Final Report:
Year 3 SFUSD STEM Learning Initiative Evaluation

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Executive Summary

In the Fall of 2013, in partnership with the Mayor's Office and Salesforce.com, San Francisco Unified School District (SFUSD) launched an initiative to bring iPads to middle school math and science classrooms (the Math and Science Learning Initiative, MSLI). Year 3 of SRI International's Evaluation of the STEM Learning Initiative (formerly MSLI) focuses on SFUSD's implementation of the Core Curriculum and the integration of iPads in the middle grades. The evaluation consists of observation of teacher practice, a survey of middle school math teachers, and the collection and analysis of student's responses to a summative task.

Enactment of the Math Core Curriculum. When they described their practices using the Core Curriculum, many teachers reported increased collaboration between students. This claim was raised most commonly by respondents from schools participating in Complex Instruction professional development activities. Some teachers also reported an increase in student-centered instruction and a greater focus on conceptual understanding. Given that these reports are encouraging but inconsistent across respondents, the District should continue to help teachers develop teaching strategies that support deeper and more meaningful student collaboration around mathematics.

Equity in Students' Participation. Teachers attributed an increase in classroom conversations and more student engagement with the mathematics to the Core Curriculum and the Math Toolkit strategies. However, differentiation in heterogeneous classrooms is still difficult for some teachers, who report challenges with using the new materials with students with low prior math achievement, English Language Learners or students with special needs. The District can address some of these issues by highlighting the ways in which strategies in the Core Curriculum can support these populations and by providing additional equity-focused professional development for teachers.

Technology Use to Support Math. Nearly all middle school math teachers in our sample reported having access to and using technology during math classes. More than half of the teachers reported that their students used technology for higher order activities such as investigating content. Teachers also are demanding more integrated technology-related resources within the Core Curriculum and more coaching and integrated professional development to better use the iPads and Chromebooks they have.

Teacher Learning and Collaboration. Most teachers appreciate having common planning times with their fellow teachers, with teachers participating in Complex Instruction being some of the most vocal supporters of coaching and teacher collaborations. How often teachers meet and for what purposes varies across schools; perhaps the District could provide some standards for frequency and use of time during these district-supported meeting times. Many teachers also appreciated the support, feedback, and ideas they received from the coaches. Teachers of special needs students seemed to experience the least supports for implementing the Core Curriculum and reported the least participation in the math team meetings at their schools, suggesting that they might benefit from more targeted coaching and professional development.

Background

In the Fall of 2013, in partnership with the Mayor's Office and Salesforce.com, San Francisco Unified School District (SFUSD) launched an initiative to bring iPads to middle school math and science classrooms (the Math and Science Learning Initiative, MSLI). The initial goals for the project included deeper integration of technology into teaching and learning, and leveraging this widespread student access to catalyze more engaging learning environments and develop new student skills. During the second year of this partnership, SFUSD rolled out a district-curated K-12 Math Core Curriculum aligned to the Common Core State Standards in Mathematics (CCSS-M) with a strong focus on promoting student mathematical discourse. In 2015-16, the two initiatives—the Math Core Curriculum and the STEM Leadership Initiative (SLI, as it is now called)—became increasingly more integrated, and the Math Department's middle school team now collaborates with the EdTech Department on coaching, professional development, curricular revisions, and curating technology resources for math.

SFUSD has been making significant, simultaneous changes in the teaching and learning of mathematics. In 2009, the District adopted the A-G graduation requirements to enable all students to meet the minimum application requirements for schools in University of California system. In 2014, armed with data about inequitable results for students of color entering Algebra in the 8th grade, the District's Math Department successfully lobbied the School Board to pursue heterogeneous classroom groupings and stop tracking students by achievement levels, a policy that had been de facto filtering students of color from higher level math courses. The Math Department also proposed a curricular and professional development model to support teachers both in working with heterogeneous classrooms and in adopting the Common Core State Standards. The curricular component, the Core Curriculum, is a set of materials for all grades (K-12), curated and iteratively improved by teachers, District personnel, and District partners. Formative assessment is the driver for the lessons in each unit, with entry, apprentice, expert and milestone tasks. The District also selected three main mathematical strategies to support teachers in transforming their practice and engage all students in rich, collaborative mathematical practices, especially the practice of reasoning and communicating about mathematics.

After two successful years evaluating the incorporation of technology in middle school math classrooms in SFUSD, the District engaged SRI International for a Year 3 evaluation of two components of the District's SLI work: (1) the role of the Core Curriculum and tech integration on student discourse and reasoning and (2) a pilot of computer science offerings in 5 schools. This document includes the findings on the former.

Research

Goals and Questions

The evaluation is designed to describe the opportunities for reasoning and communication in math classes supported through the multiple SFUSD initiatives in SFUSD middle schools.

The organizing research questions are:

1. What does implementation of the designed Core Curriculum and new math practices look like in heterogeneous classes?
2. Are all children getting the opportunity to participate in rich discourse and reasoning tasks?
    a. What can an analysis of students' completion of MARS Tasks tell us about students' learning and reasoning?
3. How are technology resources being used to support student learning of rigorous math? (i.e., how are teachers using it? Which kids are using the technology and how?)
4. How are teachers learning, collaborating on and adopting the new curriculum and practices?

The remainder of this report will describe findings for each of these questions in turn, with the exception of question 2a as coded MARS data are not yet available.

Evaluation Methods

Data in this report were collected by SRI with aid from District partners between January 2016 and May 2016. We selected three representative middle schools in which to observe Math Department meetings and classrooms. We also surveyed all middle school math teachers in the District. Finally, we collected student responses to a MARS task from 15 classrooms across the District. In addition to this data, the Math and EdTech Department teams described the program goals as well as the curricular and professional development model.

Survey

All full-time SFUSD middle school math teachers (158 teachers), including 35 special education teachers (e.g., Special Day Class–SDC, Co-teacher, Resource Specialist Program) received the survey. We received 85 responses, or 51% of the total population of SFUSD's middle school math teachers. Of those, 8 declined to participate in the research. While this low response rate hinders our ability to make generalized statements about SFUSD's middle school math teacher population, over 66% of respondents (51 teachers) reported not participating in the Teacher Leader Summer Institute (August 2015), which suggests that the data from the survey could provide insights from a group of teachers from whom the District hasn't necessarily received prior direct feedback.

Respondents have contributed to the development of the curriculum materials in one of three ways: piloting and providing feedback in the development year (24%, SY2013-14), piloting and providing feedback in the first year of implementation (36%, SY2014-15), or teaching the revised materials in this past year (40%, SY2015-16). Of the 77 respondents, however, 49% reported not contributing to the writing of the Core Curriculum (or were unsure if they had), which means that we are

getting a good sample of people not invested in the development and yet willing to provide feedback.

Observations

We focused data collection on three schools, chosen for their diverse size, demographics, and professional development models. We collected data from six classroom observations and three Math Department meetings. The observations provide qualitative descriptions of the enacted Core Curriculum and are not representative of district-wide implementation.

