AFTER MISCONCEPTIONS ARE REVEALED

Clanton enacted the “Defining Lines by Points, Slopes and Equations” FAL in November 2016, with her Math I students. Students’ average score on the pre-lesson assessment was a 1.06 out of three possible points, or 35 percent. Their post-lesson assessment scores showed growth with an average of 1.5 points, or 50 percent.

But Clanton knew she needed to address students’ remaining misconceptions before their unit exam. She planned re-engagement activities based on the concepts that continued to be a struggle for students.

“The re-engagement activities for this FAL were review concepts on a warmup the next day,” she said. “I did a matching activity that centered on the misconceptions I observed in most of the groups, and I also did a few ‘exit ticket’ slips during the remainder of the unit that reviewed those same concepts.”

The re-engagement activities paid off for her students; their average grade on the unit exam was 85.

# South Carolina

## Testimony of an Elementary Teacher about SREB’s MDC Professional Development

The 2016-17 academic year was the first year incorporating MDC into the math curriculum for third-grade teacher **Laura Seear** of **Carver Elementary School** in Florence, South Carolina. She provided the following testimonial of how her teaching practices have changed:

I was immediately interested in the MDC approach because it pertained to much of what I was already incorporating into my classroom instruction in English language arts and other content areas. The in-depth questioning, rigor and hands-on instructional approach that MDC provides intrigued me from the beginning. The strategies got children thinking critically on their own and actually enjoying the “productive struggle” of solving a difficult problem.

This program has opened my eyes to a new way of teaching math — one that allows children to learn and succeed in solving problems and enjoy what they are doing at the same time. It has enabled me to see how important it is for children to do their own thinking and how we as teachers often do too much of the thinking for our students. This program amazed me with how much children can grow, how much knowledge they can absorb, how their thinking skills and problem-solving skills can be totally transformed and how the mental practices and thinking techniques they learn while using MDC can carry over to other subjects in the classroom.

The math professional development impacted my test scores profoundly. I’ve always seen my students grow and achieve on the NWEA MAP Test, but their success this past year was much greater than ever. **I give the credit to the MDC program. All of my students, 100 percent, made huge MAP gains on the math test. All my students but one, not only met their goals but EXCEEDED them. That’s huge! I was so impressed with their test results and that over half of them scored way above grade level.**

The greatest satisfaction of all was seeing their huge grins and smiles. My students were so proud of their successes, and their confidence grew greatly in the area of math because of this program. I was so impressed with the stamina and endurance they had while taking this assessment, and they had this stamina because of all the tasks and FALs they had done with MDC that required a great amount of effort and time to compete.



This program has taught me so much as a teacher, not just about math but about teaching in general. It has also taught me a great deal about my students. I have learned how critical questioning is and how important it is for students to do the thinking and to show their thinking.

I’ve learned how critical it is for students to focus on the process not just the outcome. I’ve realized how incredible the need for students to be able to explain and justify their reasoning is to their understanding of a concept and that by doing it through collaborating with their peers creates a much more meaningful learning experience.

What I love most about this program is that it is hands on and teaches children that having a “productive struggle” is okay and that it is okay to be challenged and not get a problem right the first time. I believe that we can teach our students practical and crucial life skills in addition to math skills through this one concept.

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*“All my students — 100 percent — made huge MAP gains.”*

Laura Seear  
Carver Elementary School

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# West Virginia

## MDC Takes Students Outside Their Comfort Zone

Since implementing the instructional strategies of the Mathematics Design Collaborative in her classroom in the second half of the 2015-16 school year, **Stephanie Carter** says she's come to realize that her role as a teacher has changed. "I'm no longer the holder of all the answers in my classroom, and I no longer deliver content to my students and simply hope that it sticks," Carter explains.

Carter is a ninth-grade algebra and algebra support teacher at **Riverside High School (RHS)** in Kanawha County, West Virginia. She began MDC training in December 2015. During SREB's MDC workshops, Carter was encouraged to challenge her students to think critically, struggle and not look for a recipe for solving problems. Carter says she proudly welcomes the process of declaring herself as a facilitator of learning, a motivator of persistence and an encourager of students stepping outside of their comfort zones to learn math.

