The Mathematics Enthusiast

Volume 10
Number 3 *Number 3*

Article 10

7-2013

# Making Explicit the Commonalities of MSP Projects: Learning from Doing

Marilyn Strutchens

W. Gary Martin

Follow this and additional works at: https://scholarworks.umt.edu/tme

Part of the Mathematics Commons

Let us know how access to this document benefits you.

Recommended Citation

Strutchens, Marilyn and Martin, W. Gary (2013) "Making Explicit the Commonalities of MSP Projects: Learning from Doing," *The Mathematics Enthusiast*: Vol. 10 : No. 3 , Article 10.
DOI: https://doi.org/10.54870/1551-3440.1286
Available at: https://scholarworks.umt.edu/tme/vol10/iss3/10

This Article is brought to you for free and open access by ScholarWorks at University of Montana. It has been accepted for inclusion in The Mathematics Enthusiast by an authorized editor of ScholarWorks at University of Montana. For more information, please contact scholarworks@mso.umt.edu.

# Making Explicit the Commonalities of MSP Projects: Learning from Doing

Marilyn Strutchens & W. Gary Martin
Auburn University

**Abstract:** The seven projects discussed in the preceding articles are funded by the National Science Foundation (NSF) Math and Science Partnership (MSP) program (Hamos et al., 2009), which began in 2002. One of the main goals of the MSP program is to build capacity and integrate the work of higher education, especially its STEM disciplinary faculty, with that of K-12 to strengthen and reform mathematics and science education (Hamos et al., 2009). Thus, the MSP program brought together three sets of people (disciplinary faculty, teacher educators, and school system personnel) who do not usually work together to reform the mathematics and science education of teachers. For many of the MSP partnerships this was the first time that members of these groups were purposefully working together to develop mechanisms designed to 1) increase both preservice and inservice teachers' mathematical content knowledge for teaching; 2) provide teachers with the opportunity to learn mathematics in the manner in which their students should learn mathematics in order to develop habits of mind similar to those of mathematicians, such as making conjectures and testing them out, modeling contextual situations with mathematics, and persevering in solving problems; and 3) engage all of the partners in collaborative opportunities focused on student learning and assessment. Accordingly, the seven partnerships discussed throughout this issue and other partnerships chose coursework at universities, some combination of coursework and professional development, and/or study groups as the mechanisms to accomplish the objectives of the MSP program.

As principal investigators of a Targeted MSP, we can empathize with the leaders of the seven partnerships discussed in this special issue of the *Mathematics Enthusiast*. The project with which we are affiliated is the East Alabama Partnership for the Improvement of Mathematics Education (also known as Transforming East Alabama Mathematics or TEAM-Math), which was formed in November 2002 to improve mathematics education in 14 school districts in East Alabama with the support of Auburn University, Tuskegee University and other partners. Together, the districts in this partnership serve roughly

***The Mathematics Enthusiast*, ISSN 1551-3440, Vol. 10, no.3**, pp.777-792
2013©The Author(s) & Dept. of Mathematical Sciences-The University of Montana

59,000 students. TEAM-Math received major funding from the NSF MSP program in 2003, along with a number of other internal and external grants.

The mission for this partnership is: "To enable all students to understand, utilize, communicate, and appreciate mathematics as a tool in everyday situations in order to become life-long learners and productive citizens by Transforming East Alabama Mathematics" (TEAM-Math, 2003). A central goal of the partnership is to ensure that *all* students, including African-American and other historically underserved groups, receive high-quality mathematics education. This requires a comprehensive set of strategies addressing all aspects of the educational system. Thus, the partnership has been working to systemically change what is happening in mathematics education across the east Alabama region. TEAM-Math's design includes five primary components: (1) curriculum alignment, (2) teacher leader development, (3) intensive professional development, (4) outreach to stakeholders, especially parents, and (5) improvement of teacher education. In our 10 years of existence we have impacted over 1700 K-12 teachers of mathematics in the partner schools.

We believe that involvement in professional development will lead to change in teacher attitudes toward and use of reform practices (i.e., those consistent with the recommendations of *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics [NCTM], 2000), which in turn will positively influence student motivation, ultimately leading to improved achievement in mathematics. Previous analyses of TEAM-Math project data (e.g., Woolley, Strutchens, Gilbert, & Martin, 2010) showed that students who reported greater teacher use of reform practices, higher teacher expectations, and higher teacher standards, demonstrated higher levels of confidence and

interest in mathematics and lower levels of anxiety as it relates to mathematics. Moreover, students with more desirable levels of motivation to learn mathematics performed better in mathematics, including standardized test scores and self-reported grades in mathematics. There was also a direct relationship between teachers' uses of reform practices and expectations and students' performance in mathematics (Woolley et al., 2010).

