



The Silicon Valley Mathematics Initiative

Silicon Valley Mathematics Initiative **Pedagogical Content Coaching**



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The Silicon Valley Math Initiative’s work is based on the belief that the key to improving student achievement in math relies on improving teaching and learning in the classroom. SVMI sees pedagogical content coaching as a promising method for actually getting into the classroom and providing interventions to help teachers improve their instruction.

What is Pedagogical Content Coaching?

Pedagogical content coaching is based on the premise that throughout their careers, teachers need to continue to grow in their knowledge of content and of pedagogy. A content coach helps teachers to extend their understanding of mathematical knowledge, of instructional strategies, to assess student thinking and to develop effective lessons for all students in their classrooms. Coaches are typically experienced and exceptional teachers who are released from their teaching responsibilities to work in this professional development role.

What does content coaching look like?

Coaches help math teachers to improve instruction through intensive in-class professional development. They focus on helping teachers to understand important math concepts and to understand student thinking about those concepts. They also help teachers to develop techniques to support all students.

Coaches employ a variety of strategies to engage teachers. Typically, coaching involves an ongoing process of pre-teaching conferences, in-class experiences and post-conferences. The focus of the pedagogical content coaching is on students’ thinking, understandings and work products. Coaches vary the roles they play from modeling to team-teaching to leading. Key to being an effective coach is listening and asking questions to develop the teacher’s own capacity. Often the coach works with teachers outside of class, sometimes in teams, on student work examinations, mathematics concepts, lesson planning, and other professional development experiences.

A pedagogical content coach may assume various roles when working with a teacher. These roles are determined by the needs or status of the coach-teacher relationship. In 2001, Dr. Joanne Rossi Becker studied coaching styles in the SVMI and developed three descriptions of the role of a coach:

Coach as a Collaborator: The coach sees him/herself as a resource to the teacher. In partnership with the teacher, this type of coach provides materials, information, and encouragement and works collaboratively with the teacher in planning lessons. The coach gives little direct feedback to the teacher about his/her pedagogy or presentation of the math of the lesson. Rather, discussion focuses more on what the students seem to understand and teachers are free to interpret that information.

Coach as Model: The coach uses a long-range plan of working with teachers by modeling instruction. The instruction actively involves children in high level tasks as well as modeling the coaching process itself with the coach as the teacher. The coach may provide follow-up lessons for the teacher to use after the model lesson.

Coach as Leader: The coach is a guide to the teacher. The direct guidance is effective and accepted on content issues and pedagogy because of the way it is approached. The comments are grounded in what the teacher did and what the students seem to understand. The coach and teacher become collaborative problem solvers in designing next steps in instruction.

What does a coach do?

The skills and knowledge that a coach needs in order to fill these different roles are varied. In order to be effective, content coaches need to be knowledgeable about math, about teaching and about the teaching of math. Additionally they need to know how to teach adult learners and they need good interpersonal skills in order to develop good relationships with the teachers who they coach. Coaches use a variety of strategies in order to build relationships with teachers and to help teachers to grow.

Building relationships

Before any effective coaching can take place the coach and teacher must build a trusting relationship that promotes mutual respect and safety. Coaches should not be expected to evaluate the teachers who they coach. Mixing formal evaluation duties will endanger a relationship that could lead to positive change. Building a positive relationship takes time and effort. In order to build this relationship, teachers need to believe that value will come from the interaction—primarily that teachers' will improve both their instruction and grow their content knowledge. To be successful, several basic requirements need to be established for coaching.

Fundamental Requirements for Successful Coaching

- Clearly defined roles, responsibilities and expectations
- Time for preparation and reflection
- A trusting, honest, respectful relationship between coach and teacher.
- Effective listening skills
- Strategic questions that promote thinking
- Data collection (teacher/student behavior) and thoughtful feedback

The roles and expectation of the coach and the teacher must be clear. People come to coaching with pre-conceived notions. Many view coaching from experiences with sports, music/dance/art lessons, or other mentoring experiences. The pedagogical content coach plays a different role than the traditional roles that many other kinds of coaches play. The purpose of content coaching is to develop teacher capacity. This is done by asking open-ended questions and focusing on students in the classroom – what they understand and their misconceptions.

Trust is built through actions and experiences. A coach can develop a trusting open relationship by focusing on students' thinking, understandings and misconceptions, and student products. This focus allows a discussion of the learning process without directly examining teacher moves or teacher talk. These coaching conversations allow mathematics issues and issues around the learning strengths and needs of the students to emerge.