She notes, "I now answer questions with more questions, challenge the ideas of students and encourage them to do the same with one another." It promotes student engagement in productive struggle.

### Gaining Acceptance of Productive Struggle

Some students are apprehensive and resistant to productive struggle. "They think teachers are unwilling to help," says Carter. She recalls at the beginning of the 2016-17 school year, some of her ninth-grade students attended a middle grades school where they experienced MDC strategies and formative assessment lessons.

**"These students became unsuspecting advocates. They would tell the other students, 'you have to try first,' admonishing them not to be so quick to ask for help, but try to work the problem first," says Carter. This peer endorsement of sorts helped break down the barriers and resistance to productive struggle.**

### Data Tell the Story

Carter believes the tools and strategies of MDC help improve students' standardized assessment scores. In 2014-15 and 2015-16, West Virginia used the Smarter Balanced Assessment to measure the achievement of students in



Stephanie Carter  
Riverside High School

grades nine, 10 and 11 in English language arts and math, and to determine a school's growth in scores from one year to the next.

Carter notes that less than six months after implementing MDC in her classroom, she saw an increase in her students' scale scores on the Smarter Balanced Assessment. **In the 2014-15 school year, her algebra and algebra support students' average scale score was 1.42 compared to 1.74 in the 2015-16 school year — six months later. Scale scores range from a low of Level 1 to a high of Level 4.**

### MDC AND TEACHING GRIT

"If faced with something they don't know right away, my students seem to think they can't do it," says Stephanie Carter.

Teaching them grit involves asking, "if you don't know this, then what do you know? Take what you do know and try to work from that and see if you can solve the problem," she notes. "It's the problem-solving skills that I think they get."

Stephanie Carter  
RHS Algebra I and algebra support teacher



It's worth noting that many of Carter's algebra support students are typically low-performing students or have special needs.

Student growth is even more impressive when looking at the state's Diagnostic Assessment (see tables 15, 16) and comparing Carter's Algebra I students to Algebra I students in other classes where MDC instruction was not used.

**In Diagnostic 1, which evaluated students' proficiency in concepts such as inequalities and multi-step equations, Carter's students earned an average score of 55 percent. Students who did not receive MDC instruction scored significantly lower. Diagnostic 2 evaluated concepts such as constructing an argument and problem solving. As the table reflects, Carter's class again outperformed students who did not receive MDC instruction.**

"I see a difference in Stephanie's classroom," says Principal **Valery Harper**. "The students are investigating, thinking, experiencing productive struggle, and with all of this, still having fun in the classroom. **The students will tell you this is their favorite class of the day, but they also are experiencing higher rates of learning. MDC gives us the best of both worlds!**"

Harper notes RHS had a 7 percent average increase in the ninth-grade Smarter Balanced scores when comparing the 2014-15 school year to the 2015-16 school year when MDC was implemented. **She also notes that schoolwide, MDC-trained teachers showed an average of 21 percent higher student scores over students who were taught by non-MDC-trained teachers.**

## MDC Strategies Transform Student Learning

During his seven years teaching middle grades and high school mathematics in northern West Virginia, **Craig Mason**, a math teacher at **New Martinsville School**, often receives encouraging notes from parents of students. They tell him he is "the first math teacher my child ever understood" or "my kid finally 'gets' math from being in your class."

He is confident in his ability to reach students. When **Wetzel County Schools** chose to participate in SREB professional development for the Mathematics Design Collaborative with middle grades and high school teachers in fall of 2015, Mason found that the formative assessment lessons easily aligned with the West Virginia College and Career Readiness Standards and provided a valuable resource for his students to apply learning to complex and real-life applications.

**Table 15**  
**Riverside High School: Algebra I Diagnostic #1**  
**Assessment 2015-16**

MDC Instruction (Carter's class)	55%
Non-MDC Instruction	32

Source: West Virginia Department of Education

**Table 16**  
**Riverside High School: Algebra I Diagnostic #2**  
**Assessment 2015-16**

MDC Instruction (Carter's class)	21%
Non-MDC Instruction	14

Source: West Virginia Department of Education

**"The lessons challenge my students to levels they were not typically accustomed to in their previous math classes (prior to MDC),"** says Mason, **"but they are also accessible to every student, which is very important."** He credits the structure of the FALs and the focus on improving students' math habits with his students' increased ability to construct viable arguments and critique the reasoning of others.

