**Teaching English Learners Early Mathematics (TEEM)**

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**Teaching English Learners Early Mathematics (TEEM)**

## A. Significance

**Summary.** With *Teaching English Learners Early Mathematics (TEEM)*, California State University, San Bernardino (CSUSB), the Riverside County Office of Education (RCOE), two LEA partners, Romoland and Nuview Union School Districts (RSD and NUSD), and Romoland Head Start and State Preschool programs propose to build on a history of close collaboration to develop, implement and evaluate a replicable model for improving the academic achievement of English Learner (EL) students in pre-K through grade 6.

TEEM will increase the number and proportion of ELs completing challenging courses in core academic subjects through a novel combination of interventions designed to support communities of inquiry among students, teachers and school leaders. Students will engage in structured inquiry through the use of interactive notebooks in mathematics; teachers will improve mathematics instruction through the formation of communities of inquiry supported by Summer Institutes and an adaptation of Japanese Lesson Study; and principals will develop as instructional leaders in mathematics through a variety of supports. The project will directly impact at least 4000 students, 75 teachers and 7 principals.

**1. Absolute Priority.** TEEM is designed to address Absolute Priority 4(a). We will increase the number and proportion of ELs successfully completing challenging courses in core academic subjects by implementing structured inquiry-based approaches to learning, teaching and school leadership. These approaches will develop collective efficacy in schools and provide ELs access to challenging math content from pre-K through grade 6.

*Importance of math in early grades.* To maximize long-term impact, we have developed math-focused interventions for ELs in early grades. The risk of dropout is roughly twice as high

for ELs as it is for non-ELs (Callahan, 2013), and in many cases the dropout problem is a math problem. In the Los Angeles Unified School District, students who passed Algebra I by grade 9 were twice as likely to graduate as those who had not (Silver, 2008). In order to improve academic outcomes through high school, ELs must succeed in challenging math courses, and they must begin early. Academic performance in early grades is a strong indicator of future dropout risk, and high-quality preschool decreases the risk (Rumberger & Lim, 2008).

In California, achievement gaps existing in grade 2 largely persist through grade 7, a "pivot year" in which student achievement varies widely and determines future opportunities in math (Terry and Rosin, 2011). In California, ELs are a large percentage of early-grade students, and many struggle in math. In 2013, ELs made up 35.7% of CA grade 2 enrollments, and 47% of those students tested below proficient in math.

The status of ELs statewide is mirrored in the partner LEAs, RSD and NUSD, small districts serving the unincorporated communities of Romoland and Nuevo in Riverside County, neighboring the city of Perris, CA. The percentage of students receiving free or reduced-price lunch is 76.1% at RSD and 65% at NUSD, while the state average is 58%. Per the 2010 Census, the largest ethnic group in both communities is Hispanic/Latino at 51.4% (Romoland) and 54.5% (Nuevo). In Nuevo, 45.4% of people aged 5 or more years speak a language other than English at home. Results from the 2013 California Standards Test (CST) showed the percentage of students classified as EL tapers through the elementary grades (Figure 1).

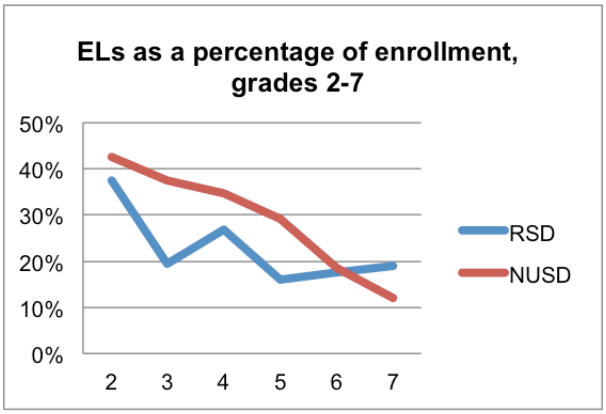


Figure 1

While the proportion of ELs decreases, the math achievement gap for ELs grows with the complexity of the mathematics from grade to grade. Figure 2 shows aggregate CST data among ELs and their English-Fluent / English-Only peers in RSD and NUSD. In the seventh grade, 52% of English-Fluent or English Only seventh graders were proficient or advanced in mathematics while only 13% of ELs attained that level of achievement. A student classified as EL in the grade 7 pivot year faces restricted access to advanced mathematics, to success in high school and college, and to STEM careers.

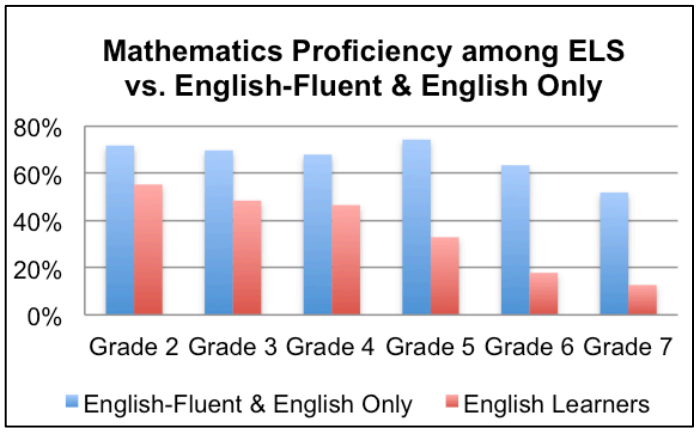


Figure 2

Mathematics interventions supporting ELs and their teachers are especially timely in light of the Common Core State Standards for Mathematics (CCSS-M). The CCSS-M call for students to demonstrate proficiency through eight Standards for Mathematical Practice (SMP). In order to give ELs access to the CCSS-M, Moschkovich (2013) recommends that teachers balance concepts with procedures; maintain high cognitive demand; develop productive student beliefs about math; and engage students in the SMP. At the same time, teachers in the 22 states using the new Smarter Balanced Assessment Consortium (SBAC) tests to assess student proficiency with respect to the CCSS-M are challenged to prepare ELs for the higher language demands of these tests. TEEM will support teachers in this shift by developing a replicable model of intensive professional learning.

