| Shared Leadership | Continuous Improvement | Student-Led Learning |

MLC Model for Teacher Leadership:

Lessons Learned from Culver City Unified School District

April 2016

MLC Model for Teacher Leadership:
Lessons Learned from
Culver City Unified School District

Prepared for
Katharine Clemmer [a]
Director of Mathematics Leadership Corps (MLC)
Loyola Marymount University

Prepared by
SmartStart Evaluation and Research [b]

SMARTSTART
EVALUATION & RESEARCH

Table of Contents

Executive Summary

Math Leadership Corps (MLC) is a peer coaching based teacher leadership model that is designed to build a culture of continuous improvement, shared leadership, and student-led learning in school districts. This paper describes the MLC model, using data from the Culver City Unified School District (CCUSD), and discusses lessons learned from implementing the model through a partnership between the district, a university, and non-profit organizations.

Continuous Improvement

MLC uses one-on-one and small team peer coaching to support teachers and foster a culture of continuous improvement in which school members continually use data to improve instruction and student learning.

- o In CCUSD, MLC teacher leadership program participants indicate that the program helps them better understand the diverse needs of students, tailor math instruction for them, and sustain the changes they make in instruction. The observed quality of data-driven instruction improved steadily over two years for teachers who participated in the MLC teacher leadership program since 2013-14.
- o The MLC teacher leadership program is fostering a growth mindset among participating teachers. This is especially true for teachers in schools that adopted the MLC model earlier on, as their perceived level of continuous improvement is higher compared to teachers in schools that implemented MLC later.
- o MLC participants feel that sustained coaching is necessary to continue to develop the culture of continuous improvement, spread the use of data-driven instruction, and further improve math instruction aligned with the Mathematics Teaching Practices (National Council of Teachers of Mathematics; NCTM) and the Common Core State Standards for Mathematical Practice.

Shared Leadership

MLC helps create a culture of shared leadership through supporting administrators and teacher leaders' development of a shared vision of instruction and student achievement in the area of mathematics, and a collaborative approach to making data-informed decisions related to teaching and student learning.

- o In CCUSD, MLC participants indicate that the level of administrator support for professional collaboration among teachers is increasing. They also note that the common language they acquire through their participation in the program enables them to collaborate more effectively with their colleagues around math problems by focusing on students.
- o Leadership in CCUSD is beginning to be more distributed as MLC peer coaches have increased leadership skills and frequent interactions with administrators regarding the math program.
- o Teachers who see more evidence of continuous improvement in their schools also observe more shared leadership as measured by the shared vision held by, and collaboration enacted between administrators and coaches.

Student-Led Learning

MLC supports consistent implementation of data-driven, problem solving focused instruction to increase student engagement which leads to student-led learning.

- o Exposure to MLC's data-driven, problem solving focused instruction is positively related to students' math problem solving approach and metacognition.
- o Compared to before MLC implementation, teachers now observe more peer collaboration among students focused on math problem solving, willingness to try solving challenging math problems, and persevering through them.

- 2014-15 California Assessment of Student Performance and Progress (CAASPP) math test data suggest that improvement in math problem solving approach may lead to better outcomes in actual problem solving tasks.

In sum, a culture of continuous improvement and shared leadership is emerging in CCUSD with the integration of a peer coaching system as part of the leadership structure. MLC implementation in CCUSD involved forming a cross-sector partnership, identifying, allocating, and managing resources, gaining commitment from teachers and the community, and delivering the teacher leadership program. For districts interested in adopting the MLC model, the partners recommend the following:

- Establish a clear, shared purpose of the partnership at the start of MLC implementation.
- Create an effective, ongoing communication channel for all partners.
- Secure 2 years of funds, as opposed to yearly contract, for the partnership to implement MLC.
- Before committing to the partnership, assess the fit between the district and the cultural shift that the MLC model will bring.
- Prepare to engage in a continuous recruitment of teacher participants with staff turnover.
- District and site administration should have full understanding of the MLC model and the non-linear nature of student learning within the MLC model.
- Invite parents and community members into classrooms and have students communicate what and how they learn.
- Commit to a limited number of subject areas for professional development in a given year while implementing the MLC model.
- Facilitate regular cross-grade observations and other learning opportunities for teachers to develop a K-12 math program.
- Administration and coaches should start collaborating early on to meet the needs of the teachers and the schools.

The partnership is currently implementing the MLC model in two other districts in Southern California to refine it. Future research in those districts will continue to document the development of the culture of continuous improvement, shared leadership, and student-led learning and its effects on student achievement in math.

Background and Purpose

The problem

Much work remains in increasing student achievement in mathematics in the U.S. In 2015, less than half (42%) of high school graduates who took ACT or SAT exams met the benchmark for college readiness in mathematics (1; 2). This benchmark is important because it distinguishes students who enter college and graduate within four years from those who do not (3).

Successfully studying at college level requires a different type of learning beyond recalling information. Students need to be able to engage in high-level thinking and assess their own understanding to adjust their learning process and performance (4). This type of learning is called self-regulated learning: an active, constructive process in which the student chooses his/her own learning goals and plans, controls, and monitors his/her motivation and behavior that make up the learning process (5; 6). Such self-regulated learning is associated with higher achievement in math (6; 7) and is the basis for lifelong learning (8).

Research suggests that self-regulated learning is teachable in the form of learning strategies (9; 10) but the current literature rarely reports the actual exhibition of self-regulated learning by students. Use of self-regulated learning strategies may in fact decline over a short period of time – during the academic year – in high school (5). Moreover, students' enthusiasm for learning also declines as they move up the grade levels, reaching the lowest in ninth grade (11). This may be due to the mismatch between adolescents' growing desire for control and the decrease in decision-making and choice in the learning environment (12). Therefore, teachers need better strategies to engage students in mathematics and allow for self-regulated, student-led learning.

Instructional change

Interventions aimed at promoting self-regulated learning exist. However, teachers who provide direct instruction and set the stage for self-regulated learning need to believe in it to teach it. Research indicates that teachers who believe that students are active participants in learning who can develop their own solutions to problems teach self-regulated learning strategies more often than teachers who do not (8). At the same time, students who believe that their ability can improve through effort perform better in mathematics compared to those who believe that their ability is fixed, because the former type of students address challenges by making greater effort or shifting learning strategies (12).

For students to take ownership of their learning, teachers need to make instructional shifts to meet their students' needs. Data-driven instruction is one way to do so. When teachers systematically monitor and analyze student data, they are able to identify each student's strengths and weaknesses, provide individualized, appropriate instruction to similar groups of students, and thus increase achievement for all (13; 14). However, research suggests that teachers need training to effectively use student data to improve instruction (15; 16; 17).

Organizational change

Coaching is one way to provide ongoing, coherent professional development for data-driven instruction. Coaches embedded within the school system can play a central role in helping teachers make sense of student data and make instructional decisions based on the data (13; 14; 18). Further, teachers are better able to make changes to instruction and sustain the changes when they become involved in curriculum development through team decision-making (19). Participating in coaching also increases teachers' collaboration, leadership capacity, and sense of shared responsibility for student learning (16; 14). This relates to shared leadership in which multiple members of the school system, including teachers and administrators, engage in school-wide decision-making regarding instruction and student learning to achieve a common goal of student achievement (20; 21; 22).

A model for change

Math Leadership Corps (MLC) is a peer coaching based teacher leadership model that is designed to build a culture of continuous improvement, shared leadership, and student-led learning in school districts. This paper describes the MLC model for district change, using data from Culver City Unified School District, and discusses lessons learned from implementing the model.

Math Leadership Corps (MLC) Model

Overview

Math Leadership Corps (MLC) is a leadership model in which teachers and administrators create a continuous improvement culture and share leadership to build and implement a coherent math program that promotes student-led learning. In this model, teachers continually utilize coaching and student formative and summative data to improve practice and attain the MLC vision where all students have the mathematical reasoning and procedural skills to design creative solutions to complex problems.

MLC Mission

To partner with school districts to help increase student achievement by developing a culture of shared leadership, continuous improvement, and student-led learning

The diagram below shows the three main concepts of the model: continuous improvement, shared leadership, and student-led learning.

1. MLC uses one-on-one and small team peer coaching for data-driven instruction to support teachers and foster a culture of **continuous improvement**.
2. MLC helps create a culture of **shared leadership** by supporting administrators and teacher leaders' development of a shared vision and collaboration in making data-informed decisions about instruction and student learning.
3. MLC supports consistent implementation of data-driven, problem solving focused instruction to increase student engagement which leads to **student-led learning**.
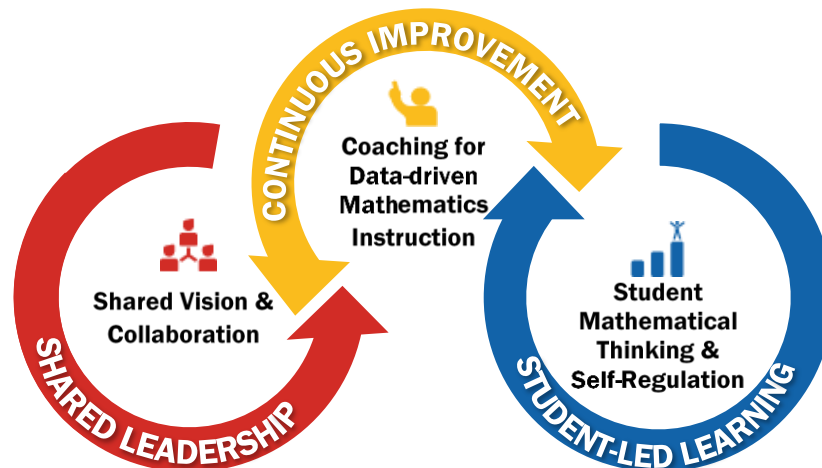
Note: Icons made by Freepik from www.flaticon.com

Process of organizational change

The driver of the model is continuous improvement, a process cycle that consists of several components including visioning, planning, implementation of planned strategies, and data gathering and analysis. Throughout the cycle, school members use data to continually evaluate goals, actions, progress, and outcomes (23; 13). However, teachers' comfort and readiness levels in using and interpreting student data vary widely (15). To help districts develop capacity for data-driven instruction, the MLC model incorporates peer coaching. Peer coaches help teachers identify, collect, analyze, and translate data into instruction that allows students to lead their own learning and develop problem solving skills in mathematics.

