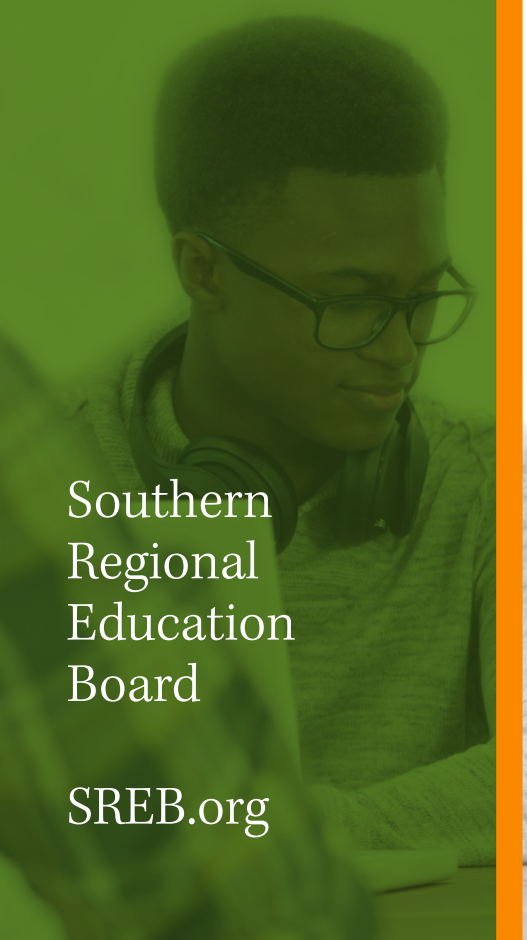
SREB

Engaging Students in Deeper Learning Through Powerful Literacy and Mathematics Assignments



Southern Regional Education Board

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Inside

The Southern Regional Education Board is a nonprofit, nonpartisan organization based in Atlanta that works with state leaders and educators to improve education. SREB was created in 1948 by Southern governors and legislators to help leaders in education and government work cooperatively to advance education and improve the social and economic life of the region. SREB's 16 members states are Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia.

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Engaging Students in Deeper Learning Through Powerful Literacy and Mathematics Assignments

Introduction

Far too many students graduate high school without the foundational literacy and mathematics skills needed to succeed in postsecondary education and careers. This trend is largely attributable to students' classroom learning experiences. Students are not exposed to the types of complex grade-level literacy and mathematics assignments that will advance their achievement and prepare them for college and careers. District and school leaders need to support teachers to put in place classroom practices to reverse this trend.

The Southern Regional Education Board (SREB) provides professional development to teachers in the instructional strategies of the Literacy Design Collaborative (LDC) and the Mathematics Design Collaborative (MDC). **This professional development provides time for teachers to receive out-of-class guided instruction in planning assignments that engage students in challenging learning experiences followed by embedded classroom coaching and feedback**.

In 2017, SREB partnered with My Student Survey to develop and administer surveys to middle grades and high school students in schools where LDC and MDC instructional practices were implemented. **The focus of the study was to compare the instructional experiences students encountered in the classrooms of teachers who experienced intensive LDC and MDC professional development from SREB (LDC and MDC trained teachers) to students who were in classrooms of teachers who had not participated in this professional development (non-LDC and non-MDC trained teachers).** The data show SREB strategies produce good results in helping teachers and students grow and achieve their best.

The Findings

Overall, analyses of student perceptions indicate that students in classrooms where LDC and MDC were used experienced the desired literacy and mathematics instruction to a greater degree than students in non-LDC/MDC classrooms. The study found LDC-trained teachers in English language arts (ELA), social studies, science and career and technical education (CTE) incorporated literacy-based assignments in their curricula more often than non-LDC-trained teachers. Students in classrooms where LDC had been implemented were reading and discussing grade-level texts and writing about those texts more often than students in classrooms where LDC had not been used.

Based on student perceptions, results show that LDC- and MDC-trained teachers engaged students in more challenging assignments and used more questioning and feedback strategies to address students' deeper understanding of literacy-based assignments and mathematical concepts, and to motivate students to assume greater ownership of their learning. Both LDC and MDC students reported their teachers encouraged peer discussion, and students experienced classroom environments that promoted collaboration and active learning to a greater extent than students in comparison classrooms.