*Improving outcomes in core academic subjects through attention to metacognitive and non-cognitive skills and mindsets.* When students believe that intellectual ability is not fixed but grows through effort, they show greater persistence (Dweck, 2006). The National Mathematics

Advisory Panel (2008) reported that interventions addressing affective and motivational factors can improve the achievement of traditionally underserved groups. TEEM will help ELs develop the metacognitive and non-cognitive skills key to success through the use of interactive inquiry notebooks for math. The notebooks will not only be a tool for collecting and recording classroom activities, but they will make student metacognition explicit and provide a structured space for developing reading, writing, and study skills.

TEEM directly addresses Absolute Priority 4(a) through the creation of a professional development (PD) model and student interventions that result in increasing the number and proportion of ELs that successfully complete challenging courses in core academic subjects: not only in mathematics, but in other subjects through structured writing.

**2. Novelty.** Unlike many accepted practices for supporting ELs which focus on general academic language development (IES, 2014), we propose to achieve improved outcomes for ELs while keeping a strong disciplinary focus on *mathematics*, combining four structured inquiry-focused interventions targeting students, teachers, and school leaders. TEEM's approach to improving the achievement of ELs is based on the novel premise that educators need deep *mathematical* understandings to provide ELs access to the SMP in a CCSS-aligned curriculum, that "vocabulary is necessary, [but] not sufficient" to provide that access (Moschkovich, 2013), and that providing that access will support ELs in strengthening language skills through reasoning, talking and writing about complex disciplinary content.

In order to provide a comprehensive approach to increasing ELs' access to rigorous mathematics, we will adapt and combine four evidence-based interventions in a novel way:

1. The adaptation of interactive inquiry notebooks – a best practice in science teaching – to

mathematics

2. Summer Professional Development to immerse teachers in math inquiry and notebooking

3. The adaptation of the Japanese Lesson Study model of professional learning for teachers

4. The purposeful, regular and intensive participation of school principals in the professional development represents an innovation compared to usual practice.

Given the need to intervene early, another novel aspect of TEEM will be the creation of a PD pipeline for preschool educators who rarely receive opportunities for math-focused PD. Through its focus on mathematics, its combination of research-based interventions, and the purposeful inclusion of school leaders and early education providers, TEEM offers a novel approach compared to what has been previously attempted nationally.

**3. Advancing Theory, Knowledge and Practices.**

TEEM interventions are built upon existing research and promising practice, with adaptations that will make it an exemplar for new practice.

*Interactive notebooks* are used successfully in many science classrooms (Hargrove & Nesbit 2003). Used intentionally, student notebooks provide evidence of the teacher's teaching practices and the students' learning (Shimojyo 2012) and are a formative assessment tool of great value. They make student metacognition explicit and provide a structured space for the development of reading, writing, and study skills. It is a promising practice, and also an inexpensive and sustainable one since paper notebooks are easily obtained. It is a culturally responsive practice: in Mexican and other Latin American classrooms, *el cuaderno* (notebook) is used in a more structured and rigorous fashion than is common in the United States (Celedon-Pattichis & Ramirez 2012). Amaral and colleagues (2002) found that the use of interactive

notebooks in elementary science classrooms in an impoverished section of inland California improved EL achievement not only in science, but also in reading and writing. TEEM will move the field forward by adapting a promising practice in science education to the mathematics classroom, and measuring its impact. We will test the hypothesis that the use of purposefully designed math inquiry notebooks to develop language, organizational and metacognitive skills will accelerate EL achievement not only in math but also in language learning.

The combination of interactive notebooks with the lesson study model for PD will be a unique and powerful way for teachers to develop effective formative assessment practices.

*Lesson Study.* The transition to CCSS calls for teachers to make major shifts towards greater focus, coherence, and rigor in math instruction (CCSS Initiative 2014), but observers have noted that fundamental teaching practices have changed little in the last century (National Research Council 2001). TEEM will support teachers in the shifts using the Japanese lesson study model.

Lesson study gained attention with the publication of *The Teaching Gap* (Stigler & Hiebert, 1999) and is the subject of active research (Lewis et. al. 2009). Lesson study incorporates many characteristics of effective PD and school change: it is intensive, ongoing, and connected to practice; it is focused on student learning, it addresses the teaching of specific curriculum content, and it builds strong working relationships among teachers (Darling-Hammond et. al. 2009). In lesson study, teams of teachers develop a practice of inquiring into their students' thinking and investigating the effectiveness of their instruction. In a cycle of lesson study (Fig. 3), teachers agree to shared learning goals. They research relevant curriculum and pedagogy, and they plan, observe and refine a "research lesson" addressing the goals.

Based on its documented effectiveness and on experience gained in previous projects, TEEM will use lesson study to create new opportunities for schools to build a knowledge base for teaching core academic subjects to ELs. Through close observation, teachers develop "the eyes to see students" (Lewis, 2004), seeing past language deficiencies into the content of students' mathematical thinking. TEEM teachers will build and share knowledge of their students' language needs and learn to anticipate those needs. The project evaluation will provide needed evidence about the effectiveness of pairing interactive notebooks with lesson study PD, a pairing which theory suggests is highly promising. Student notebooks will be a key resource for lesson study, providing teachers with data to inform their study, help discern student needs, set instructional goals and evaluate success of research lessons.

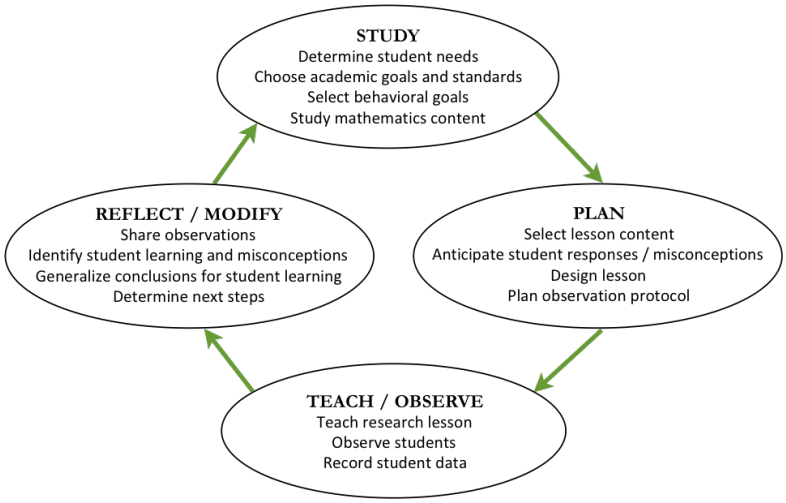



**Figure 3 - The Lesson Study Cycle**

*Supporting Instructional Leadership in Mathematics.* Among all school-related factors, the impact of leadership on student learning is second only to teaching, and this impact is greatest in high-need schools. At the same time, there is little research on how principals continue their professional learning on the job (Leithwood et. al, 2004). While *Instructional Rounds* (City et. al, 2009) are considered best practice for principal learning, principals without a significant background in mathematics receive little support in considering the mathematical content of the lessons they observe in classrooms. To fill this gap, TEEM's fourth novel intervention will support principals as "lead learners" at schools (Liptak 2005), developing their

capacity as instructional leaders in the transition to CCSS. Principals will attend Summer Institute sessions and monthly sessions built in to district-wide principal meetings. Project staff will support principals in Instructional Rounds. In later years of the project, TEEM will phase in opportunities for principals to join teacher teams in lesson study.