Mason also credits FALs with encouraging his students to participate as active learners through proper questioning, peer-to-peer critique and persevering when tackling challenging problems. "My students' level of engagement is transformed since involving them in MDC strategies," he continues.

## Following the FALs

Mason describes how he helps students address common misconceptions following FALs. “After assessing the pre- and post-tests following the FAL, I will address common misconceptions through full-class discussion, group assignments (peer-to-peer learning), Carnegie Tutor online (interactive software) or partner problem-solving activities,” he says.

One example: “Following our problem-solving FAL on volume (Using Space Efficiently: Packing a Truck), we went back and addressed common misconceptions through additional discussion, online interactive Carnegie Lessons and group assignments (peer-to-peer learning),” he says.

“We ended that re-engagement with a (Math Assessment Project) task, ‘Fearless Frames,’ where students developed a rectangular and triangular box from metal tubing. The goal is to maximize the volume of that box from a set amount of tubing,” he says.

**“This problem-solving task lets my students show me that they conceptually understand volume of rectangular and triangular prisms, the seventh-grade state standard for volume.”**

## Students Increasingly More Confident

Mason sees his students becoming increasingly more confident in their ability to solve complex problems, which enables them to discuss their thinking within a group of peers with less hesitation. **“My students are more confident in their ability to do math now that I encourage them to productively struggle,”** he says.



Craig Mason  
Wetzel County Schools

His students’ fear of failure is steadily decreasing, as evidenced by the students’ willingness to provide alternative methods of approaching problems and constructively critiquing the thought processes of others. Their performance on the West Virginia General Summative Assessment made him proud. **Although the county and his school showed marked growth after only one year using MDC strategies, the proficiency level of Mason’s class was greater than both.**

Wetzel County district leaders are encouraged by the improvements students are making since the district implemented MDC tools and strategies. Table 17 shows the same group of students as they moved from sixth grade to seventh grade. The state of West Virginia showed an average growth in students scoring Proficient of 4 percentage points. Wetzel County students grew by 9 percentage points, and New Martinsville School students grew by 17 percentage points. The percentage of Mason’s students scoring Proficient or above beat the state and district by 5 and 10 percentage points, respectively in 2016.

Table 17

## Percentages of Students Scoring Proficient on the West Virginia General Summative Assessment

SCHOOL	BEFORE MDC SIXTH GRADE (2015)	AFTER MDC SEVENTH GRADE (2016)
West Virginia	26%	30%
Wetzel County	16	25
New Martinsville School	15	32
Mason’s 7th Grade	NA	35

\* The NA from the seventh-grade class indicates that Mason didn’t have those students in the sixth grade.

## Leading Teachers

Mason serves on the Leaders of Learning committee, a Regional Education Service Agency-level committee that focuses on improving professional learning communities. The committee held teacher-showcase days, where teachers can observe their colleagues in their classroom (a “showcase” lesson).

Mason sees the showcase day as a prime opportunity for his colleagues to observe a lesson while implementing the strategies learned with MDC. Since his school gained a new teacher this year, Mason and the other MDC-trained eighth-grade teacher, **Justin Cochran**, shared research-based strategies by implementing a FAL with their new colleague, but they didn't stop there.

“I also reached out to our K-5 teachers with the Concept Development and Problem Solving FALs used by the Kentucky Department of Education,” he says. “I showed [them] the resources [available from the state], and we completed a problem-solving task together as a group, ‘The Snail in the Well.’ I showed them the general procedure for conducting a FAL.”

## MDC Makes Math Come Alive for Students

**Brittany Dameron**, math teacher at Riverside High School in Belle, West Virginia (Kanawha County School District), quickly discovered that the Mathematics Design Collaborative tools and strategies, such as formative assessment lessons, make math come alive for her students.