The Frameworks

LDC is a planning framework for incorporating rigorous literacy standards into middle grades and high school content area assignments. LDC provides a system for creating assignments using reading, writing and thinking skills and strategies to advance students' academic achievement and their abilities to read, comprehend and analyze grade-level texts and express their understanding orally and in writing.

MDC is a planning framework for using formative assessment lessons (FALs) to engage students in assignments that advance their understanding of mathematics concepts and fluency with mathematics procedures. FALs allow teachers to gauge what students understand and do not understand and to correct misconceptions. This framework helps mathematics teachers shift from "GPSing" students, (e.g. telling students step-by-step how to arrive at the answer) to allowing students to think, reason through and productively struggle to solve complex, multistep, abstract and real-world problems.

For the past three academic years, SREB has partnered with school districts across the South to help teachers implement these planning frameworks in a manner that engages students in deeper, higher-level assignments to positively impact student learning.

Scope of Work

The surveys were administered in schools where LDC and MDC have been implemented and professional development and other support have been provided by SREB. For comparison purposes, the surveys were administered to students in classrooms where teachers had received LDC or MDC training, classroom coaching and feedback, and to students in classrooms where LDC and MDC strategies were not used (non-LDC and non-MDC classrooms). The LDC survey was administered to 25,820 students, and the MDC survey was administered to 11,300 students.

Each survey consisted of approximately 40 items, and each item had a five-point response scale (1 = Never, 2 = Sometimes, 3 = Often, 4 = Almost Always and 5 = Always). Each survey was designed to measure the broad instructional practices expected if teachers were implementing the frameworks with fidelity. The survey items aligned to each instructional practice and were divided into five categories. These categories reflect the desired instructional practices directly associated with the LDC and MDC frameworks.

Five Categories of the LDC Survey

Objectives and Learning Targets refer to how well teachers explain the learning goals of their lessons and activities. Example item: When we go over the daily learning goals, my teacher has us think about what we already know concerning the topic.

Reading Strategies refer to how well teachers use LDC reading strategies in their classrooms. Example item: In this class, my teacher helps us learn how to find the main ideas in our readings.

Student Ownership of Learning refers to how well teachers establish classroom environments that promote active learning. Example item: My teacher asks questions that make me really think about the texts we read.

Writing Strategies refer to how well teachers use LDC writing strategies in their classrooms. Example item: I write essays in this class to show what I have learned.

Assessments measure whether teachers use a variety of assessment strategies to monitor student learning. Example item: My teacher has us show what we know in different ways.

Five Categories of the MDC Survey

Balanced Approach to Mathematics Instruction refers to how well teachers use a variety of activities to improve student understanding of mathematical concepts. Example item: The teacher encourages us to come up with our own ways to solve problems.

Assignments That Matter measures whether teachers use rigorous, grade-level mathematics assignments in their classrooms. Example item: When we are doing classwork, my teacher walks around the room to ask us questions about how we are solving the problem.

Utilizing Questioning and Feedback for Deeper Understanding refers to teachers' use of questioning and feedback strategies to advance students' understanding of mathematical concepts. Example item: When we go over a problem, my teacher asks me to discuss how I came up with my answer.

Adapting Teaching and Learning refers to how well teachers adjust their instruction to target students' learning needs. Example item: If I do not do well on an assignment, my teacher helps me relearn the material with a new assignment.

Student Ownership of Learning refers to how well teachers establish classroom environments that support student ownership of learning. Example item: When we work in groups, we discuss the best way to solve a problem.

The following sections present the aggregated mean scores by category (e.g., Adapting Teaching and Learning, Student Ownership of Learning, etc.) for both the LDC and MDC student surveys. Appendices A and B list the mean scores for each individual LDC and MDC survey item.

Literacy Design Collaborative Student Survey Results

The analyses used detected significant differences between students reporting classroom learning experiences under LDC-trained teachers and those under non-LDC-trained teachers across all five broad categories of desired instructional practice. Appendix C details the analyses used to detect group differences and effect sizes.

Results showed that students in LDC classrooms received more concentrated support from their teachers. They spent more time comparing, contrasting and synthesizing grade-level texts, and they were writing about those texts more often.

Also, LDC-trained teachers provided their students with more effective feedback on their writing and other assignments. Moreover, LDC students indicated that they spent more time discussing texts with their classmates, including sharing ideas and formulating questions. Results are shown in Table 1.