The initial role of MLC is to work with administrators to establish a peer coaching system in the district as a continuous improvement strategy. Through the peer coaching system, teachers engage in metacognitive, self-regulated learning of data-driven instruction: continuously re-evaluating their practice and creating innovative solutions as students' needs change. In addition, teachers learn to collaborate more effectively through one-on-one relations as well as in small groups using a common language around data analysis. The improvement in collaboration results in distribution of leadership as coaches work with both teachers and administrators, and teachers work in partnership with each other. Coaching not only directly influences teachers' knowledge and instructional practice, but also increases their collaboration, leadership capacity, and sense of shared responsibility for student learning (16; 14). **Therefore, shared leadership develops gradually within the district from the bottom-up rather than top-down.**

In the MLC model, teachers and administrators work together to make informed decisions about teaching and learning. They sustain this culture of shared leadership through shared vision for student learning and teacher development, and collaboration to improve practice. According to the literature, these two components are essential for schools to continuously improve (24; 23; 18; 25). Thus, shared leadership and continuous improvement in the MLC model have a reciprocal relationship.

Shared leadership among teachers and administrators has a positive effect on student learning through continuous improvement, which encompasses both improvement in instruction and a change in organizational culture. First, collaboration allows teachers to hold professional discussions about theories and methods of learning and instruction rather than teaching from their own trial and error and memories from when they were in school (19). Regular interaction among teachers and administrators also shapes strong norms and standards for instruction, which results in coherent educational experience for students regardless of different pedagogy (26). Second, continuous improvement in the MLC model involves a cultural shift. MLC instills a growth mindset in both teachers and students: they set high standards and goals for learning, persevere through challenging problems, and regulate their learning processes. For teachers, this influences their professional development. For students, it cultivates student-led learning. **Student-led learning is constantly reinforced through the coaching system focused on the use of student data and problem solving focused instruction, realizing classroom-level continuous improvement.** In turn, student-led learning has potential benefits for student performance in math as research shows that instruction that promotes self-regulated learning increases students' understanding of a math concept (10).

MLC in Culver City Unified School District, CA

Culver City Unified School District

MLC was first implemented in Culver City Unified School District (CCUSD) beginning in the 2013-14 academic year. CCUSD is an ethnically diverse K-12 school district located in an urban neighborhood within Los Angeles County. In 2013-14, over 6,500 students attended the district's five elementary schools, one middle school, and one high school. About 40% of the students were eligible for free and reduced price lunch, and 12% were English Learners.

Latino/a — 40%
White — 26%
African American — 16%
Asian/Pacific Islander — 13%

English Learner: 12%

Free and reduced price lunch: 39%
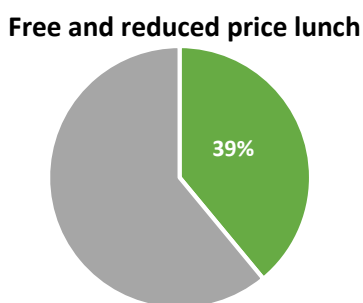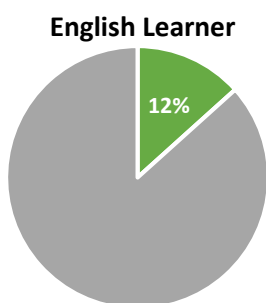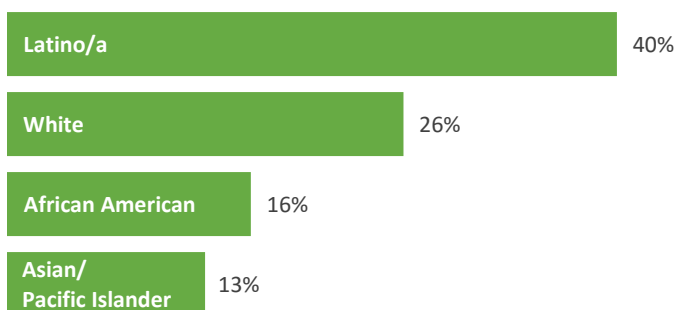
The partnership

MLC in CCUSD involved a partnership between the district, a university, and non-profit organizations in Los Angeles:

o Culver City Unified School District
o Loyola Marymount University
o Cotsen Foundation for the ART of TEACHING
o Leonetti/O'Connell Family Foundation
o Louis L. Borick Foundation

Loyola Marymount University oversaw the process, provided the teacher leadership program at the secondary schools, and provided funds. The Cotsen Foundation provided the teacher leadership program at the elementary schools, elementary principal and district level administrator professional development, and funds for the project. Leonetti/O'Connell Family Foundation and Louis L. Borick Foundation were involved in strategic planning and funding the project. CCUSD was actively engaged in the MLC implementation process, including coordinating tasks and communicating with all partners, supporting site administrators and teachers, and providing release time and funds.

Teacher leadership program

MLC in CCUSD used two distinct teacher leadership programs for elementary and secondary schools to increase teachers' knowledge and skills to deliver data-driven, problem solving focused mathematics instruction. In elementary schools, the Cotsen Foundation delivered the ART of TEACHING program focusing on Cognitively Guided Instruction (CGI). CGI is an inquiry based instructional approach that emphasizes students' articulation of their mathematical thinking during problem solving, and teachers' utilization of that information to deepen students' conceptual understanding (27). In secondary schools, Loyola Marymount University (LMU) delivered the Teacher Leadership by Design program focusing on Mathematics Learning by Design (MLD) instruction. MLD focuses on supporting students to improve their problem solving skills by engaging in metacognition and self-regulated learning (28; 29; 30). Based on the similarities between the two programs in their approach to math instruction and learning, Cotsen Foundation and LMU worked closely together to coordinate and align program goals and activities to create a K-12 model, allowing students to have a contiguous educational experience.

Common components of the elementary and secondary programs were one-on-one and small team peer coaching, peer modeling, and group collaborations. Coaches received extensive training in coaching and engaged in metacognitive reflection through extensive reflective journaling (elementary) and coaching defense (secondary). They worked with each of their participating teachers weekly in classrooms or in individual planning sessions. The coach and teacher dyad analyzed and interpreted student data, reflected on the teacher's instructional practice, and planned further learning for the teacher. Participating coaches and teachers also met in groups to analyze student data, design instruction accordingly, and address a school-wide problem of practice.

Participants

MLC introduced the teacher leadership program in two phases: two years of intensive training and one year of gradual release of support from the Cotsen Foundation for the ART of TEACHING and Loyola Marymount University. Two elementary schools started the program each year. One of the five elementary schools in the district had two language immersion programs – Spanish and Japanese; each program participated in MLC in different years. In each elementary school, a team of one full-time coach and up to seven teachers participated in the program. Middle and high schools had varying numbers of coaches each year depending on the school's need and coach availability. Each coach, who still taught in the classroom, partnered with two to three teachers to participate in one-on-one and small team peer coaching.

In **2013-14 (Year 1)**, a total of 20 teachers (11 elementary and 9 secondary school teachers) participated in MLC as a coach or a participant teacher. In **2014-15 (Year 2)**, some teachers dropped out due to taking leave of absence or leaving the district while 17 additional secondary school teachers joined MLC. Two more elementary schools with 13 teachers participating in MLC were added. In **2015-16 (year 3)**, 44 teachers are currently participating. All analyses in this paper exclude teachers from Elementary schools that started implementing MLC in year 3 (Elementary 5 and Elementary 6 in diagram below) as they have not yet had a full year of experience in the MLC teacher leadership program.
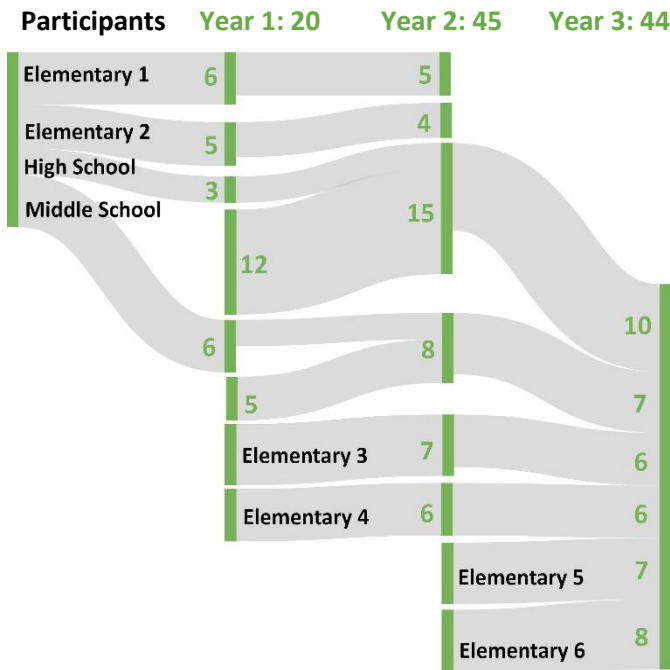
Evaluation and research

Evaluation and research of the MLC in CCUSD utilized student and teacher/administrator surveys, classroom observations, program evaluation forms, standardized math test scores, course enrollment archival data, focus group interviews, and individual interviews. The Institutional Review Board at Loyola Marymount University approved the evaluation and research procedure.

Student survey
Students completed a survey at the beginning and end of each academic year in their math class to measure their engagement and problem solving. The survey included 23 Likert-scale items and one open-ended question. Cronbach's alpha for subscales of engagement, interest, and thinking about math ranged from .56 to .87.

Teacher/administrator survey
Both participant and non-participant teachers and administrators completed a survey at the beginning of the MLC implementation and at the end of each academic year to measure perception of continuous improvement and shared leadership. The survey was administered online and included 27 Likert-scale items. Cronbach's alpha for subscales of shared vision, collaboration, and continuous improvement ranged from .92 to .96.

Classroom observation
Each participant teacher's classroom was observed at the beginning and end of each academic year to assess levels of data-driven instruction and student engagement in math problem solving. The teacher observation instrument included 27 items categorized into 8 Mathematics Teaching Practices outlined in National Council of Teachers of Mathematics (31). The student observation instrument included 23 items that measured verbal participation, actions of participation, level of interest, and dimensions of engagement.

Program evaluation forms

Participant teachers completed program evaluation forms three times each academic year to assess the usefulness of the teacher leadership program. Survey questions focused on coherence and influence of program components on math instruction, participants' satisfaction with program, how they extend their learning experience, and the program's effects on students.

Student standardized math test scores and course enrollment data

The district provided California Assessment of Student Performance & Progress (CAASPP) math test results and administrative data for high school students' enrollment in college-ready math and science courses as outlined by the state of California.

Focus group and individual interviews

Select teachers, administrators, and members of the MLC partnership participated in focus group or individual interviews to gain additional insight into how the MLC model is implemented in CCUSD. Focus group interviews were conducted in December 2014 and January 2016. Individual interviews were conducted as needed.
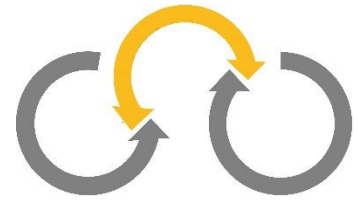
Continuous Improvement

MLC model

Teachers and administrators create a culture of frequent and focused review of real-time instructional practice. Teachers analyze a problem of practice, in both pedagogy and content knowledge, during all professional development activities. Teachers utilize student work samples, engagement and formative achievement data, and current research to inform all coaching and small group decisions to improve and deepen practice.