The proposed interventions and the evaluation of their effectiveness will benefit schools and districts nationwide: EL populations are growing rapidly across the nation (by 53% from '98 to '08; NCELA, 2008) and, to our knowledge, research investigating methods to accelerate EL growth via CCSS, lesson study, and interactive notebooking has not yet been undertaken.

## B. Quality of the Project Design

**1. Overview and Goals.** The TEEM design is based on Project DELTA (2010-2013 CaMSP), a partnership between RCOE, CSUSB, RSD, NUSD and three additional Riverside County LEAs. That project focused on intensive PD paired with lesson study to improve teacher mathematical knowledge and student achievement. Three years of student achievement data were used to investigate project impact. This pilot study met the ED-MSP's criteria for rigor and showed that intervention students outperformed a comparison group on state achievement tests. Notably, **English Learners** in program classrooms showed even greater growth than students in the general population. Expanding on this work, TEEM will strengthen the impact on English language development through the addition of interactive mathematics notebooks in early grades and through the inclusion of preschool educators and site principals.

In crafting a comprehensive approach to improving outcomes for ELs, we kept an overarching focus on communities of inquiry for students, teachers and principals. Four program activity components are proposed: 1) student interactive inquiry notebooks; 2) summer professional

development; 3) Lesson Study; and 4) principal professional learning. Through a combination of mutually supportive inquiry-based interventions, TEEM will accomplish four key goals. Please see Table 1 on p. 24 (Evaluation Plan) for quantitative benchmarks aligned with each outcome.

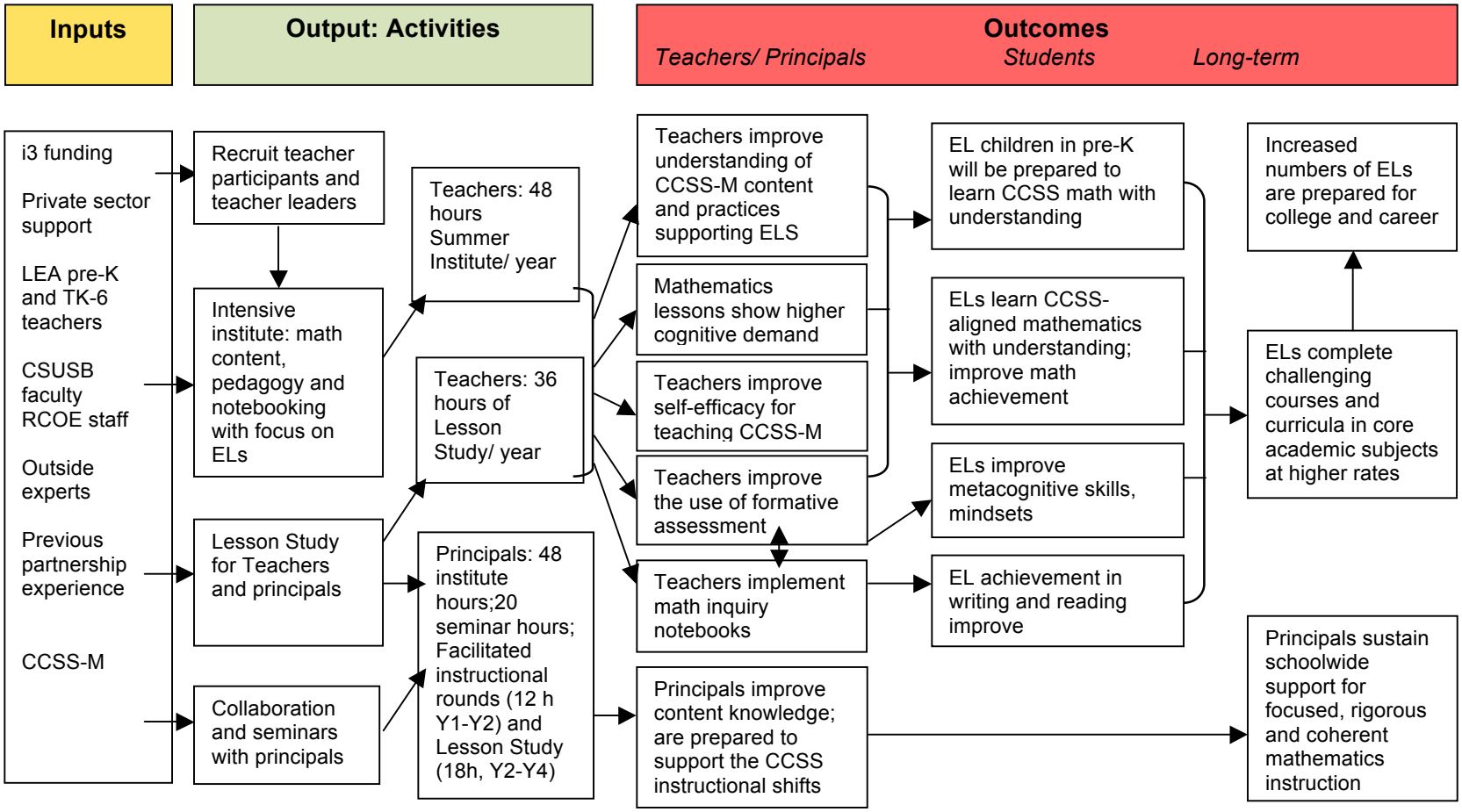
| | |
|---|---|
| ***Goal 1. Improve the academic achievement of ELs.*** | |
| Outcome 1.1 | Student mathematics performance: Students will improve their mathematics performance as measured by SBAC assessments (grades 3-6) and Assessing Math Concept (AMC) Interviews (Richardson, 2011) (pre-K - 3). |
| Outcome 1.2 | EL mathematics achievement: EL students will reduce the mathematics achievement gap relative to their non-EL peers, as measured by SBAC assessments (grades 3-6) and AMC Interviews (pre-K - 3). |
| Outcome 1.3 | Student language and metacognitive skills: ELs will show greater growth in reading and writing skills and in habits of mind compared to students whose first language is English, as measured by SBAC-ELA, CELDT/ELPAC |
| Outcome 1.4 | Student course-taking patterns: EL students in Middle School will complete and succeed in advanced math courses at higher rates, as seen in enrollment data. |
| ***Goal 2. Improve teacher knowledge and beliefs for teaching math to ELs.*** | |
| Outcome 2.1 | Teacher content knowledge: Teachers will deepen their mathematical knowledge for teaching as measured by the LMT instrument. |
| Outcome 2.2 | Teacher beliefs: Teachers will improve their self-efficacy for teaching the CCSS-M, as measured by the MTEEBI instrument (Riggs et al.) |
| ***Goal 3. Improve the teaching of math to ELs and all students.*** | |
| Outcome 3.1 | Cognitive Demand: Math lessons will maintain higher levels of cognitive demand and align with CCSS-M content and practices, as measured in classroom observations. |
| Outcome 3.2 | Teacher Formative Assessment: The frequency and quality of teachers' formative assessment will improve, as measured through observations, surveys and checking student notebooks against a project-developed rubric. |
| ***Goal 4. Develop principals as instructional leaders in mathematics.*** | |
| Outcome 4.1 | Principal content knowledge: Principals will deepen their mathematical knowledge for teaching as measured by the LMT instrument. |
| Outcome 4.2 | Principal instructional leadership: Principals will demonstrate growth as shown on a modified Principal Instructional Management Rating Scale (Hallinger and Murphy 1985) |