Additionally, across every subject area tested (ELA, science, social studies and CTE courses), students in classrooms where LDC had been implemented rated their teachers significantly higher in their use of literacy-based assignments than students in classrooms where LDC had not been used. This finding shows that regardless of discipline, LDC can be used to help teachers incorporate literacy-based assignments in their curricula.

Moreover, LDC was effective for teachers at all experience levels (0-2, 3-10 and 11 or more years of teaching experience). According to students surveyed, LDC-trained teachers at every level, those **with one, two and three years of training, were using effective literacy practices more frequently than non-LDC teachers.**

TABLE 1

Mean Category Scores for LDC Classrooms and Non-LDC Classrooms

Categories	LDC Classrooms	Non-LDC Classrooms
Objectives and Learning Targets	3.90**	3.76
Reading Strategies	3.64**	3.46
Student Ownership of Learning	3.73**	3.58
Writing Strategies	3.57**	3.36
Assessments	3.78**	3.62

Source: My Student Survey
Note: ** = Mean difference is significant at the .01 level; * = Mean difference is significant at the .05 level.
LDC classrooms = Teachers received training in literacy strategies from SREB.
Non-LDC classrooms = Teachers did not receive SREB literacy-based training.

Finally, teachers who received three years of LDC training were rated significantly higher than teachers with one or two years of experience, **which implies that over time, teachers with additional support continue to improve in their abilities to plan and implement assignments using the LDC framework with fidelity**. Results are shown in Table 2.

TABLE 2

Mean Category Scores for LDC Classrooms and Non-LDC Classrooms by Years of Teacher Training

Categories	No LDC Training	One Year of LDC Training	Two Years of LDC Training	Three Years of LDC Training
Objectives and Learning Targets	3.78	3.88**	3.88**	3.94**
Reading Strategies	3.47	3.63**	3.60**	3.81**
Student Ownership of Learning	3.60	3.71**	3.70**	3.89**
Writing Strategies	3.37	3.56**	3.54**	3.79**
Assessments	3.63	3.78**	3.74**	3.92**

Source: My Student Survey
Note: ** = Mean difference is significant at the .01 level.

Mathematics Design Collaborative Student Survey Results

For MDC, all five categories of the survey showed significant differences in student perceptions between MDC-trained and non-MDC trained teachers. This finding indicates that MDC-trained teachers were more effective at helping their students develop conceptual knowledge and procedural fluency, and apply mathematics skills to real-world problems. Furthermore, MDC-trained teachers were more effective at adjusting their instruction to meet student needs, and at creating classroom environments that promote active learning. Results are shown in Table 3. See Appendix C for more information on the analyses used to detect group differences and effect sizes.

TABLE 3

Mean Category Scores for MDC Classrooms and Non-MDC Classrooms

Categories	MDC Classrooms	Non-MDC Classrooms
Balanced Approach to Mathematics Instruction	3.65**	3.57
Assignments That Matter	3.61**	3.52
Utilizing Questioning and Feedback for Deeper Understanding	3.80**	3.71
Adapting Teaching and Learning	3.28*	3.22
Student Ownership of Learning	3.84**	3.76

Source: My Student Survey
Note: ** = Mean difference is significant at the .01 level; * = Mean difference is significant at the .05 level.
MDC classrooms = Teachers received training in math strategies from SREB.
Non-MDC classrooms = Teachers did not receive SREB math training.

Like LDC, analyses showed MDC to be effective for teachers at all experience levels (0-2, 3-10 and 11 or more years), and to be more effective for teachers with three years of training experience. Of importance, on four of five categories (Balanced Approach to Mathematics Instruction, Assignments That Matter, Utilizing Questioning and Feedback for Deeper Understanding and Student Ownership of Learning), students experiencing desired mathematics practices rated teachers at all levels of MDC training significantly higher than non-MDC-trained teachers.

On one scale, Adapting Teaching and Learning, a significant difference between MDC-trained teachers and non-MDC-trained teachers was not detected until MDC-trained teachers had received two years of MDC training. This could be due to SREB's failure to address skills and strategies associated with this category (e.g., adjusting lessons, re-engaging students in previously covered material, etc.) until the second year of professional development. Professional development on these skills was greatly accelerated in Years 2 and 3 as a result of data collected from earlier surveys. Results are shown in Table 4.