Coaching for data-driven instruction

The first step of implementing the MLC model is establishing a coaching system for data-driven, problem solving focused instruction. The most recent evaluation data from February 2016 indicate that almost half (48%) of the participating teachers (n=19) from schools that have been implementing MLC for at least one year made **changes in their instructional methods** *to a great extent* as a result of coaching in the previous three months. Of those, the majority (78%) *strongly agreed* that their coach helps them maintain the changes they have made in their instructional methods while no one disagreed with the statement. These data indicate that the MLC teacher leadership program has immediate influence on math instruction.

Within the past three months I have made changes in my instructional methods as a result of coaching

My coach helps me sustain the changes I have made in my classroom

Somewhat 42%

To a great extent 48%

Very little 10%

Agree

Strongly agree 78%

What changes are teachers making in their instruction? According to data from focus group interviews with participating teachers, coaches, and administrators in J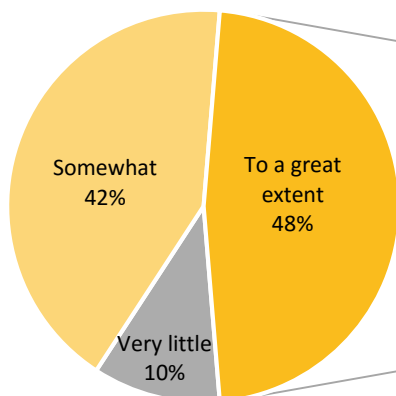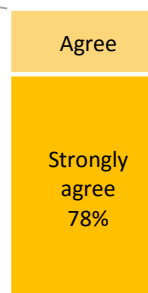anuary 2016, the main change for participating teachers is **customized instruction based on the students' needs**. The basis for this change seems to be MLC's emphasis on understanding the student's mathematical thinking and level of understanding rather than following common curriculum:

> *"I do know my students' level much better than I did before because I can see what strategies they're using or where they are getting stuck. It's opened up my ability to be **able to really gauge what they know** versus before I wouldn't really know if they understood it or whether their parents just showed them a strategy. Now, I can really see if they're actually, understanding what they're doing."* – Teacher 5

> *"Before it was one size has to fit all approach, and that was mainly the curriculum, but now there is more awareness that kids come to school with some background in mathematics, and how can I as a teacher build on that understanding? Their perspective has changed, and it's become a little more **fine-tuned in looking at each student and what their needs are** versus just looking at the needs of the whole groups. Now it's both."* – Coach 4

> *"I think a lot of times beforehand classes were pretty much next chapter, next unit... I think the students are starting to expect that we can wander a little bit more. Be a little bit more broad. **Things aren't as linear anymore…**"* – Coach 6

> *"I think just the idea that they were getting through material for the purpose of getting through material as opposed to shifting it to **make it about learning and mastery of content**, that's been the big shift."* – Administrator 3

While teachers, coaches, and administrators agree that the MLC program helps them improve instruction, they also acknowledge challenges associated with making changes, especially the amount of additional effort teachers need to make. For instance, a teacher noted "I love it and I saw the benefits of it, but to do it right, you had to put so many hours in…" (Teacher 2). Moreover, it is easy to fall back on old ways of teaching when there is limited time to juggle many responsibilities: "Whenever you are in a high-stress situation, which is pretty much all day every day when you're a teacher, you just revert back to your comfort zone." (Teacher 6). The coach's role of helping teachers sustain the changes they have made in their classroom is particularly important for this reason.
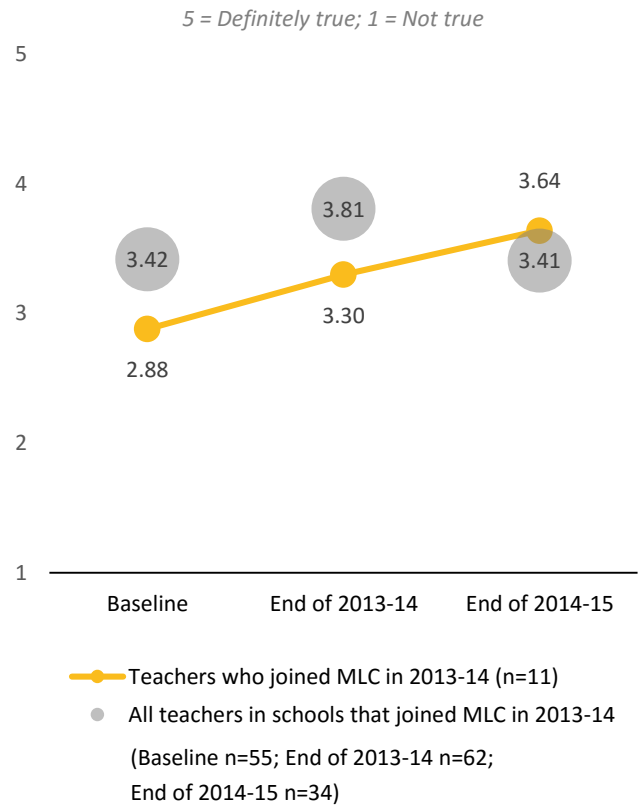
Continuous improvement culture

Implementing the MLC model through peer coaching also involves shifting the organizational culture of the district. Research indicates that teachers learn considerably from direct observation of their peers' professional practices (32). However, teachers typically do not receive extensive support such as lesson modeling from their peers, which could keep them from continuously improving their instruction as they rely on their own past experiences or trial and error (19). The teacher survey asked all teachers in the schools that implemented the MLC model to rate the truthfulness of 13 statements regarding the culture of continuous improvement in their schools, including **refining goals, learning from others, engaging in professional discussions, and taking responsibility for professional development**.

In the schools that adopted the MLC model since 2013-14, teachers' average ratings of their schools' continuous improvement culture increased from baseline to the end of 2013-14 academic year[1]. In the second year of implementation (2014-15), MLC participating teachers' ratings continued to increase non-significantly but the ratings of all teachers who completed the survey at the time was lower than the previous year. This may be due the decrease in the number of teachers who responded to the survey over time. The possibility of bias exists for teachers who opted to take the time to respond to the repeated, lengthy survey about their school culture in

that they may have been more interested in and critical about school improvement issues. Alternatively, staff turnover may have contributed to the diminishing of continuous improvement culture as new teachers had to learn and adapt to the culture.

Perceived culture of continuous improvement

5 = Definitely true; 1 = Not true

Teachers who joined MLC in 2013-14 (n=11)

All teachers in schools that joined MLC in 2013-14 (Baseline n=55; End of 2013-14 n=62; End of 2014-15 n=34)

In the beginning of the 2014-15 academic year, two elementary schools had been implementing the MLC model and teacher leadership program for a year while two other elementary schools were just starting to adopt the model and therefore did not have a full year of coaching. Teacher survey results at the time showed that teachers in the elementary schools that implemented the MLC model since 2013-14 (n=27) perceived a significantly higher level of continuous improvement culture in their schools than teachers in the elementary schools that implemented the model a year later (n=28; U = 239, p < .05). Although other unmeasured factors may contribute to this difference, it implies that having a year of peer coaching may influence the culture of the school to include more professional interactions with peers with specific professional development goals.

---

[1] Statistical comparison was not feasible as (1) the samples at the three time points were not independent and (2) using only matched samples exceedingly reduced the sample size.

Perceived culture of continuous improvement, beginning of 2014-15

5 = Definitely true; 1 = Not true

Elementary schools that implemented MLC in 2013-14	4.27
Elementary schools that implemented MLC in 2014-15	3.71
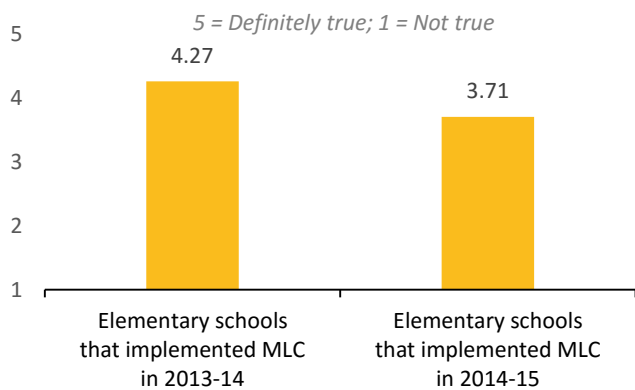
Through peer coaching and professional development activities, the MLC model aims to **cultivate a growth mindset in the district**: setting high standards, striving for competence through self-reflection, wanting to learn more, and valuing the effort required to deepen practice. Focus group data indicate that coaches are more aware of the importance of growth mindset in the MLC model than teachers or administrators. They recognize that differences in this mindset exist among teachers but that the district as a whole has begun to embrace the idea of growth mindset.

> *"I think across the board we're seeing that **there's more that we can do as teachers**. Before when we were more on our own, you're the only teacher you see. If you think you look awesome, you're some level awesome, but when you get to see the varieties of the work on that. Oh, that's interesting. **It raises the bar for everyone**."* – Coach 1
>
> *"I felt like **MLC really tried to foster this growth mindset**, and some teachers think the kids need to have it, but they don't. You have to have it, too, so you can help create it in your kids and show them what it looks like."* – Coach 4
>
> *"That's still a process even for the teachers that are all in. **Some really reflect. Others look at you with that deer in the headlight look**."* – Coach 3

In its third year of MLC implementation, the district is also experiencing growing pains. The middle school and high school experienced a rapid expansion of MLC in the beginning of 2014-15 academic year when 17 new teachers joined the program while 6 teachers in the

original cohort continued their participation. At the two elementary schools that adopted the MLC model since 2013-14, the district designed and implemented its own coaching program called Phase 2 to expand Cognitively Guided Instruction (CGI) training for teachers who were not part of MLC.

With the expansion at both elementary and secondary levels, teacher buy-in issues emerged. In secondary schools, the buy-in issues may have been due to the Math Learning by Design (MLD) program requiring standards based grading from all participants. In elementary schools, grade-level collaboration was sometimes difficult when not all teachers in the same grade could participate in the MLC program and learn CGI. Whereas MLC uses a peer coaching system in which the coach-teacher dyad personalizes the coaching sessions and follows through with actions in the classroom, participating teachers in elementary schools noted that the Phase 2 program utilized an external consultant who worked with teachers in fewer number of sessions, often in group settings. In turn, some teachers decided to solely use existing curriculum rather than utilize the CGI approach. These buy-in issues may have also contributed to the decrease in perception of continuous improvement in 2014-15. However, in 2015-16, CCUSD hired the MLC coaches in the two elementary schools that started the program in 2013-14 as their full-time, on-site coaches for all teachers in those schools. As a result, teachers in those schools stated that there is more accountability because the full-time coach is able to follow up with the lesson plans by observing classes.