The teaching practices advocated by TEAM-Math are consistent with the findings of research focused on classroom strategies for enhancing students' motivation (e.g., Stipek et al., 1998; Turner & Patrick, 2004). However, an obstacle to implementation of reform practices is teachers' own beliefs about mathematics teaching (e.g., Ross, McDougall, & Hogaboam-Gray, 2002). TEAM-Math professional development activities are designed to affect teachers' beliefs about the nature of mathematics as a problem-solving activity and about what it means to learn mathematics, based on national standards (NCTM, 2000, 2006), state standards (Alabama State Department of Education, 2003), and research on teaching and learning. Teachers are given opportunities to develop a variety of instructional strategies for students to explore curriculum content, a wide selection of sense-making activities or processes through which students can come to understand and "own" information and ideas, and many options through which students can demonstrate or exhibit what they have learned (Tomlinson, 1995; Haberman, 1992; Senk & Thompson, 2003). Teachers are provided an opportunity to enhance content knowledge through examination of exemplary curriculum materials and solutions to tasks teachers find mathematically challenging. In order to address variable expectations and levels of support for different groups of students as stated in Equity Principle (NCTM, 2000), teachers were

challenged to reconsider their beliefs about who can be successful in mathematics.

The structure of TEAM-Math's professional development was based on best practices (Loucks-Horsley et al., 2003; Borasi & Fonzi, 2002). A cohort-based model was used, where teachers at a school entered the professional development as a group. Qualitative analyses of participating schools have shown the importance of developing a supportive environment—including administrators and teacher leaders—in encouraging teacher participation in project activities (Strutchens, Henry, & Martin, 2009). Together, teachers from a school experienced a two-week and a one-week summer institute, quarterly follow-up meetings on Saturday mornings throughout the school year, other special workshops and events, and school-based activities focused on developing professional communities of practice (Wenger, 1999).

**Professional Learning Communities**

Even though we specifically discussed developing professional communities of practice within the schools, we developed professional learning communities across the TEAM-Math partnership without explicitly naming what we were doing. Professional Learning Communities (PLCs) have been characterized as having shared missions, visions and values; typically involving collective inquiry, collaborative teams, action orientation/experimentation, continuous improvement and a results orientation that focuses on student learning (DuFour, 2004; Hord, 2008). Fulton, Doerr, and Britton (2010) identified five dimensions that practitioners and researchers consistently identify as important for success in Science, Technology, Engineering, and Mathematics (STEM) PLCs: 1) *Common vision and shared values* emerge from a collaboratively defined understanding of what constitutes worthwhile student learning, with all members of the PLC working

together on related problems. 2) *Collective responsibility* requires participants to contribute and share their expertise, and a sense of accountability for the student learning that is being supported. 3) *Leadership support* is the support of principals and other school leaders, who give school faculty space and dedicated time to meet. Continuity over time is important, since it takes time for trust to be built and more time to build a common language, norms, and protocols that work for the particular PLC. 4) *Good facilitation* contains three types of facilitator roles: knowledge facilitation to direct participants to information or strategies; process facilitation to attend to the structure and interaction of the group; and focus facilitation to keep the group on target. 5) The *use of data and student work* is central to the effectiveness of the PLC. Because the work of the PLC is focused on student learning, members of the PLC need to become comfortable with working with a variety of authentic measures for gauging changes in student learning and teaching effectiveness. Observing each other's teaching and providing feedback loops and protocols for reflecting on practice are also often used as key elements in the work of the PLC (Fulton et al., 2010).

Within the structure of TEAM-Math, several PLCs were formed. We had a core leadership group that met biweekly to discuss how we were going to meet the goals of the MSP. In the first set of meetings we noticed we were not all speaking the same language so we decided to create a seminar series to help us all to get on the same page. During the seminars, mathematicians, mathematics teacher educators, graduate students, and other project leaders who are available meet to discuss issues related to teaching and learning.

These seminars (which are still on-going) enable mathematics teacher educators, mathematicians, and school leaders to develop a common vision for the partnership and

help us to have a united professional development focus for the teachers. For our initial phase of the partnership, beyond the leadership core, we had a professional development committee; a presenter team, which was subdivided by grade bands, but met as a whole group in preparation for institutes and quarterly meetings; a teacher preparation committee; a stakeholder committee; and an evaluation committee. Each of these committees contained mathematics teacher educators, mathematicians, and school partners (teachers and/or administrators). Furthermore each of these committees was a PLC. We also had a teacher leader PLC that contained teacher leaders from all of the schools that were a part of the partnership, which met quarterly.

