Handout 5:

Mathematics Professional Learning Models Proposed Project: Detailed Overview

The overarching goal of the REL AP Student Success in Mathematics Partnership (SSMP) is to support educators in understanding and using the evidence base and efficacy of different instructional approaches and interventions to prepare students for success in the Algebra I course and ultimately to increase students' success in acquiring a high school diploma on time. The proposed activity has three primary components that are designed to increase leaders' capacity to provide professional learning for teachers that improves students' preparation for and success in Algebra 1 and beyond. During the project, we plan to engage partnership members in activities to:

1. **Explore professional learning models (PLMs) for mathematics learning and teaching improvement**
2. **Support understanding and use of effective instructional practices** within the defined PLM
3. **Engage in continuous improvement to test and enhance mathematics PLMs** to best meet their division's needs

The following overview details these three activities and describes how this proposed project connects to future REL AP work and division planning.

Explore professional learning models for mathematics learning and teaching

During our conversations with school division leaders, they have identified many different types of teacher professional development available to teachers, and many different objectives of the professional learning opportunities available. In order to increase the potential influence of these opportunities for teacher learning, we propose to share what external research has found about mathematics teacher professional learning contexts and objectives so local leaders can work to create a model of teacher professional learning—or a professional learning model (PLM)—that works best for them and that will be the most productive for student achievement.

Research has identified components of mathematics teacher professional development that are associated with improved student achievement. A literature review identified teacher professional development as having positive associations with student achievement when it: a) is content focused; b) incorporates active learning; c) supports collaboration, typically in job-embedded contexts; d) uses

models and modeling of effective teaching practice; e) provides coaching and expert support; f) offers opportunities for feedback and reflection; and g) is of sustained duration (Darling-Hammond, Hyler, & Gardner, 2017). We plan to detail each of the characteristics of effective professional development and situate them in mathematics teaching contexts. It is important to clearly define each of these elements *as well as* respond to division leaders' reflections on these elements in order to build understanding of practices and define the particular PLM that will be used within the participating divisions. We will present on the characteristics and configurations of PLMs that incorporate resources embedding research-based practices and concepts, and engage members in a conversation to help them define and articulate their local PLMs. Partnership members will be invited to consider the particular components and the degree to which those components are present or absent from their current division professional learning in mathematics. This approach will seek to help members determine practical and realistic ways to implement PLMs in their local context.

REL AP also plans to host a partnership convening with national experts in mathematics teacher learning and practice. During the convening, experts will share their own work, present on how to focus a PLM in mathematics with an equity lens, and lead roundtable discussions to support divisions in defining their PLMs while also learning about ways to embed effective practices therein. The meeting will support project goals and ensure that partnership members have the opportunity to engage in rich conversations with experts and with each other.

Support understanding and use of effective instructional practice

While defining how to structure teacher PLMs in local school divisions is critical, it is also important to support use of effective instructional practices within the model to ensure that the content that teachers are learning is grounded in evidence and current research. To address this need, we will provide resources that school divisions can use to make research-based practices concrete and appropriate for classroom use.

The National Council of Teachers of Mathematics (NCTM) defines eight research-based mathematics teaching practices: (1) establishing math goals to focus learning, (2) implementing tasks to promote student reasoning and problem solving, (3) using mathematical representations, (4) facilitating meaningful mathematical discourse, (5) posing purposeful questions, (6) building procedural fluency from conceptual understanding, (7) supporting productive struggle, and (8) eliciting and using evidence of student thinking (NCTM, 2014). While these practices are widely accepted as critical to student

achievement, further specifying and defining these practices is key to supporting teacher implementation of high-quality teaching (Ball & Forzani, 2011). For example, as partnership members identify a key practice, such as "facilitating meaningful mathematical discourse," it may not be clear how individual teachers implement what is a complex instructional practice. Research on classroom mathematical discourse and how to faciliate it (e.g., Huffered-Ackles, Fuson, & Sherin, 2004) can be used to develop a common understanding of a key teaching practice.

We plan to develop materials to help clarify and support effective use of key instructional practices and disseminate materials through a video conference with division mathematics leads. This activity provides an opportunity for divisions to dig deeply into research-based practices and to reflect on the possible affordances and constraints of these practices in their districts.

Engage in continuous improvement to test and enhance mathematics professional learning models to best meet their division's needs

The logic model will provide a framework for guiding subsequent activities and support the divisions' engagement in a continuous improvement effort. REL AP will support leaders in identifying data to collect on teachers' experiences within the PLMs. REL AP's project team will guide division leaders as they document their teachers' experiences and reflect upon components of the PLM and teacher self-reported data of classroom implementation. This will be an iterative process of development and testing.