> *"I think that part of why there isn't as much buy-in, at least with Phase 2 in the elementary grades is that they don't have personalized coaching cycles. This is only hearsay from what I've heard. I think that a lot of what they're seeing is very interesting coming from this coach who is either doing, modeling a lesson or co-teaching lessons. There is not really, any accountability…"* – Teacher 6
>
> *"… now on the one hand, you have teachers who feel like they do know what they're doing, but then being told that everything they're doing is wrong because it needs to be this way. The freedom that I think a lot of high school teachers were used to having they don't have that anymore."* – Teacher 1

Despite the buy-in issues, many teachers, coaches, and administrators emphasize the importance of and their desire for **continued coaching** so that the entire teaching staff can adopt MLC's data-driven, problem solving focused instruction and continuous improvement. This is in line with the literature suggesting that peer coaching should be part of a district-wide system of coordinated professional development to meet the learning needs of multiple members, including teachers, coaches, other instructional leaders, and administrators (33).

> *"Because we're at all different levels in our learning, I think we still need that coach for maybe a total of five years before **everybody is on the same playing field**."* – Teacher 7
>
> *"I keep hoping for another year, because I think in this third year when Cotsen [support] ends, I'm hoping to really **spread my wealth to the entire staff**."* – Coach 12
>
> *"I think there does need to be more of a long care plan of continued support at least until you have **a majority of staff with a lot of capacity within** to support each other."* – Administrator 7

Summary

☑ Peer coaching helps teachers to make changes in instruction and sustain the changes.

☑ MLC helps teachers in CCUSD better understand the different needs of students and tailor instruction for them.

☑ CCUSD schools that implemented the MLC model in 2013-14 began to develop a culture of continuous improvement in the same year, resulting in a significantly higher level of perception of continuous improvement among teachers compared to schools that adopted the model later.

☑ While not all teachers embrace and practice MLC's data-driven, problem solving focused instruction, MLC teacher leadership program fosters growth mindset among participating teachers.

☑ MLC participants feel that sustained coaching is necessary to continue to develop the culture of continuous improvement and spread the use of data-driven instruction.
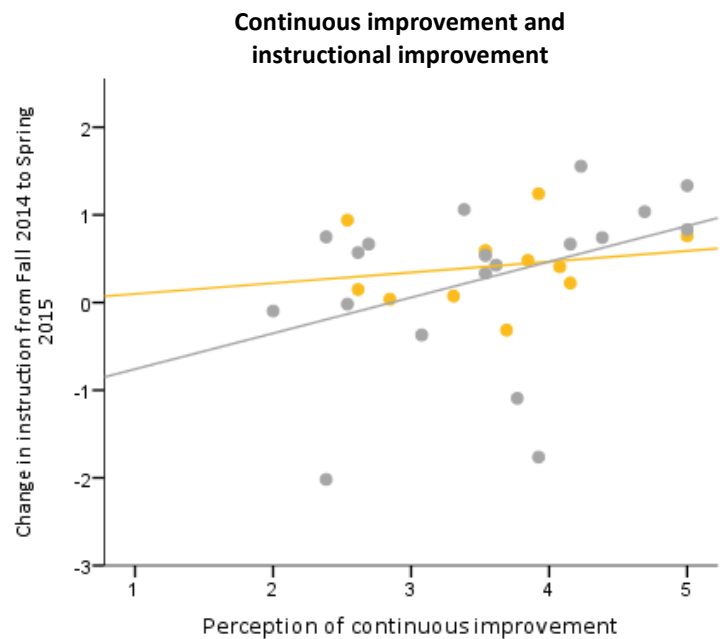
LINK #1: Continuous improvement 🔗 Data-driven instruction

Data-driven instruction is key to understanding how continuous improvement connects to student learning within the MLC model. As teachers continuously improve their instruction based on data-driven, problem solving focused practices, a classroom culture of student-led learning will develop. Observation of teachers who participated in the MLC teacher leadership program focused on use of instructional methods aligned with the eight Mathematics Teaching Practices outlined in National Council of Teachers of Mathematics (31):

1. Establish mathematics goals to focus learning
2. Implement tasks that promote reasoning and problem solving
3. Use and connect mathematical representations
4. Facilitate meaningful mathematical discourse

5. Pose purposeful questions
6. Build procedural fluency from conceptual understanding
7. Support productive struggle in learning mathematics
8. Elicit and use evidence of student thinking

In CCUSD, the quality of data-driven instruction improved steadily over two years for teachers who participated in the MLC teacher leadership program since 2013-14 (n=14). Their mean score on the observation instrument increased significantly from baseline to end of 2013-14 (t (13) = -5.15, p < .01) and then to end of 2014-15 (t (13) = -3.55, p < .01). However, the quality of instruction among teachers who started participating in MLC teacher leadership program in 2014-15 (n=22) improved non-significantly. This suggests that, as focus group participants expressed, **continued coaching is necessary for consistent improvement in data-driven instruction across groups**.

Further correlation analysis of participating teachers' perception of continuous improvement at the end of 2014-15 and their improvement in data-driven instruction in the same year revealed a non-significant correlation (p = .06). This is somewhat expected as the teacher survey asked the participants to rate the overall culture of their school, not their own attitude or behavior toward continuous improvement. Adoption of the MLC model in multiple districts will allow the researcher to conduct school-level analysis in which the culture of continuous improvement is correlated with the instructional improvement of the entire faculty.

Observed quality of instruction
5 = Did this very well; 1 = Did not do this

Teachers to joined MLC in 2013-14
Teachers who joined MLC in 2014-15

Continuous improvement and instructional improvement
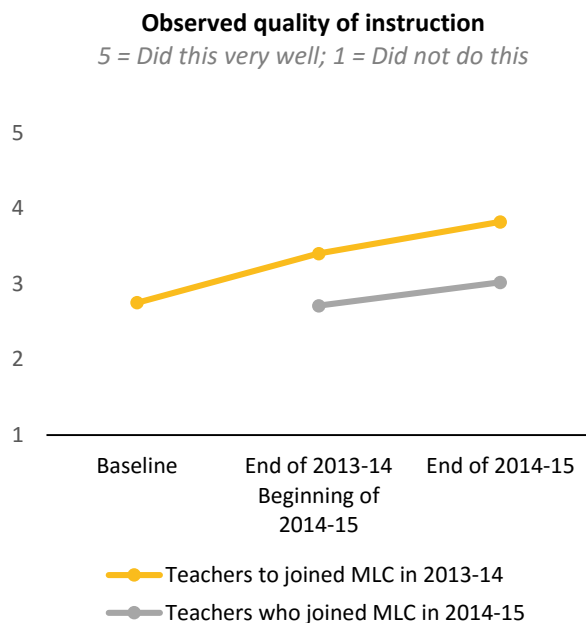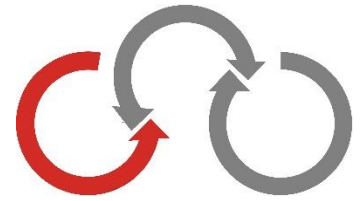
Shared Leadership

MLC model

Administrators and teachers work together to make research supported and data informed decisions about teaching and learning. They also support each other to achieve the goal of increasing student achievement by providing coherent job-embedded collaboration within leadership activities, co-constructing a shared direction, and engaging in collaborative decision-making. Teachers and administrators sustain this culture of shared leadership by developing shared vision around an ambitious goal for student learning and engaging in collaboration.
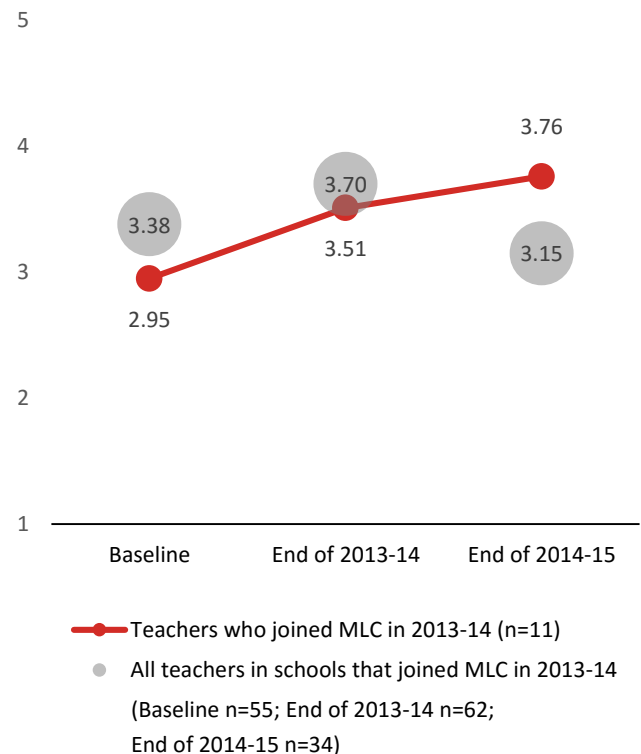
Shared vision

The purpose of shared leadership in schools is to achieve a common goal of student achievement (20; 34). **Administrators' support** is pivotal for shared leadership to occur because they can maximize leadership potential of staff and create structural and cultural conditions for shared leadership such as frequent collaboration among teachers (35; 36; 26). The MLC model conceptualizes shared vision as: [1] administrators support teacher leadership by offering job-embedded, coherent, and safe coaching, professional development, and collaboration opportunities; [2] administrators and teacher leaders develop measurable, high-standard goals for instruction and student learning. The teacher survey measured shared vision with 9 questions relating to the school **conditions for professional dialogue, collaboration, innovative practices, and sharing of knowledge** among teachers and between teachers and administrators. The results at schools that implemented the MLC model since 2013-14 showed the same pattern as their survey results for continuous improvement culture: participating teachers' (n=11) perception of shared vision increased significantly from baseline to the end of 2014-15 (t (10) = -2.89, p < .05). On the other hand, the perception of all teachers (both MLC participating teachers and non-participants) within the schools increased in the first year

of MLC adoption and then dropped in the second year[2]. As with the continuous improvement results, this could be due to the decreased sample size or staff turnover.