The logic model on the following page illustrates TEEM's theory of action.

**2. Activities.** We will implement the following activities over four years:

*Activity 1. Interactive math inquiry notebooks for students (supporting Goal 1).* Through Summer PD and Lesson Study, TEEM will support teachers and, in turn, their students, in

**Teaching English Learners Early Mathematics (TEEM) Logic Model**




Core theories and assumptions: Research on mathematical habits of mind (Cuoco et al, 1996), cognitive demand as a feature of effective instruction (AERA 2006), growth mindset (Dweck 2006), teacher and student self-efficacy (Tschannen-Moran, Hoy 2001)

implementing interactive inquiry notebooks for math. Every student whose teacher participates in TEEM interventions will be expected to maintain a hardbound notebook and use it on a daily basis as a personal reference on mathematics vocabulary, to organize their mathematics work, and to keep a summative record of their thinking and problem solving in CCSS-aligned mathematics. Notebook implementation will begin in August 2015 for the 2015-16 school year. TEEM will implement developmentally appropriate adaptations of the interactive notebook in preschool classrooms following the "authentic assessment" model (Epstein et. al., 2004).

*Activity 2. Intensive summer professional development (Goals 2 & 3).* To teach ELs equitably, teachers must develop a body of specifically *mathematical* knowledge. For example, a teacher with a deep understanding of place value and properties of arithmetic knows that the US standard algorithm is just one of many correct ways to multiply two-digit numbers, and that students could come into the classroom using any of them.

The mathematical content of the Summer institutes will be based on the sequence of key ideas described in the CCSS-M learning progressions documents for the elementary grade levels. We devote special attention to promoting robust understanding of novel and challenging topics in the new standards, including: counting and cardinality; early algebraic thinking embedded in whole number operations based on ideas of Cognitively Guided Instruction (Carpenter et. al. 1999); Fractions on the number line; and modeling with mathematics.

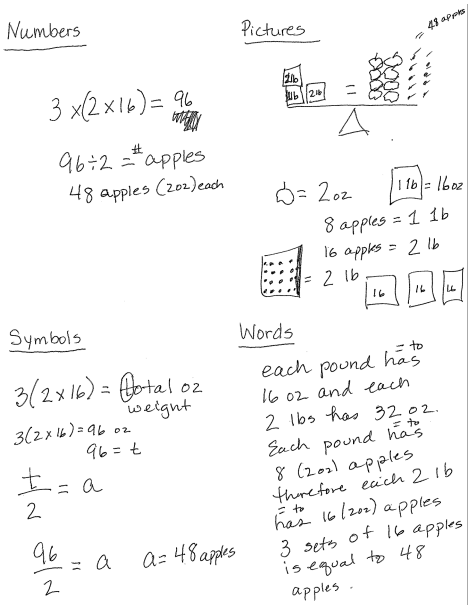



**Figure 4 – Multiple representations of a solution**

Teaching practices facilitating EL access to the SMP will be built into institute activities,

including classroom discourse (Parrish 2010); kinesthetic activities; use of concrete materials and math manipulatives; and multiple representations (fig. 4).

Throughout each institute, teachers will create and maintain their own notebooks as a record of their mathematical learning, as a reference to call upon in Lesson Study, and as a model for the student notebooks they will implement in classrooms. Thus, teachers will master the logistical elements of notebook practice, and PD providers will model the use of graphic organizers, advance organizers and diagrams enhancing academic language development. Each Summer, teachers and principals will participate in 48 hours of intensive PD provided by CSUSB faculty and RCOE staff. Pre-K educators will receive 24 hours of Summer PD, joining selected plenary sessions and breakouts focused on developmentally appropriate content.

*Activity 3. Lesson Study (Goals 2 & 3)*. This strategy builds upon the LEAs' existing practice of working in Professional Learning Communities to design Units of Study implementing the CCSS-M. TEEM teachers will work in cross-site, grade-level teams to develop CCSS-M-aligned research lessons and assess their impact on ELs by engaging in 36 hours of lesson study per year, facilitated by CSUSB faculty and RCOE staff. Each team will produce two research lessons in each project year and research lessons will be videotaped for teacher learning. Preschool educators will be introduced to lesson study by joining with Kindergarten lesson study teams in Year 1. In later years they will form their own lesson study team.

