Abstract Title: Scaling up successful strategies from a previous Targeted NSF-MSP

MSP Project Name: *Teachers Assisting Students to Excel in Learning Mathematics – Phase II (TASEL-M2)*

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120 word summary:

STEM Faculty engage in implementing content-deepening experiences for teachers in collaboration with Teachers on Special Assignment (TOSAs) by observing, supporting, and presenting focused content and Pedagogical Content Knowledge (PCK) lessons. STEM Faculty learn strategies to use with community college and university developmental mathematics courses through this collaboration. Gradual Release of Responsibility (GRR) demo lessons, lesson design, co-planning, lesson delivery, and reflection through Professional Learning Communities (PLCs) provides an effective vehicle to support all mathematics teachers in learning content, pedagogy, and specific instructional strategies to raise achievement levels for their students. Through consistent delivery of mathematics content, student achievement will increase.

- Section 1: **Questions for dialogue at the MSP LNC**.

1. How do you involve STEM Faculty in supporting teachers with content and strategies for increased student achievement?
2. How do you scale up the use of mathematics coaches to all mathematics departments in a school district?
3. How do you scale up implementation of Professional Learning Communities (PLCs) to all secondary school mathematics departments in a school district?

- Section 2: **Conceptual framework**. This section should include your project's definition of "student success" and an explanation about your project's design for measuring student success.

Scaling up the implementation of programs from Phase I of TASEL-M, Phase II is now working with one district's secondary schools, including mathematics teachers in the eight Intermediate Schools and seven Comprehensive High Schools. Substantive policy and programmatic changes were made in this district to enhance student achievement such as: eliminating a two-year Algebra course as a result of research, both external and internal; addressing an equity issue in Hispanic student enrollment in advanced mathematics courses; and creating a multi-strategy professional development plan.

Context of the work within the STEM education literature and within the *TASEL-M2* Project

STEM Faculty participate in specific content presentations and lesson design support. STEM Faculty, called Faculty Partners, (FPs), in collaboration with the Teachers on Special Assignment (TOSAs), determine Focus Topics to present. These topic areas address problems and concerns reflected by student achievement data from district benchmark assessments linked to topics in Pre-Algebra and Algebra I for the upcoming quarter, along with graduation rates, achievement by gender and ethnicity groups, and the number of students retaking Algebra I. They present depth and breadth mathematics concepts from the focused content to support greater teacher understanding of the content and ways to support student learning for higher achievement.

They also offer Pedagogical Content Knowledge (PCK) for coaches and department chairs through a World Café discussion of sample PCK mathematics problems. Through these problems and dialogue, these teacher leaders are given a greater awareness to the breadth of content and pedagogy for specific mathematics topic areas. Led by the mathematics department chairs and/or peer coaches, the teachers continue the dialogue in their Professional Learning Communities (PLCs) at their school.

Selection of the mathematicians and the mentoring strategy is supported by the MSP Knowledge Management and Dissemination (KMD) project's practice-based insights from the MSP community on STEM disciplinary faculty involvement in MSPs; in particular, *Supporting and scaffolding the work of STEM disciplinary faculty* (2009). All project faculty receive 25% released time to work on the project. Both mathematicians and mathematics educators are involved with all activities in the project.

STEM Faculty also participate with their TOSA partner for Gradual Release of Responsibility (GRR) demo lessons, lesson design, co-planning, lesson delivery, and reflection. GRR, a research-based program, provides instructional consistency as a district framework. This focus includes coaching, specific activities for observing, modeling, and debriefing, and peer-to-peer communication and collaboration within PLCs on multiple levels. This process gives STEM Faculty strategies they can use with courses at the community college and university. Mathematicians and mathematics educators do some classroom observations and reflections on the process. The project follows suggestions of the MSP KMD project *Involving STEM disciplinary faculty in deepening teacher/teacher leader content knowledge* of "Orienting STEM disciplinary faculty to the work," and "…scaffold(ing) their preparation by first having them engage in the work as learners, and then assist in implementing content-deepening experiences" (2009).

Research confirms peer coaching as an effective method to increase teacher implementation of new strategies and strengthen a culture of reasoned instructional practice. A recent NSF Project Pathways presentation at the MSP- Learning Network Conference (2009) indicated that the facilitation of professional discourse is a key factor in the development of teacher practice. The original *TASEL-M* project provided a full time instructional coach to serve a high school and its two feeder middle schools. In an effort to sustain the positive benefits of coaching, the district provides intensive training to peer coaches who will facilitate Cycles of Professional Inquiry (CPI) at their school; often referred to as Professional Learning Communities (PLCs). The CPI includes: professional development in the lesson format of GRR, model lessons, co-plan and co-teach opportunities, observations with feedback, examination of student work, and professional dialogue to facilitate this collaborative learning experience. Teachers and peer coaches have in-service and release time during the academic school year with additional days in the summer. The heart of the CPI is shared classroom experiences that enhance the conversations and the examination of student work. Providing in-class support is primarily through working with teacher-leaders who are peer coaches providing classroom support through CPI. This process is supported by the MSP KMD report on *Why teacher leadership matters: Research on the relationship between teacher leaders' practice, teachers' practice and student outcomes* (2010).