Student Assessments

We collected 599 8th grade "End of Year Dinner" MARS Tasks from 15 teachers district-wide, representing 10 schools. Scoring was done by the Silicon Valley Math Initiative, which has a record of scoring MARS tasks to a high degree of reliability[1]. Originally, this MARS Task was part of the Core Curriculum: however, it was substituted out in the second revision. Fortunately, this task assesses the CCSS-M Function Standard: Construct a function to model a linear relationship between two quantities. Therefore, these assessments represent a convenience sample of 8th grade classrooms whose teachers were willing to assign this additional task to students after Smarter Balanced (SBAC) assessments.

1 Ridgway, J., Crust, R., Burkhardt, H., Wilcox, S., Fisher, L., and Foster, D. (2001). *MARS Report on the 2001 Tests.* Mathematics Assessment Collaborative, San Jose, CA, pp 120.

Findings

Implementation of Core Curriculum (Q1)

During SY2015-16, the District rolled out the second revision of the Math Core Curriculum to all math teachers. A big goal of the Core Curriculum is to help teachers shift from teaching and lecturing about procedures to providing students with opportunities to engage in conceptual learning through mathematical practices, like making sense of and persevere in solving challenging problems, and reasoning and communicating about mathematics. The pedagogical strategies to support teachers towards this shift in practice are interwoven in the curriculum and outlined in the Math Teaching Toolkit. These strategies emphasize collaborative group work, making sense of problems, and talking about math.

While we did not specifically asks teachers whether they are using the Core Curriculum or not, in the survey, 69 teacher contributed write-in responses about the successes and challenges of their implementation of the Math Core Curriculum this year. In the findings below, many responses come from four free-response questions that asked teachers to identify their successes and challenges in implementing the Math Core Curriculum, and the ways their instruction and student learning had changed. Percentages here reflect teachers noting these topics across all free response questions. The absence of a response should not be read negatively.

Teachers reported increased student collaboration, increased discourse in their classrooms, and evidence of students showing their reasoning.

Some teachers reported shifting to a more student-centered classroom. A smaller set of teachers also communicated requests for curricular revisions, which fits in with the Districts' approach to the development of the Core Curriculum, based on the Results-Oriented Cycle of Inquiry (ROCI) model.[2] These requests were for additional extensions or adaptations to the curriculum for students of different achievement levels, and for more differentiation strategies to support for English Language Learners (ELL) and students with special needs (SpEd).

Increased Collaboration

Nearly half (47%) of teachers indicated an increase in collaboration in the classroom since they began using the Core Curriculum. They describe the ways that students work and talk together about math. While teacher report and observational data suggest that collaboration is indeed happening in the classrooms, there is still room to improve the depth and quality of the collaborations.

> *"I really noticed the difference when I give students Do Now's and ask them to complete them independently. Students quite often help each other within minutes, even after I asked them to work independently. I think that it really taught students to think about learning math in a different way so that they are no longer isolated in their learning and that they do truly learn from each other."—8th grade teacher*

2 See SFUSD's 2013-15 Strategic Plan Impact Learning. Impact Lives. Source: www.sfusd.edu/en/assets/sfusd-staff/about-SFUSD/files/SFUSD%20Strategic%20Plan_rev2_FNL_073113.pdf

"They are learning to learn from each other and taking more risks with engaged learning, though there is still a long way to go."—7th grade teacher

"There are more students learning in a cooperative atmosphere as opposed to having to learn it on their own. They learn from each other and are able to explain a team members thinking."— 8th grade teacher

"I have had success in implementing group structures. Many of my students are accustomed to reading and interpreting the text and are successful in solving the problems. Many students are now used to explaining and justifying their steps in writing and orally."—7th/8th grade teacher

"[My] students teach each other"—7th/8th grade teacher

"[My] students are more flexible in their approach to learning, they dig in and collaborate on tasks."—6th/7th grade teacher

"I have provided more opportunities for students to work within group and challenge and learn from each other."—7th/8th grade teacher

"[My] student buy-in to group work."—8th grade teacher

All observed classrooms were set up to facilitate group work, including posters around the room providing students with norms and expectations about how to behave and what to do during group work. In these classrooms, we observed students working together at several points during the lessons. From our observations, it seemed that students had been doing this all year round, given the ease with which they engaged in conversations about the math activities.

For example, we observed students working together to sketch the amount of fabric they would need if they were to sew a gym bag, to find the central tendency of people in the students' families, and to find strategies for answering SBAC questions. In many cases, the products of the collaborations were individual pieces of work. Students often helped each other with the assigned work, but the help was often procedural. The 8th grade students working together on SBAC strategies had a single joint product. In that class, some groups, students truly collaborated on the answers; in others one student carried the group.

In our sample, 10% of teachers reported challenges in attempting to support students in collaborating. These include changes in teachers' practice as they create more opportunities for collaboration in the classroom. Teachers noted the difficulties in getting all students to contribute equally when working in groups. This was also seen in observations, where in several classes one to two students did the majority of the heavy lifting. Other students participated, but more in terms of asking procedural questions or outright for answers.

"[I'm working on] getting students to be articulate. 1 or 2 people carry the group."—6th/7th grade teacher

"Not every one participated well in the group activities and learned what they supposed to learn."—8th grade teacher

Increased Focus on Conceptual Understanding

SFUSD's Core Curriculum provides teachers materials aligned with the CCSS-M that allow all students access to rigorous content and opportunities to engage in the math practices of reasoning, discourse, and collaboration. Thirty percent of the teachers in our sample described successes in developing students' conceptual understanding and shifting their practice toward a greater focus on concepts rather than procedures.

> *"The Core Curriculum has helped me to teach to students' conceptual understanding with greater consistency. The provided CPM lessons and various tasks pulled from different sources focus heavily on concepts. With that being provided, and me having to search less for such material, I can focus then on the instructional strategies I would use."—7th grade teacher*

> *"There is a greater focus on concepts, rather than memorizing procedures. Students also have internalized that learning math is more about making sense than memorization."—7th grade teacher*

> *"I think the [Core Curriculum] along with Complex Instruction has allowed students to go deeper to develop and understand their thinking."—7th/8th grade teacher teacher*

> *"Complex Instruction has helped me realize that math isn't about doing worksheets and problems. Teaching math is all about facilitating experiences where students engage with rich mathematics. The Core Curriculum has also helped me realized the emotional aspect to teaching mathematics. I try to encourage students and emphasize growth mindset as much as possible."—6th/7th/8th grade teacher*

> *"Students are thinking deeper. It makes them do more of the work. Students who were proficient or a little bit below proficient at the beginning of the year have been successful accessing the curriculum."—7th/8th grade teacher*

We also observed some classrooms in which students used Core Curriculum lessons that provided challenging problems that engaged students in both developing concepts and practice mathematical practices. For example, we observed an 8th grade class during the second day of a lesson on surface area of prisms and cylinders. The teacher started the day with the information on the challenge (make a cylindrical gym bag) and images to support their understanding of the context (what is involved in buying fabric). Then students independently worked on ways to calculate the perimeter of a circle–the skill they needed to make their models.[3] The students worked on this for a few minutes, coming up with various ways to calculate it.