*Activity 4. Professional learning for school leaders (Goal 4)*. The principal's support is key to the success of any school improvement project. Principals will join teachers in TEEM Summer Institutes, and in two-hour monthly meetings with TEEM staff. In Years 1 and 2, they will participate in two facilitated half-day sessions of instructional rounds. Principals will work alongside teachers in lesson study in later years when teams are established in their practice.

| Project Design Summary | | |
|---|---|---|
| **Who** | **What** | **When** |
| 75 RSD and NUSD TK-6 teachers and 7 principals in<br><br>Plenary and grade-band sessions | Summer Intensive PD: | 48 hours annually |
| | Y1 - whole numbers & algebraic thinking; place value | July 20-23 & 27-30, 2015 |
| | Y2 - geometry; multiplicative thinking | July 18-21 & 25-28, 2016 |
| | Y3 – Fractions and rational numbers | July 17-20 & 24-27, 2017 |
| | Y4 – Proportional reasoning, expressions and equations | July 16-19 & 23-26, 2018 |
| 75 RSD and NUSD TK-6 teachers in grade-level teams | Lesson Study:<br>Two three-day cycles planning, teaching and reflecting on classroom lessons. | 36 hours annually<br>3 days in Fall, 3 days in Winter/Spring each project year |
| 6 LEA Preschool educators | Summer Intensive PD - selected plenary sessions and preschool-focused breakouts | 24 hours annually<br>July 20-23, 2015<br>July 18-21, 2016<br>July 17-20, 2017<br>July 16-19, 2018 |
| | Lesson Study | 2 cycles (36 hours) with Kindergarten, Year 1<br>2 cycles (18 hours) Years 2-4 |
| 7 RSD and NUSD principals | Monthly principal meetings | August-May; 20 hours annually |
| | Facilitated instructional rounds | Two half-days, Year 1&2 |
| | Lesson study with teachers | Three days, Years 2-4 |
| RSD and NUSD students in 75 classrooms | Interactive inquiry notebooks | Daily from August 2015 through the project period (TK-6); Daily from August 2017 in preschool |

In a survey of RSD and NUSD teachers conducted in July 2014, 94% of the 50 respondents were "very interested" in receiving support teaching the CCSS-M to ELs; 92% were "very interested"

in student math notebooks. The percentage that were "very" or "somewhat" interested in lesson study was 92%; in Summer PD 86%. Staff turnover being low in these LEAs, we are confident we can recruit and retain a sufficient number to meet our target of 75 teachers over 4 years.

**3. Potential Risks.** Based on our experience in complex partner-driven projects, we anticipate several potential risks to project success and have developed strategies to mitigate these.

| Potential Risk | Mitigation |
|---|---|
| Potential turnover in district or school site leadership may slow project down by affecting district priorities | Collaborate with district leadership in planning/ proposal process to ensure alignment with district priorities.<br>Include LEA leaders on Steering Committee to maintain communication and continued alignment to LEA priorities |
| Teachers may be experiencing "change overload" with new standards and assessments | Implement Lesson Study as a tool to help address existing challenges by involving teachers in setting study goals |
| Teachers may worry that questionnaire data or in-class observation may be used to evaluate their job performance | Use IRB-approved protocols in data collection/ analysis<br>Develop and follow group norms that ensure open and welcoming Lesson Study practice |
| Principals' lack of time for PD | Build some activities into existing district principals' meetings and connect with principals' everyday work<br>Build and maintain district leadership support and encouragement of principal participation. |
| Availability of substitute teachers while project teachers participate in Lesson Study | Develop MOU with districts ensuring that substitute teacher pools increase as necessary<br>Devote grant funds to sub teacher pay. |
| Difficult to change teacher beliefs | Explicitly address beliefs during Lesson Study activities |

## C. Quality of the Management Plan and Personnel

### 1. Management Plan

TEEM's management structure is designed to ensure effective operation and maintain communication and feedback among partners. CSUSB-UEC, CSUSB's nonprofit auxiliary

responsible for administering over $20M in grants and contracts awarded to the university, is the legal applicant and fiscal agent. Within CSUSB, the project will be housed in the Center for the Enhancement of Mathematics Education (CEME), the home of multiple projects designed to improve K-12 math education. At CEME, Sarah Zayas (.50 FTE) will serve as Project Coordinator providing operational and administrative support. Andrea Blanco (.50 FTE) will serve as Financial Manager. Both have experience supporting large grant-funded partnerships, including the NSF MSP *Algebraic Concepts for Elementary Students* (ACES). Dr. Davida Fischman, CEME director and ACES PI, will serve as advisor to the project leadership. Project Director Dr. Madeleine Jetter (.44 FTE), Associate Professor of Mathematics at CSUSB will maintain responsibility over all aspects of the project, with Victoria Kukuruda of RCOE (.25 FTE) serving as Co-Director.

A two-tiered leadership structure will guide project implementation:

| | Composition | Responsibilities |
|---|---|---|
| Leadership Team<br>Meets monthly | Project Director and Co-Director, Project Coordinator, Teacher Liaisons from each LEA school site | Plan, manage and implement project; provide input on PD plans and timelines |
| Steering Committee<br>Meets quarterly | Project Director and Co-Director, Project Coordinator, District Leadership, Parent representatives | Oversee and guide general project operation and vision; review progress; plan for long term success and sustainability |

The Professional Development (PD) Team will design and deliver the Summer PD and facilitate Lesson Study. The PD team will include Dr. Jetter and Dr. Diane Brantley (CSUSB), a published expert on instructing and assessing ELs in the classroom, working with RCOE staff and independent consultant Nora Ramirez, a nationally recognized expert on teaching math to ELs.