“Someone once told me that, in the education world, there would be times that you experience paradigm shifts that forever alter the way you see education,” she said immediately after her first semester implementing MDC tools and strategies. **“When I first experienced MDC, I never imagined that this would be one of them.”**

The 2016-17 school year was the first time she used the Representing Trigonometric Functions Concept Development FAL in her trigonometry and precalculus class. The FAL is designed to help students determine the formula to measure the revolving height of a person on a rotating Ferris wheel. Students must be able to reason abstractly and quantitatively, model with mathematics, and look for and make use of structure.

He also invited all the math teachers, kindergarten through eighth grade, to observe his classroom while implementing a FAL. **Additionally, Mason has reached out to colleagues in other content areas to share strategies, practices, and FALs and the benefits of proper questioning within the classroom that push students forward without doing the work for them.**

Mason is now a teacher-leader in his school and is respected as such at the county level as well. He was chosen to take a leadership and support role as an MDC local trainer for Wetzel County for the 2017-18 school year.

**He is also a 2017 state-level finalist for the Presidential Award for Excellence in Mathematics and Science Teaching (PAEMST) program.** The award, given on behalf of the White House Office of Science and Technology Policy, is the highest honor the U.S. government bestows on K-12 mathematics and science teachers, acknowledging model teachers who inspire their communities and lead the improvement of mathematics and science. He will be recognized at the annual conference of the West Virginia Council of Teachers of Mathematics in March 2018.

## Raising the Grade

Students' final grade in the two-semester course is 50 percent trigonometry and 50 percent pre-calculus. During the 2015-16 academic year, the average final grade for the trigonometry portion of the course was 80. **With the benefit of formative assessment lesson and Dameron's use of MDC strategies on a regular basis, the average grade for students in the 2016-17 school year rose to 83.**

“For me, this year with MDC has been even more amazing, if that's possible, than last year,” Dameron says. “I have noticed two key changes in my students.

**“They are not asking me to give them answers.** They are asking for me to help them. I am amazed at this transition,” she says. “My students are not asking me to GPS them; they are asking questions to guide their learning. When I got away from the level-one questions in my classroom, my kids did also.

**“My students are no longer afraid to persevere through hard tasks,”** she adds. “The expectations and the bar have been raised in my classroom. If students have a ‘simple’ assignment, they automatically question what they did wrong. They no longer give up when they can’t get a right answer. They keep trying to get the right answer.”

## Guided Teaching

**Kimberly Goff**, SREB’s MDC trainer in West Virginia, says, “Brittany worked hard to utilize the lessons with strategic placement throughout her units to guide her teaching.” “She made productive struggle an expectation in her classrooms by learning how to provide feedback, rather than answers, and encouraging students to use one another as resources as they solve problems.

**“Now, the students roll up their sleeves and dig in,”** Goff continues. **“Brittany is a resource, not the holder of the answers, and her students are much better for it.”**

“I love the MDC strategies and find them so helpful in my classroom,” Dameron concludes. “Not only do I feel like my students are better prepared in terms of content and persevering for the [state] test, but they are more engaged in class.



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# Appendix A: Alabama Achievement Data

## Alabama College- and Career-Readiness Percentages for Math in Schools Implementing MDC

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER-READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER-READINESS STANDARDS
Alabama State Average	38.2%	41.2%
<b>Blount County</b>		
Hayden Middle School*	40.4	61.7
JB Pennington High School*	23.2	34.7
<b>Jefferson County</b>		
Bragg Middle School*	42.7	52.0
Brighton Middle School*	19.8	30.0
Irondale Middle School*	28.0	31.7
North Jefferson Middle School*	43.7	49.7
Rudd Middle School*	25.3	32.0
<b>Macon County</b>		
Notasulga High School*	12.0	18.3
<b>Oxford City</b>		
Oxford Middle School*	38.3	46.3
<b>Walker County</b>		
Bankhead Middle School*	21.7	40.7
Carbon Hill Jr High School*	28.6	41.1

Source: Alabama Department of Education

Note. \* = The school experienced a gain across one academic year.