3 This class used an 8th grade Core Curriculum lesson from Unit 8.7 – Triangles and Beyond.

Afterwards, the teacher introduced the equation c = 2ϖr. Later in the lesson, students worked in groups to model, with sketches, the material they would need to make a cylindrical gym bag. Many students in the groups grappled with what the addition of a seam would do to their calculations of area and circumference.

One concern in developing and revising curriculum from a variety of sources is the potential for a loss of coherence. However, teachers reported that the Core Curriculum has given them a more coherent approach to teaching mathematics.

"[The Core Curriculum] has made me look at math in a more holistic/conceptual sense as opposed to a laundry list of tedium that must be covered. It's easier to be aware of and discover connections across topics instead of memorizing facts for a test and then forgetting about them."—6th/8th grade teacher

"Having time to going deeper into concepts rather than bouncing from standard to standard."—7th grade teacher

Teachers Reported an Increase in Student-Centered Instruction

Through the Core Curriculum and its foundation in formative assessment tasks, the Math Toolkit's strategies to support collaboration, and two professional development models (Teacher Leadership and Complex Instruction), teachers also learn a variety of ways to set up and monitor group work that encourage students to participate and engage with the mathematics. Group work and student-centeredness are often intertwined. Group work in itself does not suggest that a classroom is more student-centered, but students working collaboratively, knowing what to do and what norms to follow for productive collaboration, can give teachers more confidence in students' abilities to self-regulate and stay focused on content, leading to a more student-centered classroom.

A quarter of teachers in our sample noted a shift in their teaching, away from direct instruction, towards a student-centered classroom, where students reason and communicate about mathematics and teachers take on the role of facilitators. In observations this came through in the amount of group work students' engaged in. Teachers still presented material, but for less than a third of the period. The rest of the time students were to engage with the material and each other.

"Students are taking more leadership in their learning, so that it's more student centered. I am having students own the discussion of the learning more through discussions."—6th grade teacher

"The teacher is no longer the bearer of knowledge. We learn from each other."—8th grade teacher

"With Complex Instruction and the [Core] Curriculum, we have had less direct instruction and teacher talk and more opportunity for student voice. We have also seen an increase in our students' ability to engage in academic struggle."—8th grade teacher

"The Core Curriculum requires that students work cooperatively in complex groups. This removes the center of instruction from the teacher and places it within the student teams, enhancing student discussion of math concepts and strategies."—6th grade teacher

"There is more discussion between myself and the class - not as directive but more of co-creating a common understanding. There are less problems, but they progress and develop in the depth of the task."—6th/8th grade teacher

"Before my students could only do problems that I explicitly taught them how to do. If they were asked to do something challenging they would just say that they couldn't do it. Now my students can tackle any challenging problem because they have the confidence and critical thinking skills to do so."—6th/7th/8th grade teacher

Because teachers responded to an open-ended prompts about successes and challenges with implementing the Core Curriculum, we have little evidence from teachers who may be having less success with student-centered practices. However, one teacher reported feeling rushed through the curriculum to meet benchmark testing demands, which could suggest that others may have similar concerns.

"Unfair time pressure because of state testing and Interim Assessment Block (IAB) testing. I have given the IAB during windows that do not match what our students have learned, instead of meeting students' needs. I am still feeling rushed to go through the curriculum instead of meeting students' needs because of the testing windows."—6th grade teacher

Opportunities for SFUSD

Learning how to work in groups and participate productively in collaborative situations is a difficult, if necessary, skill. Teacher reports of increased collaboration are a step in the positive direction, as collaboration is seen as socially desirable. However, the District should help teachers learn to support deeper and more meaningful collaborations through professional development and the Core Curriculum. In the next revision of the Core Curriculum, the District can revise or curate tasks/activities to truly require collaboration.*

The data we collected makes it difficult to parse apart the effects of Complex Instruction and the effects from using the Core Curriculum. In this evaluation we got as far as understanding how some teachers are using the curriculum via self-report and through some observations, however future evaluations could dive deeper into fidelity and parameters of implementation. What enables some teachers to successfully engage in student-centered practices, deep conceptual discussions, and productive collaboration? How do schools that are engaged in Complex Instruction implement the Core Curriculum differently?

* Roschelle, J. & Teasley, S. D. (1995). The construction of shared knowledge in collaborative problem-solving. In C.E. O'Malley (Ed.), *Computer-supported collaborative learning* (pp. 69–97). Berlin: Springer-Verlag.

Equity in Students Participation (Q2)

By changing its practice of ability-tracking students, the District has been working to ensure that all students have the same opportunities and equal access to rigorous mathematics and mathematical practices. Additionally, through the partnership with Salesforce, 8th grade teachers benefited from a smaller class sizes with no more than 24 students this past school year. Unfortunately, we cannot disentangle the effect of class size reduction from changes due to the Core Curriculum. During the 2015-2016 school year, many teachers reported an increase in student participation (compared to their experience in previous years). While student engagement and participation reportedly increased, teachers noted that they still have low achieving students, specifically ELL and SpEd students, who continue to struggle to participate fully.

In observations, it was very apparent that it is challenging to engage all students. Teachers seemed to tackle this in different ways. In one class, Spanish-speaking students helped translate work for bilingual students who needed it. In another, students were paired up by level, with the exception of one advanced student who sat in a group with two lower achieving students so that she could help them engage in the material, and she could learn to more clearly communicate her thoughts. The success of this strategy was unclear based only on that observation. In another class, students had chosen their own groups, making for some productive pockets and other wildly uneven groups. These variations also held with discourse and engagement; some very bright spots of high engagement and discourse, and other pockets of students that were completed checked-out.

Some Increases in Classroom Discourse

In heterogeneous classrooms, whole class discussions mean that all kids have access to the mathematics (hopefully rich, meaningful mathematics), and all kids may have the opportunity to communicate about the discipline, even if not all students contribute verbally to the conversation. Nearly half of the teachers in our sample (46%) reported an increase in (or the new appearance of) productive discourse in their classroom.

"They lowered the 8th grade class sizes, which is amazing!!!! The amount you can do, the kind of support you can give, the conversations, everything is so much better with the smaller class size. If only they would lower the 7th grade class sizes..."—7th/8th grade teacher

"Students are now more comfortable to share the process [rather than] the 'right' answers. They are practicing to work with partners and small groups. They expect to be asked to explain their thinking."—6th grade teacher

"They are more immersed in the total language and ideas of mathematics, not as focused on specific procedures. There is more justification and clarification of ideas."—6th/8th teacher

"They spend more time learning from each other. They also have more opportunities to explain their thinking and to challenge each other."—6th/8th teacher

"They know they need to explain their reasoning more. They resist, but the ones that get into it really master the concepts so much better."—6th grade teacher

"Valuing the process and reasoning behind each students' path in finding a math solution and examining them in detail with the class. More group work and student talk activities."—6th grade teacher

While teachers reported increased discourse from previous years, the quality of the discourse and the number of students participating is varied. In all observations, students participated in whole class and small group discussions to some extent. In a few classes, students engaged in boisterous conversations about the lessons. While some students talked together about the math as they worked through problems, much of the conversation centered on answers ("It's not 24, it's 23!!") or procedural moves ("You have to divide first!") Much less conceptual talk between students was observed. In whole class conversations, however, the teachers posed questions that encouraged students to explain their thinking. It became evident throughout the observations that some students, especially those with limited English, did not participate as much in either small group or whole class discussion.