The tables below summarize, for each of the key outcomes and management objectives, the timelines and milestones for completion of major project activities, the metrics that will be used to assess progress on an ongoing basis, and annual performance targets.

| **Objective: Implement Project Planning, Launch and Effective Management Systems** | | | |
|---|---|---|---|
| **Supporting Actions** | **Timeline** | **Responsibility** | **Metrics** |
| Steering Committee Kickoff Meeting | Oct. 2014 | Project Director, Steering Committee | SC Meeting Minutes |
| Finalize private sector support | Oct. 2014 | Project Director, CSU Chancellor's Office | Funding commitment letters |
| Finalize evaluation instruments; obtain IRB approval for research | Oct. 2014 | Project Director, Project Coordinator Evaluator | Informed Consent protocols; IRB approval letter |
| Conduct initial Principals' meetings at RSD & NUSD | Nov. 2014 | Steering Committee, Site Principals | Principal participation agreements |
| CEME set up contracts with partners | Nov. 2014 | Financial manager, Steering Committee | Contracts in place for paying invoices |
| Conduct participant recruitment meetings at RSD and NUSD sites | Nov. - Dec. 2014 | Steering Committee, Site Teachers | Teacher commitment letters |
| Recruit comparison teachers | Nov. 2014 – June 2015 | Leadership Team, Evaluator | Comparison teacher commitments |
| Recruit teacher liaisons for Leadership Team | Jan. 2015 | Leadership Team | Leadership Team commitment letters |
| **Milestones:** 90 treatment and 90 comparison teachers initially committed to TEEM; 7 site principals committed to TEEM; 7 teachers committed to Leadership Team | | | |
| **Supporting Actions** | **Timeline** | **Responsibility** | **Metrics** |
| Quarterly Steering Committee Meeting | Quarterly from Jan. 2015 | Project Director, Project Coordinator, Steering Committee Evaluator | SC Meeting agendas and minutes |
| Monthly Leadership Team Meeting | Monthly | Project Director, Leadership Team, Evaluator | LT agendas and minutes |
| **Annual Performance Target:** All participants attend at least 85% of scheduled meetings | | | |
| **Supporting Actions** | **Timeline** | **Responsibility** | **Metrics** |
| Annual Performance | Annually | Project Director, | Complete and timely |

| | | | |
|---|---|---|---|
| reporting | | Financial Manager, Evaluator | reports |
| **<u>Annual Performance Target</u>**: Annual reports reflect a project on schedule and within budget. | | | |
| **Objective: Enhance Mathematics Instruction to Improve Achievement for ELs** | | | |
| **Supporting Actions** | **Timeline** | **Responsibility** | **Metrics** |
| Plan Summer PD | March-July 2015-2018 | PD Team | PD Team planning logs |
| Deliver Summer PD (See project design for content) | July 2015-2018 (See project design for dates) | PD Team, Treatment Teachers | Daily attendance logs; LMT response data |
| **<u>Milestone</u>:** TK-6 teachers complete 48 hours, preschool teachers 24 hours of intensive PD in math, EL-focused pedagogy and notebooking. All treatment teachers complete at least 80% of PD hours each July. | | | |
| **<u>Annual performance targets</u>**: Treatment teachers outperform comparison teachers on LMT assessments by 10%. | | | |
| **Supporting Actions** | **Timeline** | **Responsibility** | **Metrics** |
| Teachers engage in two three-day cycles of lesson study | TBD by teacher teams | Treatment teachers PD Team | Attendance logs; Written reflections; Lesson video |
| **<u>Milestones</u>**: Lesson study teams will complete two videotaped research lessons annually. All treatment teachers participate in a minimum of 80% of lesson study hours annually. | | | |
| **<u>Annual Performance Target</u>**: Teachers will demonstrate growth in effective teaching of mathematics to ELs as measured by classroom observation instrument. | | | |
| **Supporting Actions** | **Timeline** | **Responsibility** | **Metrics** |
| Students set up and organize math inquiry notebooks for daily use | August annually | Treatment teachers | Notebook rubrics |
| Students use notebooks to record daily work including teacher inputs and student thinking | Daily Aug.-May each project year | Treatment teachers, students | Notebook rubrics |
| Teachers check notebooks weekly | Aug. – May. Annually | Treatment teachers | Notebook rubrics |
| Teachers refer to student | TBD by | Treatment | Lesson Study written |

| | | | |
|---|---|---|---|
| notebooks to plan and reflect in lesson study | teacher teams | teachers PD team | reflections |
| **Milestone**: Student notebooks will achieve an overall score of 80% as measured by a rubric reflecting notebook organization; daily use; teacher inputs and student development of SMP. | | | |
| **Annual Performance Target:** Treatment students will outperform a matched comparison group on SBAC Math and ELA assessments by 5% per year. Achievement gap will narrow by 8% by project close. | | | |
| **Objective: Develop Principals as Instructional Leaders in Mathematics** | | | |
| **Supporting Actions** | **Timeline** | **Responsibility** | **Metrics** |
| Principals attend intensive Summer PD | 8 July days per year as above | Site principals PD Team | Attendance logs |
| Principals attend monthly district-based TEEM seminars | Monthly through project period | Site principals PD Team | Attendance logs |
| Principal teams participate in facilitated instructional rounds | Two half-days Years 1 & 2 | Site principals PD Team | Observation logs Written reflections |
| Principals participate with teachers in lesson study | 3 days annually from Year Two | Site principals PD Team | Attendance logs Written reflections |
| **Milestone:** Principals participate in 48 hours of intensive PD each July, 20 hours of monthly seminars, two half-days' instructional rounds and 3 days lesson study | | | |
| **Annual Performance Target:** Principals will participate in at least 80% of activities and demonstrate growth as measured by the Principal Instructional Management Rating Scale. | | | |

**2. Commitment of Key Partners and Stakeholders**

The partner organizations -- CSUSB, RCOE, RSD and NUSD -- have committed to build on a record of productive collaboration to develop a model of instructional change supporting ELs. These organizations were partners in the three-year ED MSP, Project DELTA. The LEA leaders have shaped this proposal with the Project Director and co-Director through face-to-face meetings, phone calls and videoconferencing, and will maintain a role in TEEM management through participation in the project Steering Committee. All partners have committed the

resources necessary to ensure success for TEEM. Please see Appendix G for these commitments.

**3. Feedback and Continuous Improvement**

The partners have put in place procedures to ensure feedback and continuous improvement in the operation of TEEM. The Leadership Team will include teacher liaisons representing each participating site and will meet each month to provide feedback to the project management team. The Steering Committee will include leaders from each of the partner LEAs, as well as a parent representative, and will meet on a quarterly basis to provide regular feedback between partners. The independent evaluation will provide formative feedback through implementation data on TEEM's lesson study and notebook practices, enabling the Leadership Team to plan adjustments.

**4. Project Director**

Dr. Madeleine Jetter is a CSUSB mathematician with publications in both pure mathematics and in math education (see CV). She was the PI of Project DELTA, a three year project providing mathematics PD to 100 teachers in 6 districts with $3M in ED MSP funding. In that capacity she worked in concert with partners at RCOE to design and deliver intensive PD, coordinate and facilitate Lesson Study, communicate with district partners and teacher liaisons, manage CSUSB's subcontract budget, and work with partners to provide required reports.