College and career readiness is commonly referred to as a student's ability to qualify for and succeed in credit-bearing college courses leading to baccalaureate degrees, associate degrees or certificates, or career pathway-oriented training programs without the need for remedial course work. However, states may use different criteria to define college and career readiness; therefore, for the purpose of this report, college and career readiness standards may vary by state and the summative assessment(s) administered in those states.

# Appendix B: North Carolina Achievement Data

## Percentages of Sixth- and Seventh-Grade Students in North Carolina Schools Implementing MDC That Meet College- and Career-Readiness Standards in Mathematics on the State End-of-Grade Assessment

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
North Carolina State Average	42.0%	44.7%	47.6%
<b>Alamance-Burlington</b>			
Graham Middle School**	15.8	20.5	24.8
Hawfields Middle School**	32.4	52.5	54.3
Southern Middle School**	42.1	43.0	48.5
Western Middle School**	44.2	45.8	49.9
Woodlawn Middle School**	54.8	58.2	58.4
<b>Asheboro</b>			
South Asheboro Middle School**	34.6	40.0	43.9
<b>Bertie County</b>			
Bertie Middle School**	15.4	20.4	26.2
<b>Buncombe County</b>			
Valley Springs Middle School**	55.4	58.8	61.4
<b>Burke County</b>			
Heritage Middle School*	52.9	47.6	52.4
Table Rock Middle School*	41.5	38.3	47.0
Walter Johnson Middle School**	44.2	45.3	48.2

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Catawba County</b>			
Maiden Middle School*	—	32.7	45.4
Mill Creek Middle School*	—	52.1	52.3
Riverbend Middle School*	—	34.9	38.3
<b>Columbus County</b>			
Acme Delco Middle School**	12.9	21.6	23.8
Cerro Gordo Elementary School*	—	47.7	49.6
Evergreen Elementary*	—	29.4	35.6
Williams Township Middle School**	38.7	41.0	45.3
<b>Craven County</b>			
Grover Fields Middle School*	—	48.9	52.6
HJ MacDonald Middle School*	—	46.0	49.0
Tucker Creek Middle School*	—	55.9	56.7
<b>Gaston County</b>			
Belmont Middle School*	—	53.7	56.4
Bessemer City Middle School*	—	18.7	23.4
Cramerton Middle School*	—	55.4	63.1
Holbrook Middle School*	—	36.8	45.2
Southwest Middle School*	—	24.0	29.3
Stanley Middle School*	—	34.3	39.3
WC Friday Middle School*	—	35.8	38.8
WP Grier Middle School*	—	32.6	38.5
York Chester Middle School*	—	15.5	17.3



DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Granville County</b>			
Butner-Stem Middle School*	—	18.7	24.8
GC Hawley Middle School*	—	35.4	47.0
<b>Hickory</b>			
Grandview Middle School*	—	25.2	27.6
<b>Lenoir County</b>			
Contentnea-Savannah School**	25.2	28.0	30.3
EB Frink Middle School**	21.6	27.6	32.3
Rochelle Middle School*	8.8	8.2	12.5
Woodington Middle**	20.3	27.0	27.4
<b>Madison County</b>			
Madison Middle School*	41.1	40.6	42.9
<b>Nash-Rocky Mount</b>			
Rocky Mount Middle School**	9.2	9.9	11.4
Red Oak Middle School*	24.6	24.4	29.0
Southern Nash Middle School**	23.6	25.7	27.4
<b>Onslow County</b>			
Dixie Middle School*	—	34.6	38.8
Hunters Creek Middle School*	—	24.9	29.8
Jacksonville Commons Middle School*	—	27.7	33.6
New Bridge Middle School*	—	42.9	43.2
Southwest Middle School*	—	27.3	27.5
Swansboro Middle School*	—	32.6	36.9
Trexler Middle School*	—	39.8	40.5