The full process will follow a Plan-Do-Study-Act (Park et. al, 2013) continuous improvement approach, and it will have four main steps:

1. Plan: introduce the plan and its purpose
2. Do: data collection
3. Study: synthesize and reflect on the data
4. Act: refine the PLM by applying lessons learned and challenges to the PLMs

The "Plan" step of the cycle will focus on stating the objective, questions, plan to carry out the continuous improvement cycle, and plan for data collection. The plan step is not for accountability; rather, it is part of a systematic way to obtain feedback and reflection for improvement of the PLM model divisions are designing and implementing. In the planning stages, we will identify and discuss possible data collection instruments aligned with each component of the logic model. In the "Do" part of the cycle, REL AP will support the partners to carry out the plan and collect data. During the "Study" step, the REL AP team will help the partners to summarize and reflect on their data. The fourth step of

the process, "Act," is where partnership members' use what they learn to reflect and refine the content, tools, and processes of the PLM they developed and tested.

REL AP staff will prepare a descriptive summary of the project for partnership members that documents the successes and challenges of the PLMs, as conceived by participants. The summary will provide information about characteristics of PLMs as implemented, participants' reflections on the data, and the refinement of the PLM. The results will lay the foundation for an improvement discussion with division superintendents so they can reflect on their mathematics teacher learning opportunities and future designs of PLMs. This information will support division leaders in implementing changes and in continuing to investigate components of the PLM. The Plan-Do-Study-Act continuous improvement approach will also build the capacity of the division to collect and use data for improvement purposes (Park et. al., 2013).

Purpose, Relevance, and Connections to Future work

Understanding these models is important because teacher professional learning can support student achievement. However, if opportunities set aside for teacher professional learning are underutilized, gains in student achievement may not be realized (Darling-Hammond, Hyler, Gardner, 2017). This project will seek to provide a better understanding of mathematics PLMs and support divisions in implementing these models to strengthen teacher professional learning and their teaching practices. The proposed project will support teacher learning of research-based mathematics instructional practices through capacity building of the mathematics leaders and facilitators. They will share their new knowledge and deepened understandings in order to build their teachers' capacity to deliver mathematics interventions that will improve readiness for Algebra I by grade 9. Further specifying effective mathematics teaching practices and effective PLMs may improve the instructional practices of teachers participating in PLMs and subsequently benefit their students.

By participating in the project, mathematics leaders across divisions will develop a common language for their current work and a shared understanding of teacher professional learning. Division mathematics leaders and teachers will have access to the materials and rubrics to support their own work of analyzing and supporting teaching practices. Through their use of shared research and project-created materials, participants may also build their own capacity for developing rubrics and materials to support professional learning. The practice of creating a project-specific logic model and setting a research agenda will support division leaders and their partners to develop a framework for studying

teacher professional learning and its outcomes in future research as well. Future work with REL AP staff could focus on additional research on mathematics teacher professional learning and the possible connection to classroom instruction and student achievement.

References Cited

Ball, D. L., & Cohen, D. K. (1999). Developing practice, developing practitioners: Toward a practice-based theory of professional education. In L. Darling-Hammond & G. Sykes (Eds.), *Teaching as the learning profession: Handbook of policy and practice* (pp. 3-32). San Francisco: Jossey-Bass.

Ball, D. L., & Forzaon, F.M. (2011). Building a common core for learning to teach and connecting professional learning to practice. *American Educator, 35*(2), 17–21.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective Teacher Professional Development* . Palo Alto, CA: Learning Policy Institute.

Garet, M.S., Porter, A.C., Desimone, L., Birman, B.F., & Yoon, K.S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915-945.

Goldsmith, L.T., & Seago, N. (2011). Using classroom artifacts to focus teachers' noticing: Affordances and opportunities. In M.G. Sherin, V.R. Jacobs, & R.A. Philipp (Eds), *Mathematics teacher noticing: Seeing through teachers' eyes.* New York, NY: Routledge. 169-187.

Huffered-Ackles, K., Fuson, K.C., & Sherin, M.G. (2004). Developing levels and components of a math-talk learning community. *Journal for Research in Mathematics Education, 35*(2), 81-116.

Kleickmann, T., Trobst, S., Jonen, A., Vehmeyer, J., & Moller, K. (2016). The effects of expert scaffolding in elementary science professional development on teachers' beliefs and motivations, instructional practices, and student achievement. *Journal of Educational Psychology, 108*(1), 21–42.

National Council of Teachers of Mathematics (NCTM). (2014). *Principles to Action: Ensuring Matematical Success for All.* Reston, VA: NCTM.

Park, S., Hironaka, S., Carver, P., & Nordstrum, L. (2013). Continuous Improvement in Education. Stanford, CA: Carnegie Foundation for the Advancement of Teaching. Retrieved from https://www.carnegiefoundation.org/wp-content/uploads/2014/09/carnegie-foundation_continuous-improvement_2013.05.pdf.

Putnam, R. T., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher*, *29*(1), 4-15.