Perceived level of shared vision

5 = Definitely true; 1 = Not true

Teachers who joined MLC in 2013-14 (n=11)

All teachers in schools that joined MLC in 2013-14 (Baseline n=55; End of 2013-14 n=62; End of 2014-15 n=34)

Participating teachers and coaches provided diverse viewpoints regarding **administrators' support** in the January 2016 focus group interviews. Overall, coaches seemed more aware of administrators' role in the MLC implementation process than teachers. They stated that their site administrators give them autonomy in working with the teachers they coach, but step in as needed to provide support. While some teachers noted that their site administrators made them feel more comfortable participating in the MLC teacher leadership program, there was concern at higher grades that participation in MLC was implicitly made mandatory.

---

[2] Statistical comparison was not feasible as (1) the samples at the three time points were not independent and (2) using only matched samples exceedingly reduced the sample size.

> *"I feel **more support from the administration**… I think that administrators having this knowledge and being supportive it really makes me relax and feel much more comfortable."* – Teacher 3

> *"[Our administrator has] been very good about talking to everybody what's going on, but not being involved in the process too much. Now that I know a little bit about it, that's a pretty amazing thing to be able to do. To juggle all of that without putting your input into it too much and **letting the teachers guide the process**."* – Coach 7

Site administrators' levels of involvement in the MLC implementation varied across schools. Some have switched gears to provide more support for the coaches to develop as leaders. Others have been working more directly with teachers – especially new teachers - to help them understand the MLC model and to ensure that they address the standards for Mathematics Teaching Practices even if they are not participating in the MLC teacher leadership program.

> *"Now in year 3, we've been involved in the leadership aspect of supporting the coaches more. Where the coaches are seen on daily basis for **support on their coaching and being leaders within their department**, and being able to lead but co-collaborate with their teachers that they're coaching."* – Administrator 1

> *"Definitely playing that **cheerleader role** and looking for opportunities for them to have the professional development they need and baby stepping them through. I think we have a more hands on approach."* – Administrator 6

> *"We've had new teachers to the site. Some who are part of [MLC] and some who are not. Supporting them to understand what it is, what they're responsibility is, and whether they are a fit for our school, **we've had to wear many hats being an evaluator, being a coach, being a liaison for understanding**."*
> – Administrator 4

Collaboration

Creating the structural and cultural conditions for collaboration contributes to the development of shared leadership in schools because collaboration fosters professional relationships that can carry out tasks collectively (36; 37). The teacher survey included 5 questions focusing on the **emergence and development of teacher leaders** and their activities including meeting together and sharing their expertise. In other words, the survey measured **collaboration among teacher leaders**. In schools that adopted the MLC model in 2013-14, MLC teachers' (n=8) perceived level of collaboration among teacher leaders increased non-significantly over time, indicating that they observed teachers participating and collaborating in leadership activities in their schools more in the second year than in the beginning. In contrast, the perceived level of collaboration for all teachers who took the survey at each time point dropped between end of 2013-14 and end of 2014-15. This implies that teachers who did not participate in the MLC teacher leadership program did not observe the same level of collaboration among teacher leaders as MLC participants did.

Perceived level of collaboration

5 = Definitely true; 1 = Not true

3.28   3.86   3.80

2.70   3.26   2.64

| | Baseline | End of 2013-14 | End of 2014-15 |

● Teachers who joined MLC in 2013-14 (n=8)

● All teachers in schools that joined MLC in 2013-14
(Baseline n=48; End of 2013-14 n=53;
End of 2014-15 n=34)
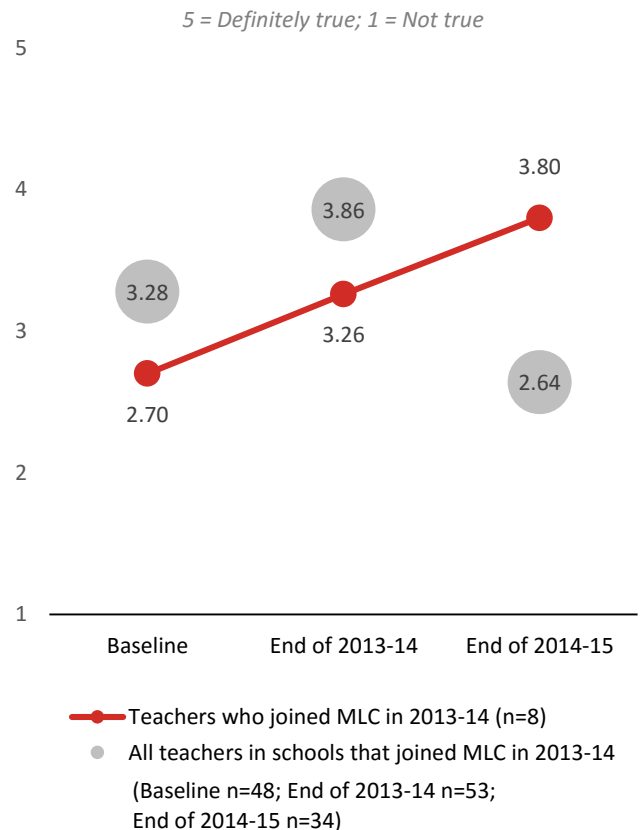
Promoting leadership among teachers can contribute to higher levels of shared leadership in schools because responsibilities can be distributed among multiple people other than just the site administrator. Research implies that teacher leaders, such as coaches, who learn to exercise reflective practice may engage in more instructional leadership practices such as setting instructional goals and monitoring improvement (38). On the most recent 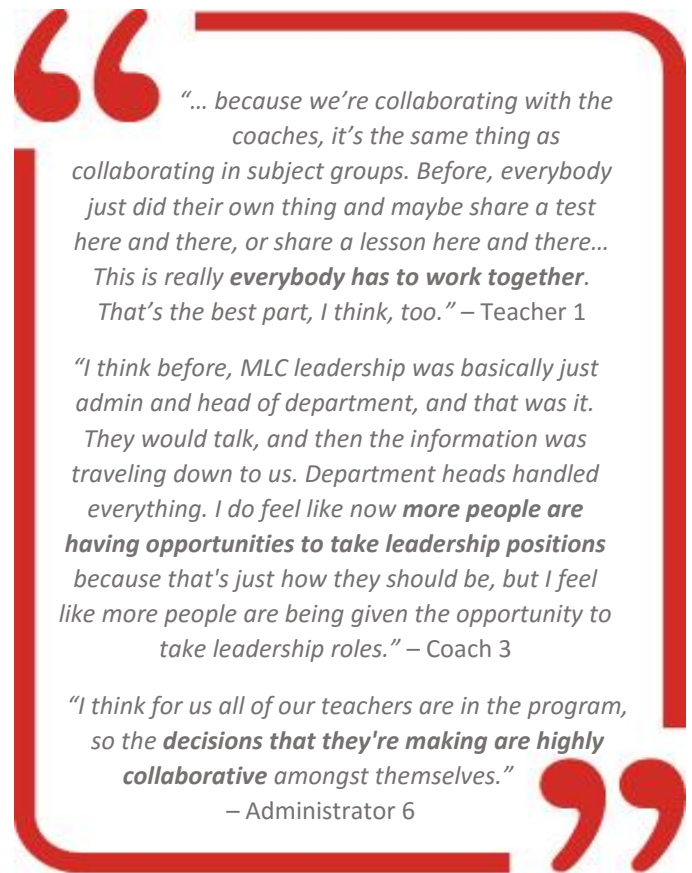evaluation form in February 2016, 76% of participating teachers (n=21) in schools that have been implementing MLC for at least one year stated that the **MLC program develops teachers' leadership skills**. Teachers described that the program helps develop leadership skills because they can participate in adult learning, improve instruction, share their knowledge and experiences with others, and in turn build confidence. Others also mentioned that they see their coaches either possessing leadership skills or continuing to develop their skills in facilitating group or one-on-one discussion. These experiences of MLC participating teachers as a group may explain why their perception of collaboration among teacher leaders differed from other teachers who did not participate in the MLC teacher leadership program.

Shared leadership

How is shared leadership beginning to emerge in Culver City Unified School District? Focus group data from January 2016 indicate that teachers, coaches, and administrators all acknowledge **more collaborative decision making and distributed responsibilities among teachers**. Teachers noted more collaboration amongst themselves, such as discussing student work or how to solve math problems, and observing each other's classes. On the other hand, coaches noted more communication with administrators: they inform their site administrator more frequently about what happens in the teacher leadership program, and administrators provide feedback as needed. This closely ties back to shared vision which includes administrator support and collaboration between administrators and teacher leaders to develop high-standard goals for instruction and student learning. This has important implications for student achievement as research suggests that when administrators and teachers set high-standard goals and communicate, all students have consistently rich educational experiences even if individual teachers use different instructional methods (26).

> *"… because we're collaborating with the coaches, it's the same thing as collaborating in subject groups. Before, everybody just did their own thing and maybe share a test here and there, or share a lesson here and there… This is really **everybody has to work together**. That's the best part, I think, too."* – Teacher 1

> *"I think before, MLC leadership was basically just admin and head of department, and that was it. They would talk, and then the information was traveling down to us. Department heads handled everything. I do feel like now **more people are having opportunities to take leadership positions** because that's just how they should be, but I feel like more people are being given the opportunity to take leadership roles."* – Coach 3

> *"I think for us all of our teachers are in the program, so the **decisions that they're making are highly collaborative** amongst themselves."* – Administrator 6

This increased collaboration among teachers as well as between coaches and administrators is possible due to the district having a **"common language"** that came from participating in the MLC teacher leadership program. Teachers and coaches noted that the data driven, problem solving focused instructional methods allow them to interact more frequently and in a more focused way by sharing math problems and approaches to problem solving. Administrators also noticed that teachers' collaborative meetings have become stronger as they have common vocabulary and focus on math.

> *"When we go observe, it's not as scary because they're doing the same exact thing that they would be doing in third just a little bit of a different problem type or numbers are a little bit higher or more difficult. It does allow for a lot more conversation and for us to understand what they're doing in different grade levels because they're all basically starting in the same way when they start a new problem type." –* Teacher 4

> *"… when the [participating teachers] do come together and discuss, there is consistency in that we're all trying the same thing in the same exact way. It just really depends on the kids. We're all trying to move in the same direction."* – Coach 12

> *"My involvement has allowed me to speak to teachers in their language, and also look for areas to support that… I think from that perspective it's given me a broader perspective that I did not have before."* – Administrator 3

Summary

☑ MLC participating teachers perceive increasing levels of administrator support for professional collaboration among teachers, as well as increasing levels of partnership between administrators and teacher leaders to set common goals for teaching and learning.

☑ Administrators shift their level of involvement in the MLC adoption process to provide necessary support for coaches.

☑ MLC helps develop leadership skills especially for peer coaches and participating teachers.

☑ Through a common language attained from participation in the teacher leadership program, teachers are better able to collaborate around math problems.