TABLE 4

Mean Category Scores for MDC Classrooms and Non-MDC Classrooms by Years of Teacher Training

Categories	No MDC Training	One Year of MDC Training	Two Years of MDC Training	Three Years of MDC Training
Balanced Approach to Mathematics 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: My Student Survey
Note: ** = Mean difference is significant at the .01 level.

Advancing Student Achievement

A preliminary review of schools with available data that have used LDC for one to two full academic years revealed reason for optimism. The districts below have seen significant gains in student achievement in classrooms where literacy-based assignments were implemented with fidelity. Not all states had released their 2016-17 achievement data at the time of this report.

The Impact of the Literacy Design Collaborative on Student Achievement

In Alabama, ACT Aspire ELA data were collected from 36 middle grades schools (grades six through eight) across nine districts. Of those 36 schools, 27 made significant gains from the 2015 to 2016 academic years. Eight of those schools made gains greater than the state.

In Louisiana, state end-of-course ELA III data were collected from the Ouachita Parish school district. All five of the district's high schools showed significant increases from the 2016 to 2017 academic years that were greater than gains made by the state.

In North Carolina, state end-of-grade (EOG) ELA and state end-of-course (EOC) ELA II data were collected from 236 schools across 26 districts. One hundred and sixteen middle grades schools (grades six through eight) provided EOG ELA data, while seven middle grades schools provided both EOG ELA and EOC ELA II data. Additionally, EOC ELA II data were gathered from 113 high schools. Of the 236 total schools, 122, or 52 percent, made achievement gains in ELA. Fifty percent of middle grades schools made gains greater than the state on the EOG ELA assessment, and 43 percent of middle grades schools made gains greater than the state on the EOC ELA II assessment. Forty-eight percent of high schools made gains greater than the state on the EOC ELA II assessment.

In West Virginia, state end-of-grade ELA data were collected from three districts: Kanawha, Mercer and Wetzel counties. Two of three districts, Kanawha and Mercer, showed districtwide increases in the percentage of middle grades and high school students (grades six through 11) meeting college- and career-readiness standards over the last three academic years, with both districts outpacing the state's gains. Wetzel County made a significant gain from the 2015 to 2016 academic years but declined in 2017.

The Impact of the Mathematics Design Collaborative on Student Achievement

In Alabama, ACT Aspire mathematics data were collected from 23 middle grades schools (grades six through eight) across five districts. Of those 23 schools, 17 made significant gains from the 2015 to 2016 academic years, and all 17 showed gains that were larger than the state's gain.

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.

In North Carolina, state end-of-grade mathematics and state end-of-course mathematics I data were collected from 230 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 the 230 total schools, 180, or 78 percent, made gains. Thirty-six percent of middle grades schools made gains greater than the state on the EOG mathematics assessment across grades six through eight, and 50 percent of middle grades schools made gains greater than the state on the EOC mathematics I assessment. Forty-six percent of high schools made gains greater than the state on the EOC mathematics I assessment.

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 percentage 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.

Lessons Learned: Six Takeaways

Results from the student surveys reveal that LDC and MDC professional development are having positive impacts on teachers' practices. There are several takeaways from this study.

1. Students enrolled in college-preparatory, honors and basic courses who were exposed to either the LDC or MDC strategies were engaged in more meaningful and challenging learning environments than other students.

2. Teachers of basic courses who received LDC or MDC training made greater shifts, as perceived by their students, in their use of complex grade-level literacy and mathematics assignments than did teachers of basic courses who had not received LDC or MDC training. This is important because students in basic courses are often subjected to lower-level cognitive assignments that lack the necessary skills for college and career readiness.

3. The use of literacy-based assignments in ELA, science, social studies and CTE classrooms has great potential for advancing students' literacy levels and content achievement.

4. An analysis of individual survey items shows that students in some MDC classrooms reported having experiences that were no different from the experiences of students in non-MDC classrooms. See Appendix B. This offers clues for revising the next round of mathematics professional development to enhance teachers' abilities to engage students in complex grade-level mathematics assignments.

5. The achievement data collected by SREB shows student assignments designed from the LDC and MDC frameworks offer promise for advancing student achievement across disciplines. Data show these frameworks can facilitate powerful instructional shifts in teachers of all disciplines and backgrounds to engage students more deeply in assignments aligned to college- and career-readiness standards. The key to successful implementation of LDC and MDC is continuous professional development spread over at least three years with job-embedded coaching and feedback and with involved, supportive school leaders and locally developed certified trainers.