There is a strong theoretical and research base to indicate that cultivating teacher Professional Learning Communities (PLCs) will yield results in the form of improved student achievement (Newmann, & Wehlage, 1995). In a recent publication of the National Staff Development Council entitled *Professional Learning in the Learning Profession* (Darling-Hammond, et al., 2009) "A synthesis of research findings confirm that collaborative approaches to professional learning can promote school change that extends beyond individual classrooms. When all teachers learn together, all students in the school benefit" (p. 3). Effective collaboration between teachers has been linked to gains in student achievement, higher quality solutions to problems and increased self-efficacy among staff, as well as more systematic assistance to beginning teachers (Little, 1990; McLaughlin & Talbert, 1993; Horn, 2005). PLCs have been linked to a deepening of teachers' professional understanding (Darling-Hammond, 1993). The original *TASEL-M* project deliberately sought to develop mathematics Professional Learning Communities (PLCs) so that they could be studied for their effects on teacher instructional practice, teacher knowledge of mathematics, and student achievement.

TASEL-M2 strives to provide effective PLCs at every district secondary school mathematics department to facilitate further Cycles of Professional Inquiry (CPI) at school sites through peer coaches, department chairs, and site administrators on a regular basis as suggested by Horn (2006). "Simply gathering teachers together and asking them to talk about their teaching challenges will not help them become a teacher learning community. Their work needs to be buttressed by high quality professional development and focused frequently on problems of practice. At the same time, they need to develop

common language, a shared conception of their goals and obligations as teachers, and the kinds of relationships that will allow them to work through the vulnerable moments that arise when talking about the challenges of teaching." (p. 77)

Claims examined in the work

The work that was successful in a previous project can be scaled up to a large district through specific strategic processes.

District TOSAs in Mathematics are the link for all groups involved in the project. They work in collaboration with the STEM Faculty to present specific content and pedagogy, with peer coaches for each site to develop skills in working with individual teachers at their site, and with the Secondary Director of Curriculum in working with site principals on how they can support teachers' mathematics instruction. This model allows for all levels of the district to be engaged in the process of the grant and it's implementation.

Teachers of middle schools and high schools from the Phase I Targeted project were trained along with some new schools from Phase II in the specific strategy of GRR during the first year of this grant. The model gives site coaches training and support to bring the GRR model to all mathematics classrooms. Peer coaching through the Cognitive Coaching model is the process used to provide continued lesson design support, and reflection for teachers implementing GRR in their mathematics lessons. This group of teachers make up the Cohort I schools for the grant.

Cohort II schools are the twelve remaining middle schools and high schools in the district. They are receiving the same treatment in year 2 that Cohort I received in year 1. These two Cohorts provide three groups of schools to analyze the scaling up of strategies from *TASEL-M1*: 1) Cohort IA – *TASEL-M1* schools, 2) Cohort IB – Non-*TASEL-M1* schools, and 3) Cohort II – remaining Non-*TASEL-M1* schools in the district.

Professional Learning Communities (PLCs) within each mathematics department reinforce the work of GRR, reflection on pedagogy, and discussion on content they are required to teach. Tools are provided by expert trainers from the Orange County Department of Education to support continuation and development of effective PLCs at school sites through STEM Faculty, mathematics coaches, department chairs, and site administrators at the district level as a leadership PLC. By developing effective PLCs within each mathematics department, the professional development is enhanced through a strategic implementation process that includes continual reflection and refinement.

- Section 3: **Explanatory framework**. This section should describe what you are finding, or are set up to learn, about student success, and how it is informing, or will inform, your MSP work.

Evaluation and/or research design, data collection and analysis

This study compares three cohorts of teachers in a quasi-experimental design with a time-delay control group to address the research questions. The research design includes two "treatments" or interventions. The PLC treatment consists of training for peer coaches, department chairs and administrators in the evidence-based key features of high quality PLCs, as well as a unifying conceptual framework of instructional delivery. PLCs are analyzed using Social Network Analysis (SNA) and the TASEL-M PLC Checklist.

Achievement data will be obtained from district records, and will consist of end-of-term mathematics grades, district benchmark test data, curriculum-embedded assessments, and state standardized test scores.

Scales – ***TASEL-M2*** will employ both standard and emerging methodologies in the refinement and development of self-report measures designed to assess teacher efficacy, teacher self-regulation, and school culture. Standard methodologies include psychometric analyses to assess scale reliability and validity (e.g., internal consistency estimates, confirmatory factor analysis, and item response theory).

Key insights (retrospective for veteran projects, prospective for newer projects) that have value for the Learning Network

STEM Faculty Partners have built a close relationship with their TOSA. This relationship provides a good solid relationship with someone at the district who is a greater influence on the teachers. In the

beginning of Phase II, the TOSAs and Faculty Partners were not sure how to build the relationship. They have now built a two-way connection with Faculty Partners giving input through mathematics content teachers are responsible to teach within each quarter. Faculty Partners became more familiar with district benchmarks and data. They now provide content that helps teachers deepening their understanding while broadening the content they find students struggle to achieve.

Using a district-wide focus for professional development has greater impact on implementation. The full district program has the backing from district administration and teachers are more inclined to follow through with training. The central control and added guidance from principals, peer coaches, and department chairs provides a cohesive program with greater implementation because they are working together with a common purpose. In Phase II, the coaches are classroom teachers from their site who support all teachers in the mathematics department responsible for teaching Pre-algebra or Algebra I. Coaches from the site are seen as peers, rather than someone coming in from the outside.

Social network analysis is used to determine the effectiveness of Professional Learning Communities (PLCs) and to describe ways in which successful PLCs differ from those who have yet to truly adopt a professional community. PLCs were analyzed using Social Network Analysis (SNA). A school with considerably more training in PLC functioning showed a much stronger network structure with greater tie density (64% of all potential connections between teachers within the math department, almost two thirds were on a weekly or daily basis) than a school that was functioning as a PLC in name only (27%, or just over a quarter of all potential connections). In both schools presented, coaches appear to play a large role in the interactions among teachers. Student achievement data for these schools is analyzed for possible correlation to strength of the PLC.

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