☑ Leadership in CCUSD is beginning to be more distributed as MLC peer coaches have frequent interaction with administrators regarding the math program.

LINK #2: Continuous improvement 🔗 shared leadership

Within the MLC model, shared leadership evolves over time as teachers, coaches, and administrators actively engage in the continuous improvement process through coaching and collaboration. Continuous improvement and shared leadership within the MLC model emphasized the following behaviors and conditions:

Continuous improvement

- Teachers refine goals
- Teachers learn from others
- Teachers engage in professional discussions
- Teachers take responsibility for professional development

Shared leadership

- Collaborative environment
- Support for innovative practices, experimentation, and risk-taking
- Communication between teachers and administrators
- Development of teacher leaders
- Collaboration among teacher leaders

Data from beginning of 2015-16 academic year indicate that teachers' perception of continuous improvement significantly correlates with their perception of shared leadership within their schools. While the correlation is only moderate ($r = .504$, $p < .01$), it means that teachers who see more evidence of continuous improvement in their schools also observe more shared leadership as measured by shared vision and collaboration. Focus group data from January 2016 support that **peer coaching does influence the way teachers collaborate** in both the content and with whom teachers collaborate.

Continuous improvement and shared leadership
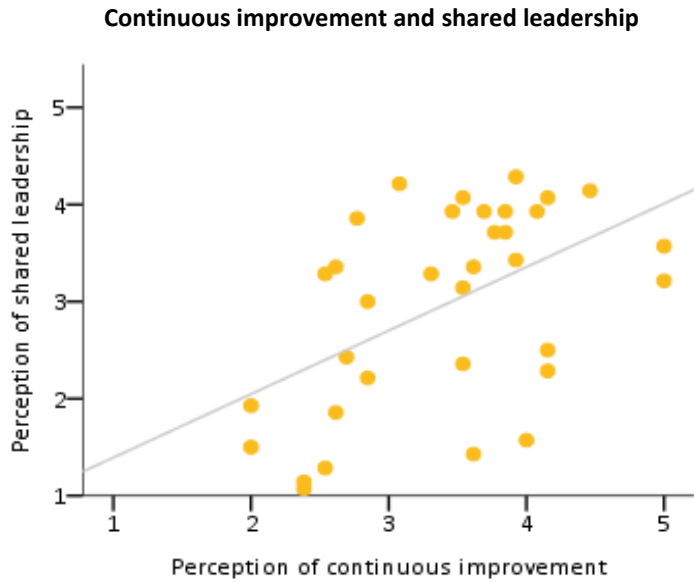
> "*Now, we are communicating **across grade levels** with our coach, which we didn't have a coach before this whole thing happened. Now, we're communicating in so many different ways and all focusing on our personal or our **growth in math and our students' growth**, which really wasn't happening before as much.*" – Teacher 4

> "*Having that opportunity and sit with your coach, talk about where your kids are, where you want to take them, what do you want, what are you expecting to see, then actually having that lesson, **having another set of eyes in there while you're in that lesson and then coming back afterwards and talking about what it was like**. I think that is so invaluable.*" – Teacher 2

While shared leadership in the MLC model focuses on the collaborative work of administrators and teacher leaders in the early stages of model implementation, administrators and coaches in CCUSD acknowledge that teachers are also collaborating differently than before. The most evident change that focus group participants pointed out is that **collaborations among teachers now focus on students**. Discussions are around student work and math problem solving rather than progress in the curriculum or other logistics.

> "*Now it definitely is, look at this kid's work. Check out what they did, beaming. **Look at this kid's work. Help me figure this out and what can I do?** It's not just at grade level. It's whoever's willing to be there. I see more collaboration. It is harder, though, because some people understand, others don't. But I see more.*" – Coach 12

> "*They're really truly collaborating now and trusting each other and having those conversations where before it was just okay we have to be together, it's PLC time. Here's our week, go. They thought that was collaboration. **Now it's much more kid focused and relying on each other to get through something that was difficult.**" – Administrator 5
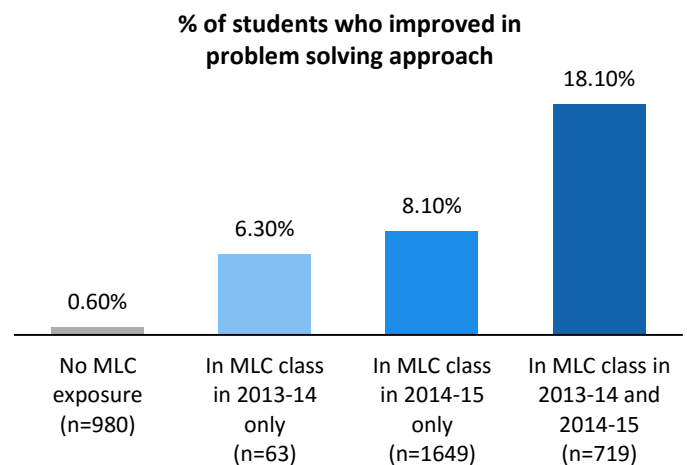
Student-led Learning
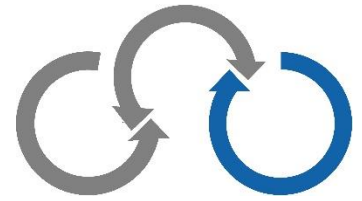
MLC model

Students actively engage in self-regulated learning through monitoring and evaluation of their understanding and achievement. In elementary school, the teacher provides the math task and students choose strategies to solve problems and set their own learning goals. Teachers teach metacognitive regulation strategies, such as monitoring their understanding, to support students in making decisions about next steps. At the secondary level, students in grades 6 through 8 continue to analyze a posed math problem or task, compare to their prior knowledge and cognitive strategies to set learning goals, select strategies, and begin to make practice choices based on teacher and peer feedback. Middle school teachers may provide more structure for feedback and choices as needed. In 9th through 12th grade, students may choose a problem or task to analyze based on a self-analysis of assessment data, compare to their prior knowledge and cognitive strategies to set learning goals, select strategies, and supported by teacher and peer feedback, make practice choices. While completing the task, 6-12 students engage in reflection by monitoring their progress, responding to peer feedback, and using success criteria to make choices. Moving toward completion of the task, all students reflect on their new content knowledge and new understanding of their learning process. This results in student autonomy and achievement.

Self-regulated learning

Self-regulated learners are in charge of their own learning as evidenced by thoughtfully using time, resources, and strategies to achieve goals, seeking challenges, and reflecting on their understanding (39; 7; 40). Current literature defines self-regulated learning well but does not provide much evidence of it in actual classrooms. The MLC student survey asked 6 questions about **how students solve math problems and how they know whether or not they are on track**. Students who took the survey both in the beginning of MLC implementation in CCUSD (beginning of 2013-14) and most recently in the beginning of 2015-16 were

categorized into those who improved in their problem solving approach and those who did not. That is, students categorized as "improved in problem solving approach" had higher average score on the 6 survey questions in the beginning of 2015-16 than in the beginning of 2013-14.

The percentage of students who improved in problem solving approach differed by exposure to MLC data-driven instruction, chi^2 (3) = 172.12, p < .01. While less than 1% of students who had no MLC exposure in the last two years showed improvement in problem solving approaches, 18% of students who had an MLC participating math teacher for two straight years did. This suggests that continued exposure to MLC's data-driven, problem solving focused math instruction may enhance students' ability to regulate their learning by using their metacognitive abilities to monitor their understanding and make choices in how they solve problems.

% of students who improved in problem solving approach

No MLC exposure (n=980)	In MLC class in 2013-14 only (n=63)	In MLC class in 2014-15 only (n=1649)	In MLC class in 2013-14 and 2014-15 (n=719)
0.60%	6.30%	8.10%	18.10%

Student-led learning

Student-led learning is emerging in CCUSD as more schools and teachers have become part of the MLC teacher leadership program. The evaluation form asked MLC participating teachers to rate their students' attitudes and behaviors toward learning at the classroom level. A series of statements described student-led learning culture: **actively connecting prior knowledge to new concepts, persevering through math problems, interest in gaining a deep understanding, working with peers, and asking questions to gain conceptual understanding**. In the beginning of the 2015-16 academic year, MLC participating teachers' ratings of their classrooms fell between traditional learning and student-led learning cultures. Four months later in February 2016, classroom ratings moved toward student-led learning culture in four of five areas. Student-led learning is most evident in the area of connecting prior knowledge to new concepts rather than memorize information. The most improved area is working with peers to solve math problems rather than relying on teacher questioning and feedback. The only area with an opposite trend was students becoming more interested in passing tests rather than gaining a deep understanding of math concepts. This could be due to upper grades preparing for state testing.

Classroom Learning Culture

Traditional learning	October 2015 · February 2016	Student-led learning
Memorize information presented to them without engaging		Actively engage in connecting prior knowledge and experience to new concepts
Wait for the instructor to tell them how to do a problem before attempting it		Persevere in reasoning through unfamiliar problems
Are more interested in passing tests		Are more interested in gaining a deep understanding of math concepts
Rely on teacher questioning and feedback to solve math problems		Actively share and critique strategies for solving complex problems with their peers
Follow step-by-step procedures from the teacher	1 2 3 4	Ask questions that drive their conceptual understanding

Focus group data from January 2016 support the evaluation data that showed improvement in the classroom level of peer collaboration to share and critique strategies for solving complex math problems. Teachers and coaches remarked that students' interactions with each other have become more positive as they engage in in-depth discussions about how to solve a math problem and motivate one another. Peer collaboration is both a self-regulated learning behavior (8) and a way in which students can learn to self-regulate experientially or from direct feedback from peers (39).

> *"The kids have such in-depth conversations… **These conversations are really intense** and really great especially that active practice with the leveling… There is just a lot of this integration and conversations, and kids bouncing around from level to level, and really helping each other."* – Teacher 3
>
> *"… student engagement has increased because the way that the strategies are rolled out it requires the students to interact with each other and the teachers in a different way. That way they are more involved and **it's not teacher-directed, it's student-driven**."* – Coach 7
>
> *"[MLC has] really transformed the approach in the classroom. It's turned it into definitely something more where the students are involved. It's not the teacher kind of tossing information at the kids. **They are fully engaged in the process from beginning to end**.* – Coach 8

Student engagement

A key indicator of student-led learning is engagement in metacognitive regulation. In the MLC model, students engage in active learning to develop an understanding of how they learn and self-reflect on their progress. This increases their motivation to continue to improve their learning strategies (40). Motivation in self-regulated learning includes beliefs about ability to perform tasks and focus on learning for mastery of content rather than performance (9; 6). The January 2016 focus group participants all noted changes in how students approach math learning. They stated that students, especially those who were struggling in math before, have become

more willing to try solving math problems because they can choose the difficulty level of the problem. This relates to **customized instruction** that teachers are incorporating as participants of the MLC teacher leadership program. For students, selecting which math problems to solve is closely related to metacognitive regulation in that they need to first know what they know and what influences their learning to make a choice (9; 6).