## D. Quality of Project Evaluation

***1. Clarity and importance of key questions, appropriateness of methods.*** *The primary intention of this project is to increase the number and proportion of ELs completing challenging mathematics coursework through structured inquiry via interactive notebooks.* The four goals presented in the Project Design section have been developed into Research Questions (RQ) for evaluation. How will the program impact: (RQ1) the academic achievement of ELs, (RQ2)

teacher knowledge and beliefs about teaching ELs, (RQ3) teaching of math to ELs and all students, and (RQ4) the development of principals as instructional leaders in mathematics.

To accomplish our goals and evaluate progress, TEEM has aligned the goals, with corresponding strategies, activities, measurable thresholds (targets) for acceptable implementation, and measurable outcomes to be closely monitored each year (see Logic Model and Fidelity of Implementation Table in App. J). **Importance:** EL populations are growing across the nation (by 53% from '98 to '08; NCELA, 2008) and, to our knowledge, research investigating methods to accelerate English language acquisition via the Common Core, new EL standards, and interactive notebooking has not yet been undertaken. *Research developed based upon these key questions would be extremely beneficial to schools and districts, nationwide*. **Research Design:** We will employ a Quasi-Experimental Matched Comparison Group Design, chosen to apply the highest level of rigor given the constraints of the educational domain (which does not allow for random assignment) and concurrently maintain internal validity (see Validity doc in App. J). This design will allow us to compare intervention groups with comparison groups not exposed to the intervention, thus mitigating the threats to validity inherent in an interrupted time-series or simple pretest-postest design. The research design selected will allow for investigation of all research questions for the Impact Evaluation and provide a framework to comprehensively evaluate the impact of the project. **Analytic Methodology:** We will apply a Hierarchical Linear Modeling (HLM) analytic methodology where TEEM participant scores are compared to matched cohort scores of non-participants. Analyses will consist of an intervention versus comparison, 2-level model with students nested in classrooms. This method was selected because the performance of students within the same classrooms will be correlated (for teacher data, nesting will occur at the school level). With this type of data, classical methods would not

produce accurate standard errors. HLM would take these correlated errors into account. All outcomes will be tested for baseline equivalence. In accordance with What Works Clearinghouse (WWC), the difference in means between the intervention and comparison group will be calculated and divided by the pooled standard deviation (SD), to compute baseline difference in effect size (*g*). If the difference between the intervention and comparison group is greater than .25, we will conclude that baseline equivalence has not been established, and a matched sample will be drawn. The Impact Analysis will be conducted on this balanced sample. **Matching Process:** The student-level comparison sample will be constructed, *by grade level*, from a group of students who have not been exposed to the program. SPSS Complex Samples software will be applied using the following procedure. A comparison group at each grade will be formed to proportionally match (as closely as possible) the treatment group on the following: 1) English proficiency 2) socio-economic status, 3) gender, 4) ethnicity, and 5) disability. The teacher-level comparison sample will be constructed by grade level taught and years of experience, as prior research tells us that these are the main teacher variables that could impact internal validity. In the initial phase, we will include the full set of these variables in the stratification. To retain an adequate sample (if there is missing data) it may be necessary to reduce the number of variables to maintain no more than a 10% decrease from the original sample. In regard to threats to internal validity, certain individuals may share characteristics that impact performance. Since it is not feasible to randomly assign individuals to groups, we will mitigate such effects by using multiple demographic variables in the selection process to hold them constant across groups.

***2. Clear and credible analysis plan aligned with expected impact and analytic approach.***

**Expected Impact:** Our expectations of impact align with our previous study of Project DELTA (See Quality of Project Design, p. 8). Effect sizes ranged from small to moderate (Cohen's *d*

effect size range: *d* = .12 to .51), thus meeting the WWC criteria for "statistically significant or substantively important (defined as a difference of 0.25 or larger) favorable associations between one critical component and one relevant outcome." **Proposed sample size**: Approximately **4,000 students, 75 teachers, and 7 principals will be impacted** by Year 4, across two rural districts. The **student sample size** will provide a power of 1.0 to detect small effects of program impact (*minimum detectable effect size (MDES)* = .10) at an alpha level of .05. The teacher sample size will provide a power of .6 to detect moderate effects (*MDES* = .6) at an alpha of .05. The principal sample size is very small and will provide a power of .2 to detect only large effects (*MDES* = .9). **Analysis Plan:** A two-level analysis plan will be applied using the research design and RQ's as the primary framework. The Process Evaluation will provide valuable formative feedback on the ongoing process and implementation in the form of progress reports made to the Teacher Leadership Team and Steering Committee so that course corrections can be made for program improvement each year. Data will be collected on an ongoing basis to complete the **Fidelity of Implementation Table** (see App. J), the results of which will be used to both provide feedback and aid in the interpretation of the Impact Evaluation, thereby providing information about key elements of the project to facilitate further development or replication. The Impact Evaluation will be conducted to assess the impact of the project. A **clear analytic approach** is demonstrated in the **Contrast Table in App. J** which addresses each key research question by identifying the groups, measures used to establish baseline equivalence, outcome measures, analytic method, exploratory vs. confirmatory contrasts, and expected reporting periods. Each contrast will be tested using the HLM method detailed above (except those that do not have comparisons, in which case ANOVA will be used). This will provide the systematic approach necessary to answer each research question. The timeline below provides a data collection guide.

| TEEM Data Collection Timeline | | |
|---|---|---|
| **Data** | **Sample** | **When** |
| ***TEACHER and PRINCIPAL Data*** | | |
| Learning Mathematics for Teaching (LMT) | IT, CT, IP | BOY Y1 (Pre), EOY (Post) |
| Math Teaching Efficacy and Expectancy Beliefs Instrument | IT, CT | BOY Y1 (Pre), EOY (Post) |
| Classroom Observation Checklist | IT | BOY Y1 (Pre), EOY (Post) |
| Formative Assessment Survey | IT | BOY Y1 (Pre), EOY (Post) |
| Attendance at Collaboration Meetings | IT | Ongoing |
| Lesson Study Survey | IT | Ongoing |
| Collaboration Assessment Records | IP | Ongoing |
| Principal Instructional Management Rating Scale (PIMRS) | IP | BOY Y1 (Pre), EOY (Post) |
| ***STUDENT Data*** | | |
| Smarter Balanced Assessment Consortium (SBAC) Test Math and English Language Arts (grades 3-6); Assessing Math Concepts (grades Pre-K-2) | IS, CS | EOY (Yr to Yr, Pre/Post) |
| California English Language Development Test (CELDT)/English Language Proficiency Assessments for California (ELPAC) | IS, CS | EOY (Yr to Yr, Pre/Post) |
| Habits of Mind Survey/PALS Student Survey | IS, CS | BOY (Pre), EOY (Post) |
| Notebooking Rubric | IS | BOY (Pre), EOY (Post) |
| Advanced Math Course Taking | IS | EOY (Post) |
| IT = intervention teachers; CT = comparison teachers; BOY = Beginning of Year (pre); EOY = End of Year (post); CCSS = Common Core State Standards; ELD = English Language Development; IS = intervention students; CS = comparison students; PALS = Patterns of Adaptive Learning Scales; IP = intervention principals | | |