6. SREB professional development providers have seen firsthand the impact principals have on the professional development process. Principals who attended trainings, observed their teachers in the classroom and met with their teachers during planning sessions were significantly more likely to have teachers who made the desired instructional shifts.

In Summary

The learning curve for implementing the LDC and MDC frameworks can be steep for many teachers, but with the support of their principals, an external training partner and experienced local trainers who can help sustain the professional development annually for new teachers, the transition is attainable and worth the effort.

Results from this study indicate that these frameworks offer teachers opportunities to challenge their students in meaningful ways. All too often, teachers of basic courses, in particular, attempt to bridge students' learning gaps through repetition-building processes such as worksheets and other drill tasks. Unfortunately, process does not always equate to understanding.

To build understanding, students must be challenged to become independent learners who understand the skills they are being taught well enough to apply them in ways that create meaningful learning opportunities. Accomplishing this feat means raising expectations for what students can accomplish.

The literacy and mathematics frameworks offer promise as instructional strategies that improve student outcomes toward accomplishing the long-term goal of having 80 percent of students graduate from high school college ready, career ready or both.

APPENDIX A

Results for the Literacy Design Collaborative Student Survey by Individual Survey Item
Mean Category Scores for LDC Classrooms and Non-LDC Classrooms by Years of Teacher Training

Categories	Students Reported	No LDC Training	One Year of LDC Training	Two Years of LDC Training	Three Years of LDC Training
Objectives and Learning Targets		3.78	3.88**	3.88**	3.94**
	My teacher tells us about the daily learning goals in this class.	3.70	3.83**	3.84**	3.88**
	I understand how the activities we do in this class relate to the daily learning goals.	3.94	4.02**	4.03**	4.02*
	When we go over the daily learning goals, my teacher has us think about what we already know about the topic.	3.62	3.73**	3.74**	3.88**
	My teacher connects new lessons to things we have already learned.	3.72	3.82**	3.80**	3.89**
	My teacher checks to make sure we understand what we are learning in lots of ways.	3.82	3.91**	3.91**	3.98**
	If I do not understand something in class, my teacher explains it a different way to help me understand.	3.89	3.99**	3.97**	3.96
Reading Strategies		3.47	3.63**	3.60**	3.81**
	In this class, I learn how to find evidence for my writing assignments within the texts we read.	3.80	3.94**	3.94**	4.14**
	I compare information from different texts that we read in this class.	3.24	3.36**	3.35**	3.57**
	I synthesize information from different texts in this class.	3.28	3.41**	3.40**	3.58**
	I learn skills that help me read the texts in this class.	3.73	3.87**	3.83**	4.03**
	In this class, I learn skills that help me read different types of texts.	3.54	3.68**	3.66**	3.86**
	In this class, my teacher helps us learn how to find the main ideas in our readings.	3.62	3.79**	3.74**	3.95**
	In this class, I learn how to find important details from the readings.	3.70	3.86**	3.82**	4.02**
	When we read in this class, my teacher has us write our thoughts and ideas about the reading.	3.12	3.33**	3.30**	3.52**
	My teacher has us write a summary of the important information in our readings.	3.19	3.43**	3.36**	3.63**

APPENDIX A (continued)

Results for the Literacy Design Collaborative Student Survey by Individual Survey Item
Mean Category Scores for LDC Classrooms and Non-LDC Classrooms by Years of Teacher Training

Categories	Students Reported	No LDC Training	One Year of LDC Training	Two Years of LDC Training	Three Years of LDC Training
Student Ownership of Learning		3.60	3.71**	3.70**	3.89**
	We discuss the texts we read with other students in this class.	3.52	3.64**	3.64**	3.92**
	My teacher asks questions in class that make me really think about the texts we read.	3.74	3.85**	3.83**	4.03**
	My teacher encourages me to share my ideas or opinions about the texts we read.	3.62	3.74**	3.72**	3.96**
	My teacher encourages us to ask questions about the texts we read.	3.75	3.85**	3.85**	3.98**
	Students in this class ask thoughtful questions about the texts we read.	3.37	3.46**	3.47**	3.60**
Writing Strategies		3.37	3.56**	3.54**	3.79**
	When I write in this class, I use evidence from the texts I read.	3.68	3.81**	3.81**	3.99**
	My teacher has us write in this class.	3.94	3.97*	3.94	4.22**
	I use information from more than one text for my writing assignments in this class.	3.44	3.62**	3.57**	3.82**
	In this class, I learn skills that help me improve my writing.	3.34	3.50**	3.48**	3.76**
	I write essays in this class to show what I have learned.	2.90	3.17**	3.13**	3.57**
	My teacher gives me feedback on my writing.	3.42	3.68**	3.64**	3.82**
	My teacher helps me be a better writer.	3.29	3.52**	3.50**	3.72**
	In this class, I learn how to organize my thoughts about what I want to say before starting a writing assignment.	3.38	3.60**	3.57**	3.84**
	In this class, I learn how to write paragraphs that have a main idea and supporting details.	3.40	3.65**	3.63**	3.93**
	I learn how to edit my writing in this class.	3.27	3.50**	3.47**	3.70**
	In this class, my teacher has me keep track of how my writing improves.	3.00	3.16**	3.16**	3.28**