> *"I found that students, who in the beginning wouldn't try anything, their paper literally would be blank when they turned it in or maybe a few scribbles. **As the year went on, they started to realize that it was safer to engage**. They actually started engaging."* – Teacher 2
>
> *"Before… their paper would be blank. As soon as they got to a word problem, they would be scared of attacking it or tackling it… Now, since that's all we really do, **they just go right in**."* – Teacher 4
>
> *"… that whole approach of giving choice to students that you can use. You can choose your number sets. **It gives a level of autonomy to kids**. For lack of better words, if you're low performing, you can still choose a number set that you're confident with."* – Coach 2

While teachers and coaches seem to agree that engagement among struggling students has increased, observations about students who perform well in math are somewhat mixed. Some students progressively choose more challenging problems while others stop at their current, already high level math problems, and do not take risks. This is due to the switch to standards based grading system that came with MLC model implementation which is still fairly new to both teachers and students. In the standards based grading system, grades are based solely on students' current proficiency level measured by specific standards; students can move to higher standards when they have demonstrated proficiency with the current standards (41). The change in the grading system seems to have affected high school students more than others because they are concerned about getting good grades to go to college. In the high school, students have a chance to take a second test to

show increased understanding in the concept but some students are not taking that chance because they worry that their grade will go down.

> "I found that if I have high performing students, they react positively to the grading system because **they love just exploring**… I found that with my low engaging, my low performing students, it's harder to get them engaged with the grading system and also the different ways that the material is taught."
> – Teacher 1
>
> "The other thing I found though, is the **higher achieving kids are more willing to settle for lower scores rather than trying to take the risk** because of the way the grades works because it's essentially one test and one retake is all they've got. If they're saying they're at that C and I know that they could get a B or an A, they're not willing to risk it and have a chance at being lower because that second grade is it. They don't want to try it." – Teacher 9
>
> "Because I think part of the struggle, too, is at the high school level, they're applying to colleges, and they're looking. They're competing along two different lines. **Yes, I could go down this journey and explore math, but if I end up with a C, we're in trouble here.** I've got to get into college. They have this need to perform well. Yes, that's at the cost of exploring and expanding my thinking…" – Coach 5

Perseverance

Perseverance through difficult problems is an indicator of student-led learning related to engagement and motivation. In addition to the availability of different levels of math problems to choose from, teachers mentioned that students have higher expectations of themselves and therefore try harder. In addition, when students do not know how to solve a math problem, they continue to try and seek help which is a self-regulated learning strategy (8). It seems that the growth mindset that participating teachers are embracing has trickled down to students and enhanced their confidence in math.

> "They're excited to show me what they know. **Even if they get stuck, it's okay**. They feel more comfortable to play with things."
> – Teacher 5
>
> "I feel like they are more comfortable with not knowing things and being able to express that and **knowing that eventually they will understand it**, so they think they are more patient with themselves. I think that makes it easier for them to kind of grasp what's going on, so then they take more risks. They are trying a lot harder, asking more questions. You see a lot more perseverance than you did before." – Coach 3
>
> "Our students love math now. I mean, there was a huge shift immediately on kids enjoying math, **enjoying the problem solving aspect**. Definitely the perseverance has increased dramatically. Their understanding to be able to explain why they're doing what they're doing has dramatically increased." – Administrator 6

Summary

☑ A higher percentage of students who had two years of MLC experience improved in math problem solving approach than students who had less or no experience in MLC.

☑ MLC participating teachers' classrooms are gradually showing more student-led learning.

☑ Compared to before MLC implementation, teachers now observe more peer collaboration that is focused on problem solving.

☑ Students are more willing to try to solve challenging math problems than before. Variation between groups exists: some students choose more challenging tasks while others are hesitant to take risks due to the importance of grades in college application.

☑ Students in MLC classrooms work through challenging problems by seeking help from both teachers and peers and trying harder.

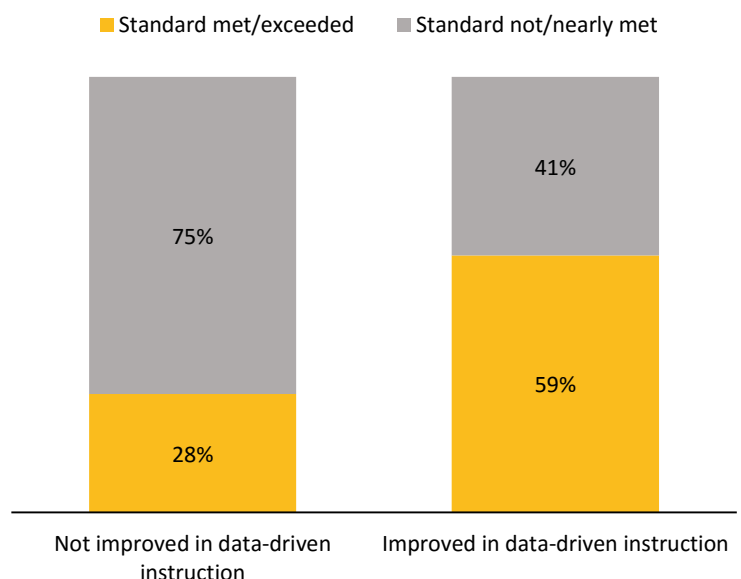# LINK #3: Data-driven instruction 🔗 Student-led learning 🔗 Math achievement

The MLC model posits that the culture of continuous improvement and shared leadership will affect student achievement in math through data-driven instruction that enhances student-led learning. Previous sections (Link #1 and Link #2) examined the relationships among continuous improvement, shared leadership, and data-driven instruction. This section examines the link between [1] data-driven instruction and student-led learning; [2] student-led learning and student math achievement; and [3] data-driven instruction and student math achievement. MLC's data-driven, problem solving focused instruction is hypothesized to influence student math achievement because of its alignment with the Common Core State Standards for Mathematical Practice.

Concept	Data-driven instruction	Student-led learning	Student math achievement
Measure	8 Mathematics Teaching Practices outlined in National Council of Teachers of Mathematics	6 survey questions regarding math problem solving approach including monitoring progress	2014-15 California Assessment of Student Performance and Progress (CAASPP) math test
Indicator	Improved in observed instruction from beginning to end of 2014-15 vs. not improved	Improved in problem solving approach from beginning to end of 2014-15 vs. not improved	Standard met/exceeded vs. standard not/nearly met

Participating teachers' improvement in data-driven instruction did not significantly correlate with the percentage of students in their classes who improved in math problem solving approach. Improvement in students' self-reported quality of math problem solving also did not relate to their achievement in math as measured by the 2014-15 California Assessment of Student Performance and Progress (CAASPP) math test. However, **students' current level of math problem solving at the time of the test did relate to their achievement**. Students who met or exceeded standard had significantly higher scores on the math problem solving scale than their peers who did not meet the standard (p < .05). The difference in scores (3.55 versus 3.48 out of 5 possible) was minimal. Further research is necessary to determine the relationship between math problem solving approach and performance in actual problem solving tasks.

Teachers' improvement in data-driven, problem solving focused instruction significantly related to student math achievement on the 2014-15 state math test. The percentage of students who met or exceeded standard was significantly higher for teachers who showed improvement in data-driven instruction in 2014-15 compared to teachers who did not show improvement (t (25) = -2.70, p < .05). However, this effect became nonsignificant when grade level (elementary and secondary) and teachers' years in MLC were held constant through multiple linear regression analysis. This means that improvement in data-driven instruction may not relate to student achievement in math when accounting for other individual and school-level factors, such as grade level and teacher experience.

Data-driven instruction and student math achievement on state math test

■ Standard met/exceeded   ■ Standard not/nearly met

Not improved in data-driven instruction: 28% Standard met/exceeded, 75% Standard not/nearly met

Improved in data-driven instruction: 59% Standard met/exceeded, 41% Standard not/nearly met

Conclusion

Evaluation and research data indicate that in Culver City Unified School District (CCUSD), a culture of continuous improvement and shared leadership is emerging with the development and integration of a peer coaching system as part of the leadership structure. Its effects on student achievement in math is not yet substantiated although there is evidence of the emergence of a student-led learning culture.

Partners directly involved in the implementation of MLC in CCUSD were the district itself, Loyola Marymount University (LMU), and the Cotsen Foundation for the ART of TEACHING. Four leaders from these organizations participated in telephone interviews and provided insights on how to successfully adopt the MLC model. Interviews lasted between 30 minutes to 75 minutes. Themes for discussion included partnership, resources, participant recruitment and retention, community support, and teacher leadership program components.

Partnership

- o The partnership among CCUSD, Loyola Marymount University, Cotsen Foundation for the ART of TEACHING, Leonetti/O'Connell Family Foundation, and Louis L. Borick Foundation has developed over the past years into a team with shared understanding of the MLC model.
- o In the beginning of MLC implementation, the partnership faced challenges around communication and understanding of roles and responsibilities. The partners persevered through these challenges by meeting more often with each other to redefine expectations and plans, maintaining positive attitudes and openness to difference in opinions, and developing trust.
- o For districts interested in adopting the MLC model, the partners recommend [1] coming to a clear agreement on the **purpose of the partnership** at the start of MLC implementation; and [2] creating an **effective communication channel** for all partners, such as holding regular meetings, using a facilitator, and maintaining clear documentation of roles and expectations.

Resources

- o Each partner contributed varying amounts of funds for the implementation of MLC. CCUSD's financial responsibilities involved not just allocating funds but also managing time, such as providing release time for teachers to collaborate and scheduling substitute teachers. Loyola Marymount University served as the backbone organization to provide oversight for the entire MLC implementation project and allocate funds accurately.
- o The partnership faced some difficulties in the past with funding for expansion of the MLC because the timeline of securing funds and finalizing the list of participating schools did not align. The partners were able to work through these difficulties by identifying and applying for various sources of funding, and using evaluation results to write grants.
- o For districts interested in adopting the MLC model, the partners recommend [1] securing **2 years of funds**, as opposed to yearly contract, for the partnership to implement MLC; [2] **assessing the fit**, before committing to the partnership, between the district and the cultural shift that the MLC model will bring as implementing the model requires more than allocating funds for the district.