***3. Key components and outcomes and measurable threshold for acceptable implementation.***

The goals, research questions (**key evaluation questions**), measures, methods, analyses, and specific targets/benchmarks provided below in Table 1, show the close alignment of the project goals and evaluation plan and demonstrate how the plan will produce implementation and performance data during the grant period to indicate whether the project is on track. **The evaluation will contain both formative and summative components to provide feedback to project leadership on fidelity of implementation, effectiveness, periodic progress, and assist in the process of data-driven program modification.** Implementation will be closely monitored and the external evaluator will calculate a Fidelity of Implementation Score (FIS)

each year. An FIS of less than 80% of the total possible would trigger the Steering Committee to create a plan to increase implementation (see Fidelity of Implementation Table in App. J).

| Table 1. Evaluation Measures, Methods, and Benchmarks | | |
|---|---|---|
| ***What is the impact of four years of exposure to TEEM on:*** | | |
| **RQ1: THE ACADEMIC ACHIEVEMENT OF ELs.** | | |
| **Measures** | **Method and Analysis** | **Targets/Benchmarks** |
| **Common Core Assessment (SBAC) (gr. 3-6); Assessing Math Concepts (Pre-K-2)** | Using SBAC-ELA and Math scores, an HLM methodology will be applied to a Matched Comparison Group Pre/Post Design. The achievement gap between EL students and the general population will also be analyzed and sig. tested. | TEEM students will outperform a matched comparison group of similar students on the SBAC-ELA and Math each year by 5%. Achievement gap will narrow by 8% by project close. |
| **EL Assessment: CELDT/ELPAC** | Percentage of TEEM students, who score in the top two performance levels, will be compared with a matched comparison group of students not exposed to the Project. Differences will be tested. | TEEM students will outperform a matched comparison group of similar students on the CELDT/ELPAC each year by 5%. |
| **Advanced Math Course Taking** | Course enrollment files will be used to track the advanced Math course taking of EL students through Middle School. | Students with more exposure to TEEM will take a higher percentage of advanced math courses relative to those with less exposure. This difference will be at least 5% each year. |
| **Habits of Mind/PALS Student Survey** | A cumulative score will be calculated for each administration, and an HLM methodology will be applied to a Matched Comparison Group pre/post design. | TEEM students will demonstrate greater growth in their scores on the instrument relative to the comparison group. This difference will be at least 5% each year. |
| **RQ2: TEACHER KNOWLEDGE AND BELIEFS ABOUT TEACHING MATH TO ELs.** | | |
| **Math Teaching Efficacy and Expectancy Beliefs Instrument** | A cumulative score will be calculated for each administration, and an HLM methodology will be applied to a Matched Comparison Group pre/post design. | TEEM teachers will demonstrate a growth percentage in their scores of at least 5% each year on the instrument relative to the comparison group. |
| **Learning Mathematics for Teaching (LMT)** | Using LMT scores, an HLM methodology will be applied to a Matched Comparison Group Pre/Post Design. | TEEM teachers will outperform the comparison group by 10% each year. |
| **RQ3: TEACHING OF MATH TO ELs AND ALL STUDENTS.** | | |
| **Classroom Observation** | A cumulative score will be calculated for each teacher each year and pre/post scores will be | TEEM teachers will demonstrate either a growth percentage of |

| | | |
|---|---|---|
| **Checklist** | compared for each teacher to measure growth. | 25% by project close or maintain a score of 80% or better. |
| **Formative Assessment Survey** | Teachers will respond to an online survey to recalling their formative assessment behavior in the previous week (pre collected in Yr1, post each year thereafter). Questions regarding the quality, type, and frequency of their activities will be collected in addition to qualitative data about how the formative assessment process impacted their teaching. | Combined with classroom observation and notebooking data a comprehensive score will be calculated and tracked year-to-year. Cumulative formative assessment score will increase by 10% each year or 30% by project close. |

| **RQ4: DEVELOPMENT OF PRINCIPALS AS INSTRUCTIONAL LEADERS IN MATH.** | | |
|---|---|---|
| **Learning Mathematics for Teaching (LMT)** | Using LMT scores, ANOVA will be applied to determine whether intervention principals have increased performance from pre to post each year. | TEEM principals will increase their performance by 10% each year. |
| **Modified Principal Instructional Management Rating Scale (PIMRS; Hallinger)** | A modified version of the PIMRS will be administered to each principal 2x Yr 1 and at the end of each year, thereafter. It will measure constructs such as creation of school goals, supervision, evaluation of instruction, etc. Additional questions regarding cognitive demand and classroom discourse will be added to customize the survey and capture activities focused on the program and math instruction specifically. | TEEM principals will demonstrate an increase of 10% each year or 30% on the PIMRS by project close. |
| **Collaboration Attendance Records** | TEEM principal attendance will be recorded (ongoing) and attendance percentages calculated at end of each year. | TEEM principals will attend a minimum of 80% of offered project hours per year. |

*Note: Reliability and validity analyses will be conducted on all locally developed instruments.*

**4. Resources for project evaluation.** The external evaluator, COREducational, is a woman-owned business bringing over 25 years of evaluation experience with similar large-scale STEM education projects, including a current i3 grant (See resume, App. F). COREducational will provide monthly updates to the Leadership Team, and present mid-year and annual reports to the Steering Committee. They will work with the National Evaluator to optimize the evaluation process and supply any requested information pertaining to the grant. 10% of grant funds will be allocated for evaluation. This should be sufficient to carry out the project evaluation effectively.

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