Participating in mathematical conversations makes linguistic demands of all students. Not only do students need to make sense of abstract concepts, but also learn to use the vocabulary and practices of the discipline. This can be especially difficult for students whose first language is not English. While the Math Teaching Toolkit and the Core Curriculum provide teachers with pedagogical tools for engaging ELLs in math conversations (such as the Three Reads Protocol and Math Talks), some teachers reported EL students have difficulty participating in math conversations.

"It's made the advanced students explain their thinking more but it's made it harder for those with limited math skills and limited English skills."—8th grade teacher

"Many are still frustrated with multiple answers, and not having the language to explain their thinking."—6th/7th grade teacher

Changes in Engagement

Teachers report increased engagement because of the relevant, hands-on nature of some activities and the group work. While engagement in and of itself is subjective, especially in teacher's responses, it could indicate that at least in some classrooms, students are more willing to contribute to math discussions with their peers and the whole class. In at least three of our observations we saw high engagement.

"I find that all my students are learning and retaining more because of complex instruction. It is engaging students who were formerly disengaged. It is challenging students to think critically."—6th/7th/8th grade teacher

"With complex instruction and Core Curriculum, we have had higher student engagement and seen growths in math skills at 8th grade. "—8th grade teacher

"It has been more rigorous and interesting than before. We have student voice surveys in my school and more students than ever before thought that math class was "interesting", "captivating" and relevant to real life. Also, the curriculum has pushed

kids to think deeper about math, and not just memorize things. "—7th grade

"Some of the lessons are excellent. Especially the 2015-2016 curriculum. The students are engaged and "matching cards" type of activities have been proven to be very successful. "—6th grade teacher

"Students who were below and far below proficient have had minimal success and continue to struggle."—7th/8th grade teacher

Differentiation in Heterogeneous Classrooms Challenging

While some teachers noted that curriculum increased motivation for some lower performing students, others reported the Core Curriculum was better at challenging higher performing students. In observations, we saw both sides of this. In one classroom, a group of teacher-described high achieving students engaged in a robust conversation about the content. While in the same classroom, two students who believed they had mastered the material expressed frustration that there were not enough extensions for them. Other students with limited English at times relied on other students to translate for them, or appeared to check out completely. In one class, an entire table of students who were more rambunctious than their peers sat at the same table, off to the side of the classroom. They were engaged in very little of an activity that had many of their classmates working and talking.

Group learning, helping others, structure, checkpoints has improved the level of explanation of answers and understanding, it has also made students more accountable to explain answers, be thorough and show their work. It has also been a better preparation for the SBAC and higher levels of thinking. And, I've noticed my IEP students and students that struggle individually are given a change to feel empowered by math. – 7th/8th grade teacher

The curriculum did "motivate the low performing students not giving up the Math."—8th grade

"It's good to use [the Core Curriculum] to challenge my higher level students."—SDC teacher

"The greatest challenge is that I feel the text-heavy nature is hard to access for newcomer students and students below grade level. It takes a lot of time to adapt curriculum to ensure it meets the needs of ALL students."—7th grade teacher

"The students in my classes have a very wide range of learning needs. Some tasks do not have enough points of entry for students struggling with the grade level content. There are even fewer opportunities for extension and deeper learning. It was an extra challenge to make sure I had materials created that would appropriately challenge students at their respective levels."—7th grade teacher

Differentiating for ELL and SpEd Students Still Difficult

While the District is providing materials and support to ensure that all students can participate in making sense of the mathematics, 30% of teachers reported having difficulties in making that happen. Teachers described challenges in differentiating for all students, especially ELLs or students with special needs. Some

of the comments reflect teachers' own beliefs and fixed mindsets, which might be addressed through additional coaching and professional development workshops. Other teachers point to an opportunity for the District to reduce the language load (not the cognitive demand) of some of the tasks to more easily enable participation from students with a variety of language abilities.

"Students' reading levels are grades lower as measured through Scholastic Reading Inventory scores, so they are having trouble with literacy, which makes it hard for them to tackle the word problems. I am spending a lot of time modifying the curriculum to meet student needs. Some/ many students have a fixed mindset that I didn't have time to address. The curriculum also has to have more social justice and more relevancy to the interests of our student d, so that they are engaged."—6th grade teacher

"Struggling students have difficulty engaging in discussions around mathematical ideas and seem to resent the need to struggle with the content to gain understanding." —7th/8th grade teacher

"[Students have] vastly differing skill levels and students so far behind they refuse to participate." —7th grade teacher

"Some of the activities are time-consuming or very convoluted with little gain. There is not enough time built in for students to do the discovery process. Higher-level students will get it within the given timeframe, but I don't think the curriculum addresses ELL and SpEd students enough to make the curriculum accessible."—7th/8th grade teacher

"Access for language learners has been trickier because there are many more word problems that they cannot understand."—6th grade

"The greatest challenge is that I feel the text-heavy nature is hard to access for newcomer students and students below grade level. It takes a lot of time to adapt curriculum to ensure it meets the needs of ALL students."—7th grade

Challenge in "including Special Education students with extreme behaviors and/or deficits."—7th grade

The District has been quite intentional in providing strategies to support ELL student engagement such as the Three-Reads strategy.[4] However, how this and other strategies can support EL's participation may not be sufficiently transparent. And perhaps, pedagogical strategies are necessary but not sufficient to support changing teacher practice and beliefs.

"It is very difficult to implement because of the non-existent support in modifying for special ed and ELL learners."—8th grade

"I understand that challenging students is optimal but we may be losing out on the "English Language Learners" and not meeting the achievement gap because these lessons may not have the proper scaffolding. Unfortunately the current culture in the district math department does not address the needs of the students mentioned above. Some scaffolding strategies need to be provided if we are to close the achievement gap." —6th grade teacher

4 For details on this strategy, see http://www.sfusdmath.org/3-read-protocol.html.

Opportunities for SFUSD

In this one-year evaluation, it is not possible to track changes in student discourse and engagement from previous years. However, a multi-year evaluation might shed some light into the seemingly positive trend reported by some teachers. Similarly, it may be important to understand what school-conditions, teacher supports, and teaching practices contribute to engaging all students equitably in heterogeneous classrooms.

It is also important to understand both the quality as well as the quantity of student discourse. While increasing discourse is important, especially in classrooms in which students have traditionally not contributed to the conversation, further research is needed to reveal who is participating as well as how they are participating. This may align well with some of the Districts' ongoing research activities, which involve collecting student surveys as well as teacher and coach interviews.