Another method of establishing the positive coach-teacher relationship is the use of demonstration lessons. Demonstration lessons are conducted by the coach. They often take place during early coaching sessions. This usually helps to set the stage for relationship building. In some cases, it takes a demonstration or two for a teacher to understand or picture a different learning environment or technique that the coach is advocating. A demonstration lesson must be carefully planned by the coach. The teacher should be assigned specific duties or areas to focus on during the demonstration lesson. The post-lesson discussion should be designed to support the goals or purpose for doing the demonstration lesson. Following a demonstration lesson and post-conference, often the teacher then is asked to teach a lesson that follows or builds upon the coach's lesson.

Pre-Conference Strategies

The role of the pre-conference is to frame the lesson for the teacher and coach. It is a time to clarify the lesson and the key mathematics that will be taught in it. It provides an opportunity for the teacher to explain the main goal and big mathematics ideas. It provides the coach with insights to the teacher's depth of mathematical knowledge. It can also provide time for discussion on effective strategies to deliver instruction. The pre-conference is a good opportunity to brainstorm possible challenges students may have and misconceptions that may be addressed up front in the lesson. Finally, it provides the coach and teacher with a common focus for the observation. Below are some common questions that a coach might use in the pre-conference.

- What topic will you and your students be working on in this lesson?
- What do you plan to do in this lesson?
- What do you hope to accomplish in this lesson?
- What mathematical ideas are embedded in this lesson?
- How does this lesson fit into your overall goals for the year?
- What aspect of the lesson might be most challenging to the students?
- Where might students have difficulties?
- What misconceptions might students have about the content you're teaching?
- Are there students who have special issues in the class?

In-class work

After the pre-conference, the coach will observe the teacher teaching the lesson they discussed or the teacher will observe the coach. During this time, the observer takes note of what is happening in the classroom. (The Observation Guide in the appendix helps to focus these observations.)

Post-Conference Strategies

The post-conference is the most important time in the coaching sessions. The pre-conference sets the stage and helps to focus and improve a lesson. The class session is mostly a data collection experience for the coach. During the post-conference, the coach shares information, provides feedback, encourages the teacher to reflect on the lesson in order to build the teacher's capacity. The post-conference is also an excellent opportunity to examine student thinking and work. Conversations around students' understandings and products generate ideas and issues of strategies and next steps the teacher should take. Focusing questions to ensure all students are making progress is a key technique of an effective coach. The post-conference provides an opportunity to assess learning, inform instruction and adjust educational plans. Effective coaches are able to focus on the connection between the intended content and student learning through effective questioning. Issues of teacher moves and "what if" scenarios are often raised by the teacher during the post-conference.

Focusing on students' thinking/work The focus of pedagogical content coaching is on students' thinking and on their work products. When the focus is on student thinking and performance, teachers see how their role as a teacher must adapt. When teachers examine student thinking that includes the student's understandings and misconceptions of math concepts, they can then develop strategies to address those needs. This is fundamental to good teaching. Student work is therefore, at the center of what happens during coaching. It is a tool for evaluating the effectiveness of changes in curriculum, instruction, and pedagogy.

A coach can use many different forms of student thinking and work to enhance the post-conference discussion. Silicon Valley Math pedagogical content coaches tend to use three sources of data for examining student thinking: 1) classroom observations; 2) student work products; and 3) formal assessments.

As a classroom observer, the coach can note the approach, thinking and discussions of the students. As part of the post-conference, the coach may report the findings of the thinking of the students. This is valuable to the teacher for several reasons. It increases the teacher's knowledge of his/her students. Even with a small class size, a teacher can't hear or see all students' thinking. Data that is collected about student thinking can then be used to inform instruction and tailor future lessons. The second value is to open a discussion about the mathematics that students are learning and where gaps or misconceptions might be forming. It provides a basis for discussions and reflections on the ongoing learning of each student in the classroom.

Another form of using student work is to examine student products completed during an observed class period. By collectively examining the student work, the teacher and coach can engage in a discussion rich with evidence. Mathematical understandings and the development of skills of selected students can be explored. Assessments of student growth or understandings can be shared. Talk of next steps and how to address a certain educational issue is a natural outgrowth of this kind of discussion.

Student thinking and understanding are also evident in formal assessments. Pedagogical content coaches work closely with their teachers to plan assessment tasks that are closely aligned to the students' goals and instructional experiences. Examination of collaboratively produced assessments provides a powerful way to evaluate the progress of instruction. These periodic assessments not only inform student achievement records, but more importantly they can inform the instructional program and strategies used by the teacher. Using the formal assessment instrument as a learning tool for students is also important. The coach and teacher can discuss ways to leverage the assessment to promote student learning.

Questioning and building capacity

Pedagogical math coaches use questions to probe thinking, encourage reflection, inform teaching and build internal capacity. The questions a coach asks serve as a model of the kinds of questions a teacher should be asking of him or herself. Questions also invite the teacher to seek advice or brainstorm ideas. Through questions, a pedagogical content coach focuses the discussion on student thinking, misunderstandings and their work. By focusing on student work, the coach and teacher can get to the heart of the mathematics and begin to assess the understanding and skills students possess. This discussion creates a fertile field to probe the teacher's mathematical depth, the ability to connect the content to the students' learning needs or styles and to focus future instruction.