APPENDIX A (continued)

Results for the Literacy Design Collaborative Student Survey by Individual Survey Item
Mean Category Scores for LDC Classrooms and Non-LDC Classrooms by Years of Teacher Training

Categories	Students Reported	No LDC Training	One Year of LDC Training	Two Years of LDC Training	Three Years of LDC Training
Assessments		3.63	3.78**	3.74**	3.92**
	My teacher has us show what we know in different ways.	3.63	3.79**	3.73**	3.95**
	My teacher returns my graded work in a reasonable amount of time.	3.87	3.94**	3.87	3.86
	Before starting an assignment, my teacher has us think about what we need to do to complete it.	3.82	3.94**	3.93**	4.02**
	Before starting an assignment, my teacher tells us about why we are doing it.	3.84	3.98**	3.92**	4.03**
	My teacher shows us examples of really good student work.	3.39	3.53**	3.49**	3.73**
	My teacher has us do written assignments in this class.	3.66	3.79**	3.80**	4.11**
	My teacher has us edit our written assignments.	3.20	3.47**	3.43**	3.70**

Source: My Student Survey

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

APPENDIX B

Results for the Mathematics Design Collaborative Student Survey by Individual Survey Item
Mean Category Scores for MDC Classrooms and Non-MDC Classrooms by Years of Teacher Training

Categories	Students Reported	No MDC Training	One Year of MDC Training	Two Years of MDC Training	Three Years of MDC Training
Balanced Approach to Mathematics Instruction		3.57	3.63**	3.67**	3.79**
	My teacher has us apply math to situations in the real world.	3.38	3.45**	3.52**	3.57**
	My teacher wants us to understand why a math problem works, not just be able to solve it.	4.14	4.11	4.23**	4.40**
	The questions on our tests have us apply our math skills to real-world situations.	3.32	3.39**	3.44**	3.42
	My teacher tells us about the learning goals for the day.	3.51	3.52	3.56	3.74**
	My teacher connects new lessons to things we have learned already.	3.81	3.82	3.90**	3.99**
	I learn how to choose the best tool for an assignment.	3.99	4.01	4.03	4.09
	I learn how to choose the best strategy to solve math problems.	3.97	3.99	4.02	4.19**
	When we solve problems in this class, we discuss which math strategy we should use.	4.08	4.10	4.15*	4.28**
	My teacher encourages us to come up with our own ways to solve problems.	3.06	3.21**	3.24**	3.48**
	On our assignments, my teacher has us write down why we chose the math strategy we used.	2.43	2.68**	2.63**	2.71**

APPENDIX B (continued)

Results for the Mathematics Design Collaborative Student Survey by Individual Survey Item
Mean Category Scores for MDC Classrooms and Non-MDC Classrooms by Years of Teacher Training

Categories	Students Reported	No MDC Training	One Year of MDC Training	Two Years of MDC Training	Three Years of MDC Training
Assignments That Matter		3.51	3.58**	3.65**	3.82**
	The assignments I do in this class are challenging.	3.34	3.37	3.51**	3.58**
	In this class, I solve challenging math problems on my own.	3.33	3.38*	3.39*	3.57**
	The problems I solve in this class make me think hard.	3.67	3.75**	3.79**	3.83*
	My teacher tells us how our assignments will help us in math.	3.46	3.48	3.52	3.74**
	When we do an assignment, my teacher tells us what we need to do to get a good grade.	3.76	3.75	3.82	4.12**
	When we are doing classwork, my teacher walks around the room to ask us questions about how we are solving the problems.	3.32	3.51**	3.61**	3.79**
	My teacher encourages me to try to solve difficult problems on my own first before asking for help.	3.91	3.99**	4.04**	4.21**
	I work with other students in this class to solve problems.	3.31	3.42**	3.48**	3.70**