The Core Curriculum revisions team should consider decreasing the linguistic complexity of some of the curricular tasks. Often, pre-existing curricula (some of which are used in this curated set of materials) are very wordy, providing lots of extraneous information and many contextual queues which can make it unnecessarily difficult for language learners.

Additionally, and inline with the recommendations regarding the integration with EdTech, the revisions team can also find ways in which multi-representational dynamically-linked technologies can provide EL and SpEd students with additional linguistic-light resources that can enable them to contribute to group and class conversations.

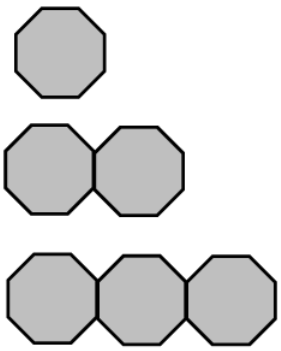
Finally, the Math Department may have additional strategies and supports for teachers working with special needs students. Make existing tools more evident and consider providing additional professional development opportunities to support these teachers in implementing the Core Curriculum.

MARS Task Analysis (Q2b)

Through its use of formative assessments, the Core Curriculum provides teachers with information about student learning. Teachers can see what students already know about a topic with the Entry Task, and then what they are learning and how they are making sense of the mathematics with the Apprentice and Expert Tasks, even before they assess whether students learn what was expected through the Milestone Tasks. For some of these tasks, SFUSD has used MARS tasks, formative and summative performance tasks aligned with the CCSS-M (concepts and practices) developed by the Mathematics Assessment Project (MAP). These tasks have been used in both teaching and high-stakes practices across the US, providing us with a large comparison group.[5] Jointly with the Math Department, we selected a milestone 8th grade task to assign 8th grade students as a way to see how students in the District were able to explain their reasoning in writing.

"End of Year Dinner" is a MARS Task in which students need to develop a linear model for the number of people who can fit around joined octagonal tables (Figure 1). The task involves both filling in the blanks and explanations. The Silicon Valley Mathematics Initiative (SVMI) scored the 599 tasks collected from 15 teachers' classrooms across 10 schools and provided data from the comparison group. The comparison group (blue bars in Figure 2) represents a total of 8,629 students from diverse backgrounds were in the comparison group. "The comparison group was derived from a sample of students from 34 school Districts who were administered the Eighth Grade MAC/MARS Performance Assessment in 2014. The End of Year Dinner task was one of the five performance tasks that comprised the test." The districts in the control group represent large urban and suburban districts, districts representing various SES and diverse student populations."[6]

Figure 1. "End-of-Year-Dinner" MARS Task set up and first question.



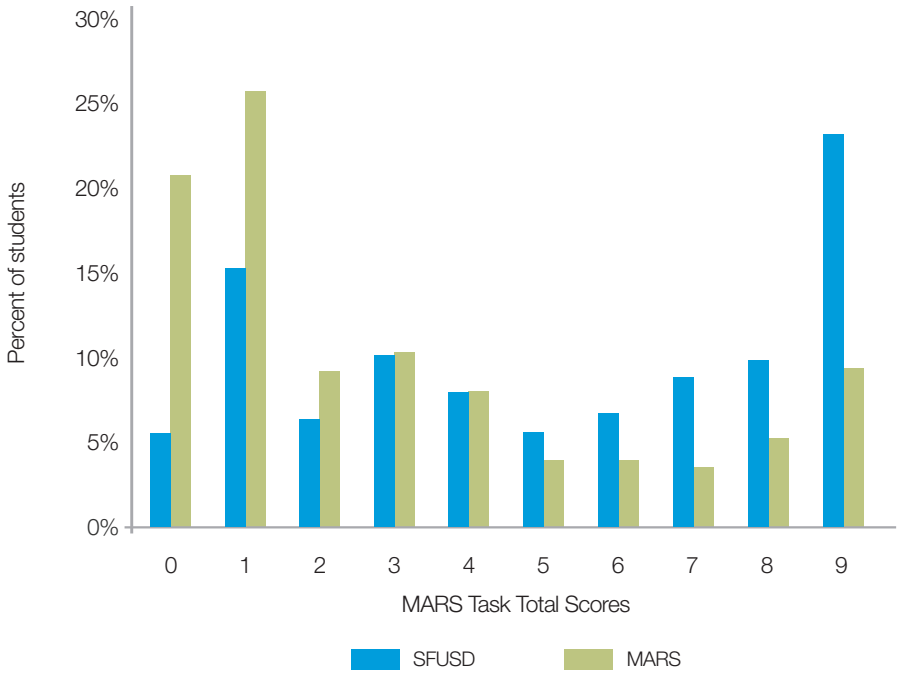
Eight people can sit around 1 octagon-shaped table. One person can sit on a side of a table that is not touching another table.

1. How many people can sit around two tables if the tables are pushed together sharing one side?

5 Mathematics Assessment Resource Service (MARS), http://www.mathshell.org/ba_mars.htm.

6 SVMI's End of Year Dinner from 2014 MAC/MARS Performance Assessment Background Information.

Figure 2. Comparison of SFUSD students to comparison group on 8th grade MARS Task.



This graph in Figure 2 shows the percent of students with a range of scores. For example, over 20% of the students in the SFUSD sample received full credit for this task (9 points), whereas less than 10% of the comparison group did. The graph suggests that students in the SFUSD sample fared better than those in the comparison group, with fewer students scoring less than two points, and more students scoring above five points. Generally, students scoring five or more points on this task correctly determined the linear function that describes the change in the number of people that can be seated at joined octagonal tables. There are four prompts in which students must explain their reasoning or describe a correct method for arriving at a solution to a closed-ended prompt. Students with more than five points successfully explained their reasoning in at least one of those prompts.

Opportunities for SFUSD

Milestone MARS Tasks can be a strong source of formative feedback for the continuous improvement of mathematics curriculum and pedagogy in SFUSD. We recommend that the District develop a structured process to collect these data and track data trends over the years.

Technology Use to Support Math (Q3)

In light of the technology infusion into middle schools and the specific attention on middle school math from the Salesforce grant, we asked teachers to report on the use of technology during their math classes. We also witnessed some technology use during our classroom observations. Nearly all the teachers in our sample (92%) reported having access to technology for use in the classroom. Additionally, 56% have sixteen or more iPads per class, 16% have up to 15 iPads, and the rest have a combination of shared iPad carts or Chromebooks for student learning. 8% reported having no access to technology for student learning. It should be noted that all teachers, even those who reported having no access to technology, identified at least occasional student use of technology during math class. In classroom observations, we observed three classrooms where teachers used technology to present and one classroom where every student had their own laptops for the lesson.

More Infusion of Technology in the Core Curriculum

The increased collaboration between the content and EdTech coaches is evident in the number of math teachers reporting students using technology during math class (about 53%). The following bar graph shows that more than half the teachers in our sample had students use technology for "Investigating Content" and "Accessing pre-made Content" (over 50%), as well as "Performing Calculations" (almost 60% said daily or weekly), and nearly 40% reported daily or weekly "Practicing Skills (e.g., worksheets, practice software)."