Good questioning can also address an all too frequent and often awkward issue of uncovering teachers' mathematical errors and omissions. Significant skill is involved in these questioning techniques. For example, teacher errors and omissions are common issues a pedagogical content coach must confront. Allowing the teacher to save face is often weighed against creating misconceptions in students. How the issue is addressed becomes a function of the relationship between the coach and the teacher, the teacher and her/his students, the type of error and above all, the ability of the coach to catch and respectfully communicate with the teacher. Often the error is addressed in a post conference. Effective coaches can pose questions about the meaning of a statement or notation that the teacher has made. The teacher must reflect on the meaning of the statement or notation. Often that can open a dialog or an invitation by the teacher to gain a better understanding. Sometimes two counter ideas can be presented (one which originates from the error and the other a mathematical sound idea). Asking the teacher to make sense of these two counter thoughts, allows the teacher to reflect and learn. In class, a glaring error may also be addressed by presenting a counter thought and asking the class to consider how those two ideas can both be true. The authority for correctness

lies in the mathematical logic and reasoning. Students, teachers and coach should all engage in the logic and reasoning of mathematics and back away from identifying authorities as absolutes and the source of knowledge. This questioning and developing logical arguments to mathematical ideas is at the center of doing mathematics.

Other coaching strategies

Pedagogical content coaches make use of the Math Teaching Rubric. The rubric is designed for the teacher's own self assessment. Coaches do not use the rubric as an evaluation instrument to rate teachers. Rather, coaches use it to create a dialog, and teachers use it as a mirror to focus on their own growth. When teachers feel comfortable and trusting they often become more realistic about their teaching and often rate themselves lower on the rubric.

Another method that has been successful for math coaches is to have the teacher identify an important content topic and assess his/her student using a performance assessment task. The coach and teacher then discuss the results of the assessment, identifying students' strengths and understandings and focusing on students' misunderstandings and misconceptions. After a careful analysis of the students' results, conversations about future instruction, centered on students' needs, should occur. The teacher and coach can collaborate together to map out an instructional strategy based on the class and the mathematics.

Finally, a coach and a teacher may decide to collaboratively team-teach a class. This sharing with no distinguished hierarchy may help the teacher ease into a mentoring relationship. Some teachers fear the loss of status from their students, if they appear to be subordinate to another person in their classroom. Teachers find out that students accept the coaching role without diminished respect. In fact, the role as a life long learner is a model that students should recognize and value. Team-teaching allows for more eyes and ears to assess learning and common discussions of the challenges facing the students. The teaming approach has benefits of co-planning lessons which often insures higher quality. It also serves as a means of modeling when the coach presents a topic or processes an activity. There is also a negotiation between coach and teacher in developing an effective classroom culture.

Math Coaching Logistics

In-Classroom Coaching: Math coaches spend the majority of their time supporting in-classroom teaching. They coach, observe lessons, team-teach and provide demonstration lessons. Additionally they provide teacher support through pre- and post- classroom conferences, lesson planning sessions, student work examinations, content trainings and formative performance assessment evaluations.

The coach should have at least 20 coaching sessions with each targeted teacher over the course of a year. Thus, a full-time math coach should have a coaching caseload of 10 to 12 teachers per year. The math coach should target experienced and successful teachers who are interested in improving their math instructional strategies and content knowledge. Novice teachers and teachers with management challenges are not good candidates for content coaching. The math coach should have the complete support of the principal, and the principal and coach should work together to support the growth of the targeted teacher.

Other Professional Development Responsibilities: The remaining time is spent supporting their district's math professional development plan. They help with the planning and facilitation of math professional development for teachers and principals, performance assessment meetings and scoring sessions, parent involvement activities and math articulation activities. In addition, coaches perform data analysis as it relates to student math achievement, and they participate in all activities sponsored by the Silicon Valley Math Initiative.

Professional Development for Coaches: In order to support the ongoing development and professional growth, coaches attend all of the Silicon Valley Math Initiative activities and take leadership roles in the Math Assessment Collaborative. They are encouraged to participate in summer programs, such as the Santa Clara Valley Math Project Leadership Institute and the SVMI Math Coaching Institute, as well as other math professional development activities sponsored by the National Council for Teachers of Mathematics, California Mathematics Council, Santa Clara Valley Mathematics Association, Connected Mathematics Project, Marilyn Burns, and others. It is critical that districts support coaches in these efforts. They play a pivotal role by providing structures and support for on-going professional development for both coaches and teachers.