Participant recruitment and retention

- o In CCUSD, recruitment was initially for two separate programs – Cotsen Foundation's ART of TEACHING program and Loyola Marymount University's Teacher Leadership by Design program. Recruitment at the elementary schools occurred in phases, with two schools joining each year. From these two programs emerged a K-2 model for teacher leadership.
- o A common issue identified by the interviewed partners is unclear understanding of commitment by the participating teachers in the beginning. Some teachers did not understand all components of the MLC model until

they had experienced the teacher leadership program even though they went through an application process and orientation. In addition, teacher buy-in issues arose with expansion and resulted in barriers to collaboration. When expanding to new districts, the partners addressed this issue by providing opportunities for teachers in those districts to connect with existing participants and students in CCUSD to learn about MLC from those who experienced it.

- o For districts interested in adopting the MLC model, the partners recommend [1] understanding that recruitment of teacher participants will be a **continuous process** with staff turnover; [2] administration having **full understanding of the model** to communicate it to the teachers.

Community support

- o In CCUSD, district and site administrators were supportive of and invested in implementing the MLC model. Although some misunderstanding around commitment existed, the partners were able to work together when problems arose.
- o In the beginning of MLC model adoption, providing accurate and clear information about MLC to parents was an issue as some parents did not fully understand the value of student-led learning and instruction that supports it. The partnership addressed this issue by having teachers and students inform parents about the model.
- o For districts interested in adopting the MLC model, the partners recommend [1] administration having complete understanding of **expectations for student learning** before implementing the MLC model; [2] **inviting parents and community members into classrooms** to showcase expectations for student learning that is not always going to be linear; [3] **having students communicate** what and how they learn to their parents by holding student-led math information sessions (e.g. open house).

Teacher leadership program components

- o The MLC teacher leadership program in CCUSD focused on alignment with the NCTM Mathematics Teaching Practices and problem solving instruction aligned with the Common Core Standards for Mathematical Practice from kindergarten through grade 12.
- o Various issues such as schedule conflicts with professional development programs in other subject areas and lack of clear connection between MLC goals and site goals existed. Constant communication between all stakeholders, including the partners, teachers, and administrators, was necessary to resolve those issues. Also in the first two years, the K-12 model was not evident since the two programs worked separately with elementary and secondary schools. In the third year with gradual shift of support from Cotsen Foundation and Loyola Marymount University to the district, CCUSD is initiating collaboration between fifth grade and sixth grade teachers to work on the transition from elementary to middle school.
- o For districts interested in adopting the MLC model, the partners recommend [1] **committing to a limited number of subject areas** for professional development in a given year while implementing the MLC model and creating a clear plan to incorporate program activities into teachers' daily schedule; [2] facilitating **regular cross-grade observations** with debriefing and providing other learning opportunities for teachers to refine the k-12 model; and [3] **administration collaborating with coaches** early on to meet the needs of the teachers and the schools.

The partnership is currently implementing the MLC model in two other districts in Southern California to refine it. Future research in those districts will continue to document the development of the culture of continuous improvement, shared leadership, and student-led learning and its effects on student achievement in math.

References

1. **ACT.** *The condition of college & career readiness 2015: National.* Iowa City, IA : Author, 2015.

2. **CollegeBoard.** 2015 College Board Program Results. [Online] 2015. https://www.collegeboard.org/program-results.

3. **Mattern, Krista D, Sharw, Emily J. and Marini, Jessica.** *Does college readiness translate to college completion?* New York, NY : CollegeBoard, 2013.

4. *Metacognitive knowledge monitoring and self-regulated learning: Academic success and reflections on learning.* **Isaacson, Randy M and Fujita, Frank.** 1, 2006, Journal of the Scholarship of Teaching and Learning, Vol. 6, pp. 39-55.

5. *Motivation and students' use of learning strategies: Evidence of unidirectional effects in mathematics classrooms.* **Berger, Jean-Louis and Karabenick, Stuart A.** 2011, Learning and Instruction, Vol. 21, pp. 416-428.

6. *Metacognition, motivation, and emotions: Contribution of self-regulated learning to solving mathematical problems.* **Tzohar-Rozen, Meirav and Kramarski, Bracha.** 4, 2014, Global Education Review, Vol. 1, pp. 76-95.

7. **Zimmerman, Barry J.** Achieving academic excellence: A self-regulatory perspective. [ed.] M Ferrari. *The Pursuit of Excellence Through Education.* Mahwah : Lawrence Erlbaum, 2002a, pp. 85-110.

8. *Teaching learning strategies: The role of instructional context and teacher beliefs.* **Kistner, Saskia, et al.** 1, 2015, Journal for Educational Research Online, Vol. 7, pp. 176-197.

9. *Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level.* **Dignath, Charlotte and Buttner, Gerhard.** 2008, Metacognition Learning, Vol. 3, pp. 231-264.

10. *Promotion of self-regulated learning in classrooms: investigating frequency, quality, and consequences for student performance.* **Kistner, Saskia, et al.** 2010, Metacognition Learning, Vol. 5, pp. 157-171.

11. *Reversing the downslide of student enthusiasm.* **Jenkins, Lee.** 5, 2012, School Administrator, Vol. 69, pp. 16-17.

12. *Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention.* **Blackwell, Lisa S, Trzesniewski, Kali H and Dweck, Carol Sorich.** 1, 2007, Child Development, Vol. 78, pp. 246-263.

13. *District-level considerations in supporting and sustaining RtI implementation.* **O'Connor, Edward P and Freeman, Elizabeth Witter.** 3, 2012, Psychology in the Schools, Vol. 49, pp. 297-310.

14. *When teachers work to use progress monitoring data to inform literacy instruction.* **Roehrig, Alysia D, et al.** 6, 2008, Remedial and Special Education, Vol. 29, pp. 364-382.

15. *Strategies to promote data use for instructional improvement: Actions, outcomes, and lessons from three urban districts.* **Kerr, Kerri A, et al.** 4, 2006, American Journal of Education, Vol. 112, pp. 496-520.

16. *How instructional coaches support data-driven decision making.* **Marsh, Julie A, McCombs, Jennifer Sloan and Martorell, Francisco.** 6, 2010, Educational Policy, Vol. 24, pp. 872-907.

17. **Means, Barbara, et al.** *Teachers' Ability to Use Data to Inform Instruction: Challenges and Supports.* Washington, DC : U.S. Department of Education, Office of Planning, Evaluation, and Policy Development, 2011.

18. **Park, Sandra, et al.** *Continuous Improvement in Education.* Stanford, CA : Carnegie Foundation for the Advancement of Teaching, 2013.

19. *A theoretical and empirical investigation of teacher collaboration for school improvement and student achievement in public elementary schools.* **Goddard, Yvonne L, Goddard, Roger D and Tschannen-Moran, M.** 4, 2007, Teachers College Record, Vol. 109, pp. 877-896.

20. *The shared leadership process in decision-making teams.* **Bergman, Jacqueline Z, et al.** 1, 2012, The Journal of Social Psychology, Vol. 152, pp. 17-42.

21. *Collaborative leadership and school improvement: Understanding the impact on school capacity and student learning.* **Hallinger, P and Heck, R H.** 2, 2010, School Leadership and Management, Vol. 30, pp. 95-110.

22. *How does leadership affect student achievement? Results from a national US survey.* **Louis, Karen Seashore, Dretzke, Beverly and Wahlstrom, Kyla.** 3, 2010, School Effectivenss and School Improvement, Vol. 21, pp. 315-336.

23. **Hawley, Willis D and Sykes, Gary.** Continuous school improvement. [ed.] Willis D Hawley. *The Keys to Effective Schools: Educational Reform as Continuous Improvement.* Thousand Oaks : Corwin Press, 2007, pp. 153-172.

24. *Continuous improvement in schools: Understanding the practice.* **Anderson, Stephen and Kumari, Roshni.** 2009, International Journal of Educational Development, Vol. 29, pp. 281-292.

25. **Stosich, Elizabeth Leisy.** Measuring school capacity for improvement: Piloting the Internal Coherence Survey. [ed.] Alex J Bowers, Alan R Shoho and Bruce G Barnett. *Using Data in Schools to Inform Leadership and Decision Making.* Charlotte : Information Age Publishing, 2014.

26. *Shared leadership for teacher and student learning.* **Printy, Susan M and Marks, Helen M.** 2, 2006, Theory Into Practice, Vol. 45, pp. 125-132.

27. **Carpenter, T. P, et al.** *Children's Mathematics.* Portsmouth, NH : Heinemann, 2015.

28. **Polya, G.** *Mathematical Discovery.* New York, NY : Wiley, 1962.

29. **Schoenfeld, A. H.** *Mathematical Problem Solving.* Orlando, FL : Academic Press, 1985.

30. —. What's all the fuss about metacognition? *Cognitive Science and Mathematics Education.* Hillsdale, NJ : Lawrence Erlbaum Associates, 1987, pp. 189-215.

31. **National Council of Teachers of Mathematics (NCTM).** *Principles to Actions: Ensuring Mathematical Success for All.* Reston : Author, 2014.

32. **Reeves, D. B.** *Reframing teacher leadership to improve your school.* Alexandria : Association for Supervision and Curriculum Development, 2008.

33. *Instructional coaching building theory about the role and organizational support for professional learning.* **Gallucci, C, et al.** 4, 2010, American Educational Research Journal, Vol. 47, pp. 919-963.

34. *Shared leadership: Is it time for a change?* **Kocolowski, Michael D.** 1, 2010, Emerging Leadership Journeys, Vol. 3, pp. 22-32.

35. *Administrative support and teacher leadership in schools implementing reform.* **Gigante, Nancy A and Firestone, William A.** 3, 2007, Journal of Educational Administration, Vol. 46, pp. 302-331.

36. *Distributed leadership: According to the evidence.* **Harris, Alma.** 2, 2008, Journal of Educational Aministration, Vol. 46, pp. 171-188.

37. *Distributing leadership to make schools smarter: Taking the ego out of the system.* **Leithwood, Kenneth, et al.** 1, 2007, Leadership and Policy in Schools, Vol. 6, pp. 37-67.

38. *Distributed leadership in schools: The case of elementary schools adopting comprehensive school reform models.* **Camburn, Eric, Rowan, Brian and Taylor, James.** 4, 2003, Educational Evaluation and Policy Analysis, Vol. 25, pp. 347-373.

39. *Classroom applications of research on self-regulated learning.* **Paris, Scott G and Paris, Alison H.** 2, 2001, Educational Psychologist, Vol. 36, pp. 89-101.

40. *Becoming a self-regulated learner: An overview.* **Zimmerman, Barry J.** 2, 2002b, Theory Into Practice, Vol. 41, pp. 64-70.

41. **Heflebower, Tammy, Hoegh, Jan K and Warrick, Phil.** *A School Leader's Guide to Standards-Based Grading.* Bloomington : Marzano Research Laboratory, 2014.