"I need more coaching on how to integrate these apps in the lesson. Even more amazing would be if the District math curriculum had suggestions in the teacher lesson plans on what apps you could use to integrate technology in the lesson."—7th grade teacher

"More applications that are directly related to common core that are intuitive to use. For example, the algebra tiles app is difficult to understand and manipulate. I

Figure 3. Availability of iPads for student learning.

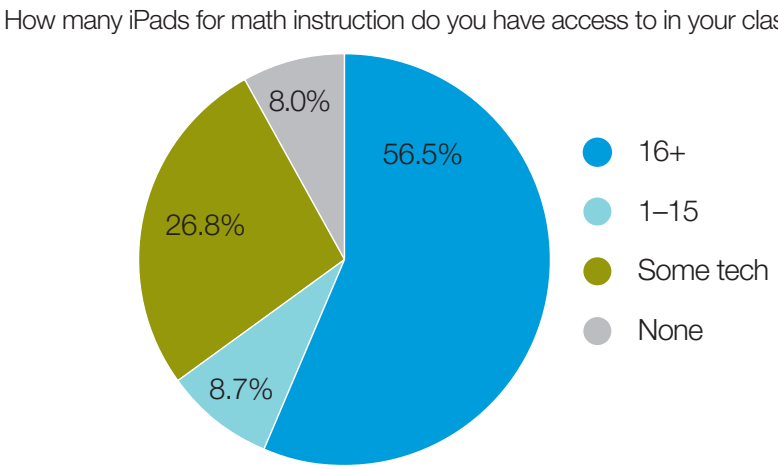
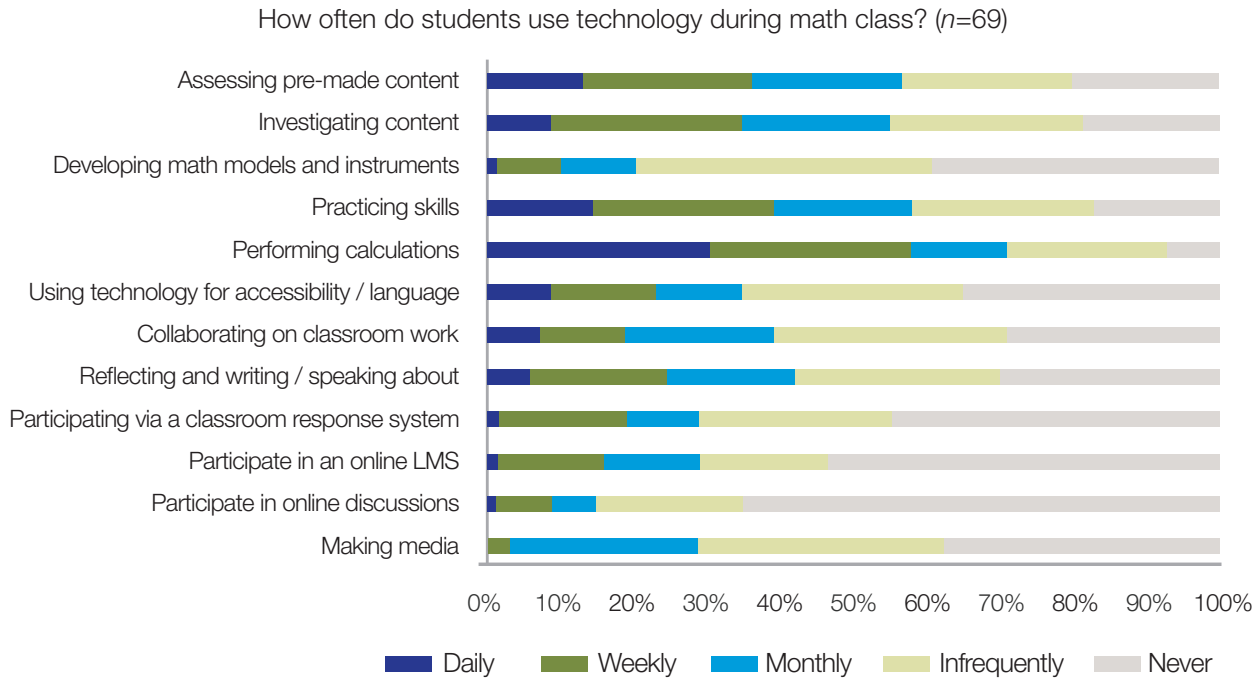


Figure 4. Frequency and purpose of student technology use during math class.



cannot find any good games for students to play around solving equations or other Common core standards. The best resources for me on the internet have been the Desmos site and Shodor site, both of which have very good interface and are very intuitive to navigate. More sites like this would be very helpful. The Desmos site in particular is really great. PD around how to use this site effectively would be great."—7th/8th grade teacher

"Adopted curriculum easily available and formatable for delivery and sharing on Google classroom. A few more iPads so that it is 1-1. Less glitches with technology, Google drive - sharing - classroom. Good styluses for all students - the rendering on iPads to not be glitchy - getting in the way of the task - keyboards that obscure text - etc." —6th/8th grade teacher

"I've had some sporadic support with using iPads in the classroom. Frankly, I have not yet been shown a meaningful way to use the iPads in the classroom. They ways in which iPad use have been modeled to me are at best replacements for paper based tasks and at worst just gimmicky. So I don't just them very often." —7th grade teacher

During our first year evaluation, some teachers had access to technology and we did not expect full integration and use during math class. This year, in addition to the report of students using technology, teachers also described which apps they use the most: google suite (drive, sheets, classroom). Teachers also use Slides (25% monthly or weekly), NearPod (23% monthly or weekly) and Explain Everything (25% monthly or weekly). Teachers also reporting discovering apps on their own – showing how much excitement there is about integrating technology.

Opportunities for SFUSD

The District should have and communicate a clear vision of how the technology should be used in the classroom to support deeper mathematics learning.

The District should continue supporting the collaboration between EdTech and Math coaches by identifying and integrating opportunities for productive technology use in the curriculum, and by finding a way of reaching that last 8% of teachers who do not have access to technology.

The district should also continue and increase EdTech coaching.