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Orange County</b>			
Charles Stanford Middle School**	48.8	55.1	58.7
<b>Person County</b>			
Northern Middle School*	—	25.1	32.2
Southern Middle School*	—	33.0	36.8
<b>Randolph County</b>			
Northeastern Randolph Middle School*	—	34.8	39.6
Randleman Middle School*	—	31.3	35.1
Southwestern Randolph Middle School*	—	38.3	39.8
Uwharrie Middle School*	—	27.9	29.6
<b>Roanoke Rapids</b>			
Chaloner Middle School*	34.3	32.1	42.7
<b>Robeson County</b>			
Fairgrove Middle School*	—	19.3	19.5
Fairmont Middle School*	—	22.8	23.9
Gilbert Carroll Middle School*	—	30.3	31.0
Lumberton Junior High School*	—	13.3	13.9
Magnolia Elementary School*	—	17.1	22.3
Orrum Middle School*	—	18.0	23.0
Parkton Elementary School*	—	33.8	36.1
Pembroke Middle School*	—	16.7	17.2
Saint Paul's Middle School*	—	24.2	24.9
Townsend Middle School*	—	7.6	8.8

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Rowan-Salisbury</b>			
Erwin Middle School**	20.4	22.4	24.5
China Grove Middle School**	25.4	31.2	31.8
North Rowan Middle School*	20.6	18.9	21.5
<b>Rutherford County</b>			
Chase Middle School**	31.1	38.4	44.2
East Rutherford Middle School*	32.2	29.2	31.3
<b>Sampson County</b>			
Hobpton Middle School**	36.7	44.2	45.3
Midway Middle School**	44.7	53.0	64.3
<b>Stanly County</b>			
Albemarle Middle School*	31.1	31.0	32.4
North Stanly Middle School**	40.6	44.1	47.0
West Stanly Middle School**	40.9	45.0	52.7

Source: North Carolina Department of Public Instruction

Note. \* = The school experienced a gain across one academic year. Note. \*\* = The school experienced gains across two academic years.

North Carolina Department of Instruction does not report exact percentages greater than 95 percent. All percentages greater than 95% are reported as >95%.

College and career readiness is commonly referred to as a student's ability to qualify for and succeed in credit-bearing college courses leading to baccalaureate degrees, associate degrees or certificates, or career pathway-oriented training programs without the need for remedial course work. However, states may use different criteria to define college and career readiness; therefore, for the purpose of this report, college and career readiness standards may vary by state and the summative assessment(s) administered in those states.

## Percentages of Students in North Carolina Schools Implementing MDC That Meet College- and Career-Readiness Standards in Math on the State End-of-Course Mathematics I Assessment

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
North Carolina State Average	48.6%	49.8%	54.1%
<b>Alamance-Burlington</b>			
Alamance-Burlington Middle College*	—	64.1	>95.0
Broadview Middle School**	59.6	84.9	88.5
Eastern Alamance High School**	44.1	50.5	53.0
Hawfields Middle School**	86.5	>95.0	>95.0
Southern Middle School*	94.6	85.0	>95.0
Turrentine Middle School**	75.0	78.6	>95.0
Western Alamance High School**	38.2	39.1	47.8
Woodlawn Middle School	>95.0	>95.0	>95.0
<b>Asheboro City</b>			
Asheboro High School **	31.7	34.2	34.6
South Asheboro Middle School**	62.7	88.9	>95.0
<b>Bertie County</b>			
Bertie Middle School*	83.9	64.3	88.0
<b>Buncombe County</b>			
Buncombe County Early College High School*	67.9	55.9	71.7
Cane Creek Middle School*	90.8	>95.0	>95.0
Enka Middle School*	89.7	86.1	91.4
Erwin High School*	27.2	19.8	36.7
Owen High School**	28.4	40.0	41.9
Owen Middle School**	74.4	91.7	>95.0

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Buncombe County (continued)</b>			
Nesbitt Discovery Academy*	88.4	>95.0	>95.0
North Buncombe High School**	40.8	51.3	64.1
North Buncombe Middle School**	87.1	87.7	>95.0
Reynolds Middle School*	89.3	>95.0	>95.0
Valley Springs Middle School	>95.0	>95.0	>95.0
<b>Burke County</b>			
East Burke High School*	49.3	47.4	68.5
Freedom High School**	39.0	43.7	43.8
Jimmy Draughn High School**	48.0	51.9	60.0
Robert Patton High School*	51.2	47.5	54.5
<b>Catawba County</b>			
Arndt Middle School	—	>95.0	>95.0
Bandys High School*	—	53.9	63.1
Bunker Hill High School*	—	21.5	37.1
Challenger Early College High School*	—	78.6	80.4
Fred Foard High School*	—	39.0	41.5
Jacobs Fork Middle School	—	>95.0	>95.0
Maiden Middle School*	—	90.8	>95.0
Mill Creek Middle School	—	>95.0	>95.0
Riverbend Middle School	—	>95.0	>95.0
Saint Stephens High School*	—	38.4	43.7