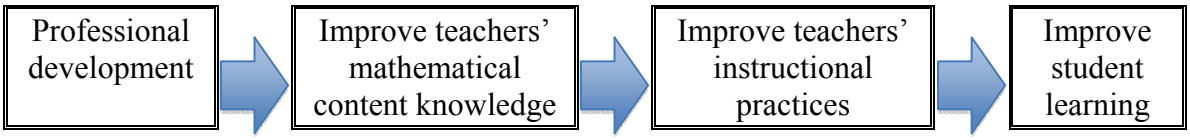
In like manner, most of the seven partnerships featured in this journal issue have PLCs that are intentional and ones that evolve as the projects grow. For example, Focus on Mathematics (Matsuura, Sword, Piecham, Stevens, & Cuoco, 2012) is devoted to improving student achievement in mathematics through programs that provide teachers with solid content-based professional development sustained by *mathematical learning communities* in which mathematicians, educators, administrators, and teachers work together to put mathematics at the core of secondary mathematics education. On the other hand, Kinzer, Bradley, and Morandi (2012) in describing project LIFT never explicitly talk about the development of learning communities, but in the work that they do, learning communities are implicit. In addition to having different forms of PLCs, the partnerships have other components in common. In the following sections we discuss those components.

**General Logic Model**

In looking across the seven projects, a general logic model seems to either explicitly or implicitly drive their MSP work. First, there is a focus on improving teachers'

mathematical content knowledge, leading to an improvement of teachers' instructional practices, which ultimately leads to improvement in student learning; see Figure 1. Note, however, there is substantial variation in how these areas are conceptualized, and a few projects include additional emphases. We will briefly describe the different perspectives taken by the seven projects.

Figure 1. General logic model for the projects.




Despite the variation among the programs in the manner in which professional development was provided, all included a major emphasis on improving teachers' mathematical content knowledge as a primary cause of change. But within that emphasis on mathematical content knowledge, there was substantial variation in the type of mathematical content knowledge targeted. Nonetheless, several themes were prevalent. All of the projects either explicitly or implicitly focused on helping teachers to develop pedagogical content knowledge (e.g., Shulman, 1986) or the mathematical knowledge for teaching (e.g., Ball & Bass, 2000) – that is, content knowledge that is interwoven with what teachers actually need to know and be able to do to support student learning. A number of projects focused on developing general themes or approaches that would be useful in looking across the curriculum (e.g., functions as a connecting theme [Teixidor-i-Bigas, Schliemann, & Carraher, 2012]) or specific conceptual areas central to the curriculum (e.g., rational number and proportional reasoning [Whitenack & Ellington, 2012].) Other

projects focused on developing a greater appreciation for what it means to do mathematics – for example, mathematical habits of mind (cf. Matsuura, Sword, Piecham, Stevens, & Cuoco; 2012; Teixidor-i-Bigas, Schliemann, & Carraher, 2012). Across all these approaches, there was a clear focus on the need for teachers to develop a deeper understanding of mathematics beyond merely increasing their knowledge of the discipline.

The projects further differed in the degree to which their professional development explicitly addressed changes in instruction. While some projects provided explicit definitions of effective teaching (e.g., Sayler, Apaza, Kapust, Roth, Carroll, Tambe, & St. John, 2012) or student outcomes, in other cases the target was more implicit. However, considering both the explicit targets along with implicit targets gleaned from descriptions of projects' work and their findings, the general theme across the projects is that students were expected to "engage in critical, in-depth higher order thinking" (cf. Gningue, Peach, & Schroder, 2012) that would promote students' development of conceptual understanding, beyond attaining procedural skill. They also imply a focus on helping students develop ways of thinking about mathematics, sometimes called processes (NCTM, 2000) or mathematical practices (CCSS, 2010). Teachers were either implicitly or explicitly expected to use instructional methods that would support the development of that kind of knowledge, becoming more student-centered, with a focus on responding to student thinking, effectively questioning students, and building classroom discourse.

Indeed, all of these aims seem quite aligned with the national consensus around school mathematics over the past decade as expressed in NCTM's standards documents, particularly *Principles and Standards for School Mathematics* (NCTM, 2000). Although the *Common Core State Standards* (Common Core State Standards Initiative [CCSSI], 2010)

postdated all of these projects, commonalities can also be seen in the emphasis on conceptual development as well as the mathematical practices. Thus, these projects can continue to provide important insights about improving mathematics education in the coming years. In fact, we have found that new activities of the TEAM-Math project have rather seamlessly transitioned to a focus on Common Core State Standards for Mathematics (CCSSM) (CCSSI, 2010); for example, we conducted a textbook review (TEAM-Math, 2012) that built on our previous work with curriculum alignment.