Teacher Learning and Collaboration (Q4)

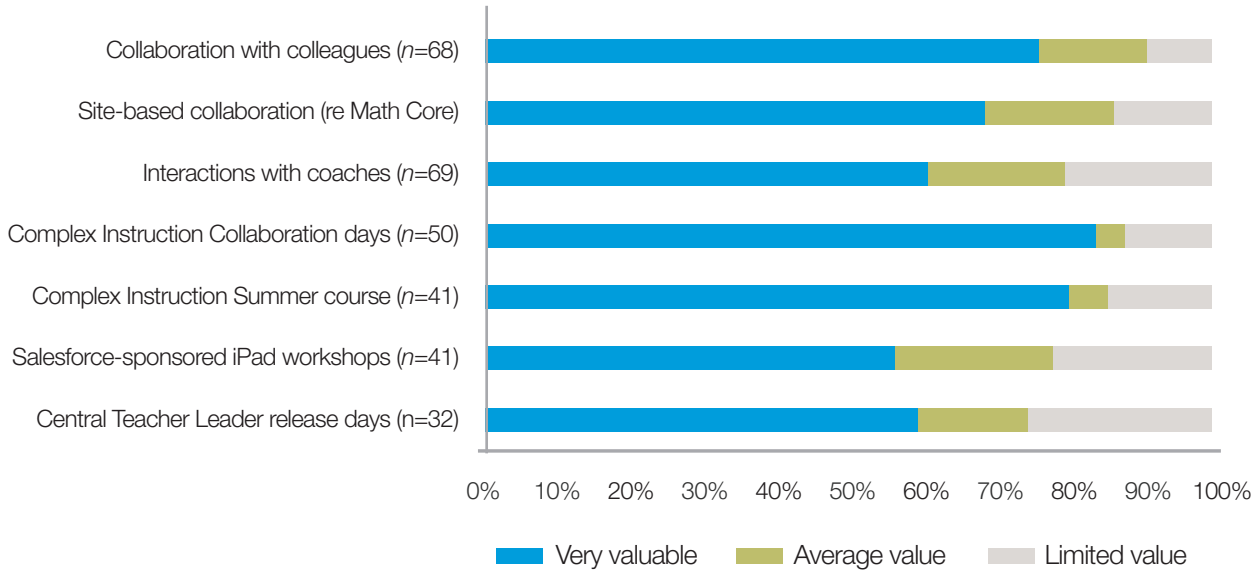
The District provides multiple opportunities for teacher learning and collaboration: common planning time at schools, Math and EdTech coaching, summer workshops on the Core Curriculum and/or Technology Integration, and two ongoing professional development models (Complex Instruction or Teacher Leadership). Math teacher leaders from each middle school participated in summer institutes on the new curriculum and math practices. Additionally, many teachers opted to participate in summer institutes centered on supporting iPad integration in service of the Math Core Curriculum.

Of the 69 respondents, about 85% reported feeling supported in implementing the Core Curriculum through the materials themselves (16%), by having school-based or cross-school collaboration time (23%), coaches (38%), participation in workshops (17%) and by having smaller class sizes (4%).

> *"I thought going to the Common Core workshop during the summer really helped me understand the ways in which to implement the practices in the classroom. Having coaches observing me and giving me feedback for ways to improve my practice is also very helpful. I just wish there were other workshops in the summer that could refuel us with those practices."—8th grade teacher*

Teachers indicated strong appreciation for the various PD opportunities provided. In particular, teachers rated as "very valuable" in collaborating together in Math Department or grade level meetings (76%), collaborating around the Math Core Curriculum at their sites (69%), and interacting with their coaches (61%). Teachers participating in Complex Instruction also highly valued their collaboration days (84%) and the summer course (80%). Respondents also valued the iPad summer workshop highly (56%).

Figure 5. Teacher valuation of various professional development opportunities.



Teachers Appreciate Having Common Planning Times

Both the survey and observations of Math Department meetings indicate that teachers find the collaboration time at school sites very valuable.

"Our math department has been very supportive and has had several partial release days to collaborate together."—8th grade teacher

"[We have had] multiple trainings and meetings devoted to implementation."—7th grade teacher

"I have been given opportunities to work with teachers at my school, math coach from the district and teachers from other schools."—7th/8th grade teacher

"Working with just one other school, afforded the opportunity to learn from others."—8th grade teacher

"Most support is via department meetings and planning."—8th grade teacher

Few teachers reported dissatisfaction with the common planning times. For one, common planning times takes away from other "valuable" activities.

We observed three very different common planning meetings in which teachers seemed very engaged. Teachers planned lessons together, shared professional development (PD) opportunities, shared what they learned from a technology training, did lesson study planning, met in grade level groups, and planned future meetings.

In one meeting, teachers engaged in Lesson Study, discussing and critiquing one teacher's lesson plan. The teachers, along with a math coach and school curriculum facilitator, went through the lesson looking for opportunities to scaffold the lesson, increase

discourse, and encourage robust collaboration. Each teacher was responsible for noticing different aspects of the lesson such as opportunities for student discourse or places where collaboration should be emphasized. The next day, all the teachers were going to observe the teacher enacting the lesson. They planned to debrief after the class. In another PLC meeting, middle school math teachers talked through business as a whole group and then broke into grade level groups to work through an upcoming Milestone task for their students. They groups read through the task with an eye toward misconceptions, talking through the places they believed their students would struggle and generating different ways to scaffold those places. Most teachers appeared to be very engaged in this process. In the last PLC, teachers discussed math department business, including updates on the ongoing Smarter Balance testing. They spent a quarter of the meeting discussing upcoming and promoting professional development opportunities from the district, and required Complex Instruction course work and activities for all teachers in the school, including several teachers who were relatively new.

Complex Instruction Receives High Marks from Teachers

Teachers involved in Complex Instruction (CI) are particularly vocal and enthusiastic about what they have learned, how they are using it, and how valuable they feel Complex Instruction is to their practice and their students. There were no negative responses regarding CI.

"We got a lot of support from our CI coaches around instructional strategies. Not some much in implementing the Core Curriculum itself. But we were generally faithful to implementing the curriculum as it was provided."— 7th grade teacher

"Complex instruction training was super helpful." —7th grade teacher

"Complex Instruction has supported me a lot by having coaches and facilitator meetings where we are talking about our practice and how we can continue to support this practice at our school." —7th/8th grade teacher

"The Complex Instruction coaching has been very hands-on and helpful. It's definitely a great support structure!" —7th grade teacher

Our CI coaches have done coaching cycles with us throughout the school year to support our use of the core curriculum and the use of ci strategies."— 6th/8th grade teacher

Coaches are Perceived as Helpful

Thirty eight percent of survey respondents mentioned coaches and coaching when describing the support they have received from the District in implementing the Core Curriculum. Their responses range from factual to over-the-top enthusiastic.

"Our complex instruction coaches (Evie and Vriana) have helped us learn more and improve exponentially. We could not have grown so much without their support. The district math team (Ho, Angela, and others) have created a coherent vision that makes meaningful work at sites possible. I truly feel blessed to work for SFUSD as a math teacher

because district leadership is so strong."—6th/7th /8th grade teacher

"Having coaches observing me and giving me feedback for ways to improve my practice is also very helpful."—8th grade teacher

"The coaches have really helped me plan, or look at easier ways to teach lessons."—6th grade teacher

"My site coach has been very helpful and continually reaches out to us for support."—6th grade teacher

A few teachers, however, did complain that the limited time they had with their coaches (once or twice a year, or not once for an EdTech coach) was not worth the effort and they would like to see the district spend their money elsewhere, like reducing class sizes in more grades or more workshops. This may not be representative of the way coaches interacted with teachers, however the District should pay attention to whether some coaches may be overextended or overwhelmed with their coaching duties.