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Columbus County</b>			
Cerro Gordo Elementary School*	—	84.6	85.7
East Columbus High School**	12.8	26.2	33.3
Williams Township Middle School*	90.9	86.7	88.3
<b>Craven County</b>			
Early College EAST High School*	—	60.8	71.7
Grover Fields Middle School*	—	94.1	>95.0
HJ MacDonald Middle School	—	>95.0	>95.0
Havelock High School*	—	46.4	54.0
Havelock Middle School	—	>95.0	>95.0
New Bern High School*	—	37.4	41.0
Tucker Creek Middle School	—	>95.0	>95.0
West Craven Middle School*	—	87.5	>95.0
<b>Gaston County</b>			
Belmont Middle School*	—	86.0	93.4
Bessemer City High School*	—	13.9	17.3
Bessemer City Middle School*	—	67.7	84.6
Cherryville High School*	—	31.8	38.3
Cramerton Middle School*	—	87.2	>95.0
East Gaston High School*	—	30.7	39.1
Forestview High School*	—	33.8	38.9
Gaston Early College High School*	—	73.6	82.7
Holbrook Middle School*	—	81.3	>95.0
Hunter Huss High School*	—	19.0	24.3

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Gaston County (continued)</b>			
John Chavis Middle School*	—	65.9	>95.0
Mount Holly Middle School	—	>95.0	>95.0
North Gaston High School*	—	28.1	32.7
South Point High School*	—	38.5	47.1
Southwest Middle School*	—	70.9	81.5
Stuart Cramer High School*	—	43.0	54.4
WC Friday Middle School*	—	87.0	>95.0
Webb Street School*	—	6.7	12.5
York Chester Middle School*	—	30.4	92.3
<b>Granville County</b>			
GC Hawley Middle School*	—	64.0	78.4
Granville Central High School*	—	21.8	35.9
Granville Early College High School*	—	57.4	76.3
JF Webb High School*	—	12.4	15.7
Mary Potter Middle School*	—	92.3	>95.0
<b>Hickory County</b>			
Northview Middle School	—	>95.0	>95.0
<b>Lenoir County</b>			
Contentnea-Savannah School**	75.0	77.3	>95.0
EB Frink Middle School**	59.2	79.4	92.3
Kinston High School**	8.8	10.1	11.2
South Lenoir High School*	20.3	19.8	30.5
Woodington Middle School*	86.2	71.7	84.8

DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Madison County</b>			
Madison Early College High School*	69.1	53.6	69.8
Madison Middle School	>95.0	>95.0	>95.0
<b>Nash-Rocky Mount</b>			
JW Parker Middle School**	25.0	30.0	50.0
Nash Central High School*	22.6	15.9	31.2
Northern Nash High School*	27.3	19.6	30.2
Red Oak Middle School*	73.6	63.9	91.7
Rocky Mount Middle School*	54.5	25.0	59.3
Southern Nash Middle School*	83.6	82.1	>95.0
<b>Onslow County</b>			
Dixon Middle School*	—	61.8	93.8
Hunters Creek Middle School*	—	48.3	86.7
Jacksonville High School*	—	23.7	32.8
Jacksonville Commons Middle School*	—	83.3	84.9
New Bridge Middle School*	—	85.1	>95.0
Northside High School*	—	40.3	68.6
Northwoods Park Middle School*	—	52.6	75.0
Richlands High School*	—	25.0	39.6
Southwest Middle School*	—	56.9	63.0
Swansboro High School*	—	36.5	37.5
Swansboro Middle School*	—	83.9	90.9
Trexler Middle School*	—	39.8	40.5
White Oak High School*	—	25.5	35.9