Finally, while the general logic model seems relevant across the projects, we would be remiss in not mentioning how some projects expanded upon this model. For example, several projects described the importance of engaging administrators in building an environment that supports change (e.g., Kinzer, Bradley, & Morandi, 2012; Lewis, Fischman, Riggs, & Wasserman, 2012; Sayler et al., 2012). Likewise, several projects focused on developing teacher leaders who could support improvement efforts at the school-level (e.g., Gningue, Peach, & Schroder, 2012; Kinzer, Bradley, & Morandi, 2012; Whitenack & Ellington, 2012). Our experience fully matches with the observation by Sayler et al. (2012) that "a robust infrastructure established to support teacher growth." We found that that support systems within a school significantly impacted teacher engagement (cf. Strutchens, Martin, & Henry, 2009). This implies that the proposed logic model may be embedded in a larger context of system change; see, for example, the expanded logic models used by Sayler et al. (2012) and by Gningue, Peach, and Schroder (2012).

**Measures and Findings**

Not surprisingly, the projects used a wide range of measures to assess progress in reaching their targets. In considering changes in teachers' content knowledge, projects

used previously-developed instruments (cf. University of Louisville, 2012), their own instruments, performance tasks, and classroom observations. In considering changes in teacher's instructional practices, projects primarily used classroom observation protocols (some designed by the state or other projects) or in-depth analyses of transcripts of classrooms. Only a few projects directly measured changes in student learning, primarily relying upon state assessments, probably a reasonable target given that these assessments are the primary targets for the K-12 partners.

Given the variety of methodologies, grain sizes, and levels of development of the analyses presented in these papers, it would be nearly impossible to provide any synthesis of the findings. We shall, however, provide a few general observations. First, projects tended to get better results when using instruments or protocols that they designed than when using more general assessments, instruments, or protocols. This is probably not surprising, since the more general measures are likely to be less aligned with project aims, particularly when considering state assessments that may focus more on procedural understanding. (Note that this may change as states implement common assessments designed by the two assessment consortia based on CCSSM.) On the other hand, self-designed measures may be less refined than external measures, lack the psychometric grounding, and may be viewed as less credible. The struggles of identifying or developing measures useful in describing progress will continue to be a challenge for projects such as these. Nonetheless, several projects were able to report informative findings supporting the effectiveness of the approaches they took.

Second, several projects engaged in more qualitative analyses of their progress, looking at what happened within a course being conducted by the project or within classes

conducted by participants in the project. These sorts of analyses were better able to capture the richness of the work being done by the projects and to lend insight not only into what happened, but why it happened. A number of important insights can be gleaned from these analyses. However, in some cases, a more careful description of their methodology and data analysis methods would help their findings rise above what could be interpreted as anecdotal evidence to a more scholarly level.

**Reflections**

We close with reflections that may be useful to those planning projects with related aims and approaches. First, it is imperative that projects be designed with knowledge generation as a key component. As the MSP movement has progressed, the inclusion of clear research plans has been increasingly emphasized in the National Science Foundation Request for Proposals (RFPs) for the MSP program. This perspective has to be part of the "DNA" of a project, not merely an add-on designed to satisfy the RFP. We suggest that to the degree possible, MSPs and other projects begin with a clear logic model, identifying measures that will be useful in tracking their progress. As TEAM-Math evolved, we recognized that our initial measures were difficult to collect in a reliable manner, leading to on-going difficulties throughout the life of the project. Moreover, as the project's understanding of its mission is refined, so the logic model and measures can be updated accordingly. For example, at its onset TEAM-Math did not adequately recognize the important role played by guidance counselors in influencing students' participation in mathematics across the grades, leading us to later include them both in our logic model and in the data we were collecting.

Second, to help ensure that adequate attention is being paid to the project's research

agenda, we suggest that someone on the leadership team might be given a primary responsibility for tracking the research effort, related to but apart from project evaluation. Efforts should be made to identify workable research designs that can fit into the life of the project in a way that generates knowledge usable by others without dramatically adding to what can seem an already overwhelming agenda. For example, as described in an earlier section, many of the projects engaged their participants in PLCs. The work of these PLCs might be "mined" not only to better understand the progress of the projects but also to generate knowledge that will be more generally useful. Indeed, considering the project leadership team as a PLC could provide an opportunity to explicitly track data on emerging understandings across the various stakeholders regarding what is needed to produce changes in teacher knowledge, in their understanding of teaching, and in student performance.