APPENDIX B (continued)

Results for the Mathematics Design Collaborative Student Survey by Individual Survey Item
Mean Category Scores for MDC Classrooms and Non-MDC Classrooms by Years of Teacher Training

Categories	Students Reported	No MDC Training	One Year of MDC Training	Two Years of MDC Training	Three Years of MDC Training
Utilizing Questioning and Feedback for Deeper Understanding		3.70	3.77**	3.81**	4.00**
	When we go over a problem, my teacher asks me to discuss how I came up with my answer.	3.77	3.93**	3.87**	4.10**
	My teacher asks questions in class that make me really think about the information we are learning.	3.57	3.63**	3.66**	3.83**
	When my teacher asks a question, she/he has all students try to figure out an answer on their own.	3.75	3.80*	3.83**	3.95**
	My teacher encourages students to share different strategies they used to solve a problem.	3.42	3.60**	3.63**	3.99**
	When my teacher asks a question, she/he gives us time to think of an answer before calling on students.	3.94	3.99*	4.01*	4.28**
	My teacher gives us time to correct the mistakes we make on problems or assignments.	3.67	3.67	3.73	3.93**
	When my teacher gives us a challenging problem, she/he gives us time to solve the problem on our own.	4.06	4.11*	4.17**	4.36**
	My teacher gives me helpful feedback on my assignments.	3.56	3.58	3.63*	3.81**
	My teacher gives me feedback on my assignments that helps me understand why I got an answer wrong.	3.67	3.72	3.77**	3.97**
	My teacher helps me learn from my mistakes in this class.	3.82	3.86	3.93**	4.13**
	Students ask each other how they came up with their answers.	3.53	3.63**	3.65**	3.98**

APPENDIX B (continued)

Results for the Mathematics Design Collaborative Student Survey by Individual Survey Item
Mean Category Scores for MDC Classrooms and Non-MDC Classrooms by Years of Teacher Training

Categories	Students Reported	No MDC Training	One Year of MDC Training	Two Years of MDC Training	Three Years of MDC Training
Adapting Teaching and Learning		3.23	3.25	3.29**	3.51**
	When we learn something new, my teacher tells us about mistakes that students might make.	3.73	3.73	3.82**	3.99**
	If I do not understand a math problem, my teacher works with me until I understand.	3.87	3.83	3.94*	4.15**
	Before the end of class, my teacher has us reflect on what we have just learned.	2.98	3.05*	3.06*	3.24**
	If I have already learned something we are doing in this class, my teacher has a different assignment for me to work on.	2.46	2.54*	2.52	2.75**
	If I do not do well on an assignment, my teacher helps me relearn the material with a new assignment.	3.09	3.12	3.13	3.41**
Student Ownership of Learning		3.76	3.81**	3.87**	4.09**
	When we work in groups, we discuss the best way to solve a problem.	3.60	3.75**	3.79**	3.98**
	When I answer a question wrong in class, my teacher helps me figure out where I made a mistake.	3.93	3.97	4.03**	4.28**
	When I get a problem wrong, other students help me figure out where I made a mistake.	3.27	3.32	3.35*	3.60**
	In this class, we see mistakes as an opportunity to learn.	3.70	3.74	3.80**	4.01**
	We work hard to complete assignments, even when they are challenging.	4.00	4.04	4.11**	4.34**
	We keep going, even when the work is difficult.	4.03	4.05	4.14**	4.33**

Source: My Student Survey

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

APPENDIX C

Information on the Statistical Analyses

Welch's independent samples t-tests with Bonferroni correction were used to assess differences in student learning experiences for students in LDC and MDC classrooms and students in non-LDC and non-MDC classrooms. Effect sizes were assessed using Cohen's d. See Tables 1 and 3.

Furthermore, one-way analyses of variance (ANOVA) with Tukey-Kramer's post hoc tests were used to determine whether student learning experiences increased when teachers received additional years of LDC and MDC training. Effect sizes were assessed using eta-squared. See Tables 2 and 4.

For information on this data, please contact Joseph Tadlock: joseph.tadlock@sreb.org.

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