Teacher Leaders and Facilitators Have Many Responsibilities

Twenty-one teachers described leadership roles and responsibilities at their schools. At schools with Complex Instruction (CI), some teachers identified themselves as Teacher Facilitators whose responsibilities include sharing research and theory, supporting CI structures in the classroom from Teacher Facilitator meetings, and participating in peer reciprocal observations. Teachers who identified as Teacher Leaders serve as Math Department chairs or co-chairs. They describe other leadership responsibilities, including facilitating common planning time and discussions during department meetings, consulting and checking in with other teachers at their school to help with the implementation of the curriculum, and liaising between their school and the District. Figure 6 shows the frequency of different terms that teachers used to describe their leadership responsibilities.

Figure 6. Word cloud denoting frequency of words used to describe Teacher Leader/ Facilitator Roles.

What this suggests is that Teacher Leaders may have too many responsibilities and could benefit from clearer direction and increased coherence regarding the role of Math Teacher Leaders from the District.

Frequency of Collaboration Varies Across Schools

Teachers reported meeting with the Math Department or with other math teachers, or participating in grade level meetings on a regular basis, with 14% of respondents meeting once a month, 30% meeting twice a month, and 39% meeting weekly. Some Special Education teachers, however, found that they didn't have much opportunity to collaborate with other math teachers at their schools.

Time Spent Planning with Core Curriculum Varies

In this second year of the Core Curriculum rollout, teachers describe the different ways they spend their time collaborating with their colleagues. In light of the District's emphasis on collaboration and the teachers' perceived value of collaborating around the Core Curriculum, it is notable that 56% of respondents spent more time than in previous years on planning teaching moves and practices. This could mean that the Core Curriculum is providing teachers with the curricular foundation that enables them to visualizing what they expect to say and do as well as what their students might say or do.

It is less clear why teachers reported spending more time designing (49%) and choosing activities (44%). Unfortunately our data provides little insights into why this could be. This suggest that including teacher interviews in a future evaluation might be helpful.

In terms of selecting learning technologies, our recommendation above, regarding more explicit integration of technology in the curriculum and communications with teachers might also reduce the amount of time teachers report they are spending on selecting learning technologies. Granted that 49% of teachers said they were spending about the same time as before selecting learning technologies, which could actually be not much at all.

Figure 7. Frequency of teacher collaborations.

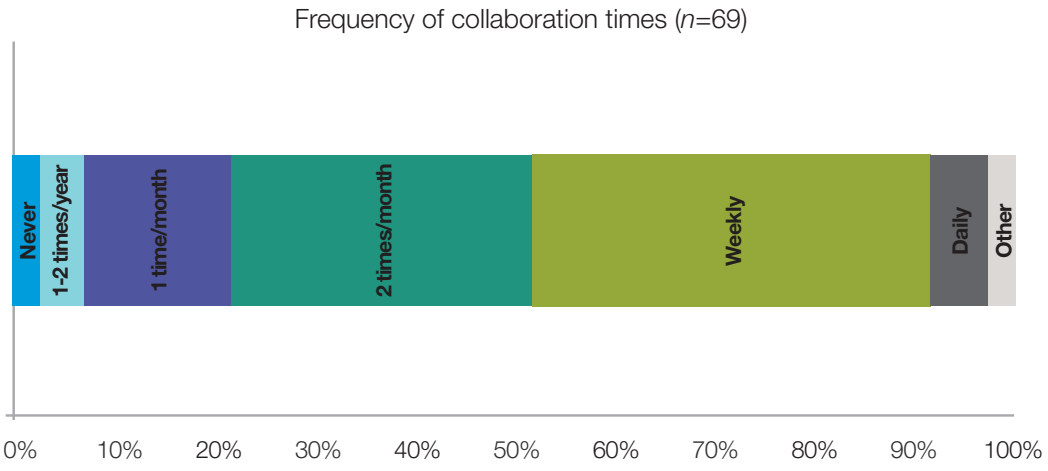


Table 1. Percent of time spent planning this year compared to previous years (*n*=73)

	Less time than in previous years	About the same time	More time than in previous years
Deciding on learning goals	16%	48%	36%
Designing activities	14%	37%	49%
Choosing activities	19%	37%	44%
Planning teaching moves / practices	8%	36%	56%
Deciding on assessments	19%	45%	36%
Designing assessments	25%	38%	37%
Selecting learning technologies	10%	49%	41%

Opportunities for SFUSD

Teachers really appreciate and report benefitting from the professional development time, especially the time they have to meet with their fellow teachers at their school sites. Since this is something the district is already doing, we would encourage them to continue doing so.

The District needs to make more explicit the models and expectations regarding the professional development opportunities teachers have. For example, 26% of respondents did not know what Professional Development model their school was offering (whether Teacher Leadership or Complex Instruction). While this might mean that they are in a school that is participating in the Teacher Leadership model, this is a clear opportunity to ensure all teachers are aware of the models, the resources, and the opportunities that are available to them. Similarly, teachers referred to the Core Curriculum also as "the Common Core" or "the Common Core Curriculum." While this is somewhat unimportant, it does suggest that consistent messaging about naming, offerings, and tools is important.

In earlier sections, we discussed some professional development opportunities for the district that are relevant here as well. Teachers working with students with special needs (Co-teacher, Resource Specialist Program, and Special Day Teachers) as well as teachers with high proportions of ELLs could use additional attention or professional development opportunities to ensure that they are also skilled at using the Core Curriculum and the Math Toolkit strategies.

Conclusions & Recommendations

SFUSD has set an ambitious goal to engage all students in learning conceptual mathematics and participating in high level disciplinary practices such as reasoning, problem solving, and communicating with others. This evaluation found evidence of some of the practices the District expected, such as all students having access to rich math tasks, collaborating as they solve challenging problems, and increased student participation in the mathematical practices. There is a lot of enthusiasm regarding the Core Curriculum and key district initiatives such as common planning time for teachers and support from Math and EdTech coaches. The most enthusiastic teachers seemed to come from schools participating in the Complex Instruction professional development model. This suggests important questions about what the model has to offer teachers, how those teachers and schools are implementing the Core Curriculum, and whether the District would consider expanding that model to more schools.

The challenges described in this report are also to be expected, and we have noted opportunities for the District throughout. Moreover, we believe that the Math and EdTech teams are committed and have already started addressing some of these issues. In particular, we would encourage the District to provide targeted supports to help teachers reach ELL and special needs students, and students described as having the lowest prior achievement, as these important populations are reported to be struggling the most with the new Core Curriculum.

Finally, we have learned that short evaluations can only provide so much actionable information. To really understand and evaluate changes in the ways teachers teach and students learn mathematics in SFUSD classrooms, we recommend that the District plan for longer-term evaluations. In a multi-year evaluation, the District could measure changes from one year to the next and obtain rich qualitative data to deepen understanding of the most impactful variables in the implementation of the Core Curriculum.

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