In summary, we applaud the efforts of these projects to generate knowledge that can inform others, beyond simply evaluating one's efforts for internal use. We fully appreciate how difficult it can be to simultaneously carry out a large project and capture what is happening in that project in a manner that will be useful to others. The reports in this collection illustrate a number of creative ways of meeting that challenge and will provide numerous useful insights for others engaged in similar efforts.

**References**

Alabama State Department of Education. (2003). *Alabama course of study: Mathematics*. Montgomery, AL: Author.

Ball, D.L. & Bass, H. (2000). Interweaving content and pedagogy in teaching and learning to teach: Knowing and using mathematics. In Jo Boaler (Ed.), *Multiple perspectives on teaching and learning* (pp. 83-104). Westport, CT: Ablex Publishing.

Common Core State Standards Initiative. (2010). *Common Core State Standards for Mathematics*. Washington, DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers.

DuFour, R. (2004). What is a "professional learning community"? *Educational Leadership*, 61(8), 6-11.

Fonzi, J., & Borasi, R. (2002). *Professional development that supports school mathematics reform* (Foundations Monograph No. 3). Arlington, VA: National Science Foundation.

Fulton, K., Doerr, H., & Britton, T. (2010). *STEM teachers in professional learning communities: A knowledge synthesis*. Washington, D.C.: National Commission on Teaching & America's Future & West Ed.

Haberman, M. (1992). The Pedagogy of Poverty versus Good Teaching. *Education Digest, 58*, 16–20.

Hamos, J. E., Bergin, K. B., Maki, D. P., Perez, L. C., Prival, J. T., Rainey, D. Y., Rowell, G. H., & VanderPutten, E. (2009). Opening the classroom door: Professional learning communities in the math and science partnership program. *Science Educator*, *18*(2), 14-24.

Hord, S. M. (2008). Evolution of the professional learning community: Revolutionary

concept is based on intentional collegial learning. *Journal of Staff Development, 29*(3), 10-13.

Loucks-Horsley, S., Stiles, K., Mundry, S., Love, N., & Hewson, P. (2010) *Designing professional development for teachers of science and mathematics.* Thousand Oaks, CA: Corwin.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

National Council of Teachers of Mathematics (NCTM). (2006). *Curriculum focal points for prekindergarten through grade 8 mathematics: A quest for coherence.* Reston, VA: Author.

Ross, J. A., McDougall, D., & Hogaboam-Gray, A. (2002). Research on reform in mathematics education, 1993–2000. *Alberta Journal of Educational Research, 48*, 122–38.

Senk, S. L., & Thompson, D. R. (2003). *Standards-Based school mathematics curricula: What are they? What do students learn?* Mahwah, NJ: Lawrence Erlbaum Associates.

Senk, S., & Thompson, D. (Eds.). (2003). *Standards-oriented school mathematics curricula: What does research say about student outcomes?* Mahwah, N.J.: Lawrence Erlbaum Associates.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4- 31.

Stipek, D. J., Salmon, J. M., Givvin, K. B., Kazemi, E., Saxe, G., & MacGyvers, V. L. (1998). The value (and convergence) of practices suggested by motivation research and promoted by mathematics education reformers. *Journal for Research in Mathematics Education, 29*, 465-488.

Strutchens, M., Henry, D., & Martin, W. G. (2009, January). *Improving mathematics teaching and learning through school-based support: Champions or naysayers*. MSP Learning Network Conference 2009, Washington, DC. Retrieved: http://hub.mspnet.org/index.cfm/msp_conf_2009_abstracts

TEAM-Math. (2012). TEAM-Math/East Alabama Regional Inservice Center Curriculum Analysis Project: Final report. Downloaded: http://team-math.net/CAP2012/

Turner, J. C., & Patrick, H. (2004). Motivational influences on student participation in classroom learning activities. *Teachers College Record, 106*, 1759–85.

University of Louisville. (2012). Diagnostic Mathematics Assessments for Middle School Teachers. Downloaded from http://louisville.edu/education/centers/crmstd/diag-math-assess-middle

Woolley, M. E., Strutchens, M. E., Gilbert, M. C., & Martin, W. G. (2010). Mathematics success of black middle school students: Direct and indirect effects of teacher expectations and reform practices. *Negro Educational Review*, *61*(1-4), 41-59.