DISTRICTS/SCHOOLS	2014-15 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2015-16 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS	2016-17 PERCENTAGES OF STUDENTS MEETING GRADE-LEVEL COLLEGE- AND CAREER- READINESS STANDARDS
<b>Orange County</b>			
AL Stanbeck Middle School*	87.5	>95.0	>95.0
Cedar Ridge High School**	37.7	52.8	56.4
Charles Stanford Middle School	>95.0	>95.0	>95.0
Gravelly Hill Middle*	>95.0	90.0	>95.0
Orange High School**	38.0	42.3	49.1
<b>Pamlico County</b>			
Pamlico County High School*	—	42.7	55.0
Pamlico County Middle School*	—	91.7	>95.0
<b>Person County</b>			
Northern Middle School	—	>95.0	>95.0
Person High School*	—	27.1	38.6
Southern Middle School	—	>95.0	>95.0
<b>Randolph County</b>			
Archdale-Trinity Middle School*	—	87.7	90.7
Northeastern Randolph Middle School*	—	89.6	>95.0
Providence Grove High School*	—	34.1	38.9
Randleman High School*	—	32.4	38.5
Randolph Early College High School*	—	73.6	77.3
Southwestern Randolph High School*	—	38.8	41.2
Southwestern Randolph Middle School*	—	83.6	90.7
Trinity High School*	—	47.4	54.2
Uwharrie Middle School*	—	83.3	>95.0
Wheatmore High School*	—	50.0	51.7

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<b>Roanoke Rapids</b>			
Chaloner Middle School*	74.7	70.5	85.7
<b>Robeson County</b>			
Littlefield Middle School	—	>95.0	>95.0
Lumberton Junior High School*	—	70.8	85.0
Lumberton Senior High School*	—	17.1	20.3
Magnolia Elementary School*	—	69.0	75.9
Pembroke Middle School*	—	92.9	>95.0
Purnell Swett High School*	—	23.0	23.5
Robeson County Early College High School*	—	78.4	83.6
Saint Paul's High School*	—	17.2	20.0
South Robeson High School*	—	10.2	16.5
<b>Rowan-Salisbury</b>			
Carson High School**	29.2	33.6	35.2
China Grove Middle School**	86.0	90.2	>95.0
Corriher Lipe Middle School**	73.1	82.1	>95.0
Erwin Middle School*	74.3	55.6	90.2
Knox Middle School*	62.5	56.0	64.5
North Rowan Middle School*	87.5	67.3	>95.0
Rowan County Early College High School*	60.0	51.6	60.0
Southeast Middle School*	67.7	61.2	79.7
<b>Rutherford County</b>			
Chase High School**	26.9	33.2	35.6
Chase Middle School**	78.6	80.6	>95.0

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<b>Rutherford County (continued)</b>			
R-S Central High School**	19.8	31.0	39.3
R-S Middle School	>95.0	>95.0	>95.0
Rutherford Early College High School**	55.1	61.2	83.7
<b>Sampson County</b>			
Early College High School**	54.5	84.1	>95.0
Hobbtown Middle School**	88.5	90.9	>95.0
Lakewood High School*	32.1	27.6	40.3
Midway High School**	47.7	49.5	60.8
Midway Middle School*	92.2	90.9	>95.0
Roseboro-Salemburg Middle School**	76.0	78.3	94.7
Union High School**	23.5	36.8	43.4
<b>Stanly County</b>			
Albemarle Middle School**	78.4	80.8	>95.0
North Stanly Middle School*	87.9	>95.0	>95.0
North Stanly High School*	35.0	17.8	43.8
South Stanly High School*	50.0	30.7	44.6
South Stanly Middle School*	75.0	>95.0	>95.0
Stanly Early College High School**	54.9	68.0	73.3
West Stanly Middle School*	>95.0	92.5	>95.0
<b>Vance County</b>			
Southern Vance High School*	—	9.5	16.6
Vance County Early College High School*	—	36.4	53.6
STEM Early High School*	—	32.9	53.6

Source: North Carolina Department of Public Instruction

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