



**STEPHEN F. AUSTIN
STATE UNIVERSITY**

**Texas Middle
and Secondary
Mathematics
Project
"TxMSMP"**



National Science Foundation
Math/Science Partnership

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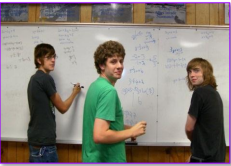
Definition of Student Success

In light of the Texas Middle and Secondary Mathematics Project, our definition of success is aligned with the National Research Council definition in the publication *Adding It Up: Helping Children Learn Mathematics*. Mathematical proficiency has the following components:

- conceptual understanding - comprehension of mathematical concepts, operations, and relations;
- procedural fluency - skill in carrying out procedures, flexibly, accurately, efficiently, and appropriately;
- strategic competence - ability to formulate, represent, and solve mathematical problems;
- adaptive reasoning - capacity for logical thought, reflection, explanation, and justification; and
- productive disposition - habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

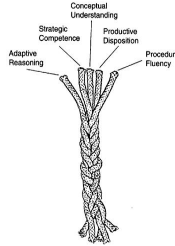
Students who have this level of proficiency would not only pass exit level exams for high school graduation, but having these attributes relative to high school courses, they would be well-prepared for college or the work place, a requirement for "student success".

If students truly demonstrate mathematical proficiency as described, the TxMSMP team would agree that we might accurately equate secondary school exit level success with college level readiness.



MSP TxMSMP Goal:

- Improve the capacity of teachers in 4-12 grade-level mathematics classrooms to impact student performance in mathematics.
- Increase the number of qualified and certified mathematics teachers for grades 4-12
- Prepare teachers to become Texas Master Mathematics Teachers
- Increase student performance at higher levels in mathematics through classroom experiences and summer enrichment institutes within collaborating districts



Role of Partners Related to Student Success

Stephen F. Austin State University mathematics faculty and educational specialists developed courses and materials to support the education of underprepared teachers throughout the East Texas region. Mathematics faculty delivered the content courses with support from educational specialists. SFASU TxMSMP project personnel were responsible for implementation of all project activities.

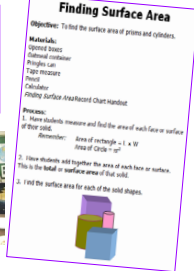
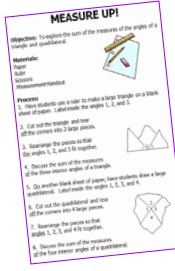
Partner District Administration – Professional Development Sessions

The Texas Middle and Secondary Mathematics Project worked with 27 school districts throughout the East Texas region and have maintained the established partnerships through ongoing conversation, professional development sessions designed specifically for district administrators. Topics for discussion in the sessions included:

- effective instructional practices in mathematics classrooms
- vertical teaming for curricular alignment
- evaluating mathematics teaching
- review of recommended curricular materials for the mathematics classroom
- teacher leadership and mentoring
- closing the gap in mathematics achievement
- an investigation of case studies in mathematics education
- utilization of data for school improvement
- next steps in strengthening the partnership
- additional grant funded opportunities

Development, Dissemination, and Implementation of Math Camp “Got Math?” Curriculum

Collaborative efforts between partners in the TxMSMP led to the development and publication of the "Got Math?" summer math camp materials for grades 4 – 8. Prior to delivery of the math camp curriculum, teachers were trained by project leadership in effective implementation within schools. The “Got Math?” curriculum was disseminated throughout partner districts and region service centers.



SFASU STEM Research and Learning Center

As a direct result of the TxMSMP, the SFA STEM Research and Learning Center will open in April 2011. The STEM Center is designed to encompass all aspects of the educational infrastructure that pertain to research and learning within mathematics and science. Activities through the STEM Center include research, program design, curriculum development and alignment, professional development institutes, outreach and recruitment. Through the center, SFA STEM faculty will have the opportunity to further contribute to the knowledge/research base within the STEM disciplines and to engage in various outreach and recruitment efforts designed to encourage students to choose STEM majors and prepare to enter STEM careers. The STEM Center is a direct result of collaborative efforts supported by the National Science Foundation.



Research Design Related to Student Success

Collaborative efforts with Horizon Research, Inc. --

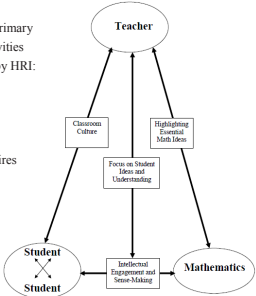
SFASU TxMSMP collaborated with Horizon Research, Inc. to further study the effects of the project on student achievement. Through supplemental data collection, analysis, and reporting, HRI studied the impact of the project's work with teachers and school/district administrators.

Three research questions emerged:

- What is the impact of teachers' participation in TxMSMP programs on their mathematics content knowledge, preparedness for teaching, and teaching practice?
- What is the impact of teachers' participation in TxMSMP programs on their students' mathematics learning experiences and achievement?
- What are the individual-, school- and district-level impacts of TxMSMP's work with administrators, and participating teachers as leaders?

To answer these questions, six primary data collection and analysis activities were conducted or coordinated by HRI:

- Teacher questionnaires
- Teacher interviews
- Analysis of teacher work
- Classroom observations
- Administrator questionnaires
- Administrator interviews



Content, pedagogical, and leadership preparedness were examined by HRI. Comparisons of teachers' reported preparedness prior to their participation in TxMSMP and at the time of that report revealed large, statistically significant changes in all five content areas (number and operations, patterns and algebra, geometry and measurement, probability and statistics, and mathematical processes) as well as significant positive changes in classroom practice and leadership. Pre/post test results, comprehensive exam results, portfolio assessments, and classroom video analyses support this assessment of the TxMSMP.

The evaluation reports submitted by HRI noted that the large effect sizes from composite mean scores for participants' preparedness to engage in leadership and mentoring prior to participation in the TxMSMP indicates a substantially greater sense of preparedness to mentor and lead other teachers.

| Composite Mean Scores for Perceptions of Preparedness to Teach Mathematics Content | | | | | |
|--|----|-------|-------|-------|-------------|
| | N | Mean | S.D. | Post | Effect Size |
| Perceptions of Preparedness to Teach Mathematics Content* | 56 | 35.68 | 15.52 | 60.55 | 10.46 |
| Perceptions of Preparedness to Teach Mathematical Processes* | 56 | 35.95 | 19.48 | 67.26 | 11.74 |
| Perceptions of Preparedness to Teach Mathematics Content* | 35 | 48.86 | 19.32 | 66.98 | 5.45 |
| Perceptions of Preparedness to Teach Grade 9-12 TEKS High School Mathematics Content* | 22 | 35.53 | 33.33 | 69.39 | 10.22 |
| Perceptions of Preparedness to Teach Grade 9-12 TEKS Advanced High School Mathematics Content* | 20 | 13.00 | 20.91 | 51.83 | 27.37 |

*Indicates a post-course score significantly different than pre-course score (paired samples t-test, p < 0.05).



SFASU Mathematics Faculty Research Team --

Analysis of teacher understanding of factoring

Master Teaching Fellows (MTFs) were selected from the pool of teacher participants who successfully completed the program and graduated with an M.S. in School Mathematics Teaching. As outlined by the research team, the MTFs selected 5 colleagues at their school site and asked them to complete a short survey regarding factoring techniques. They were then instructed to identify themes in their colleagues' work that could lead to potential professional development sessions at their school site. The research team collected the teacher work samples submitted through survey results and paired them with analyses performed by MTFs. Using the NVivo software package, researchers integrated the artifacts into a qualitative data analysis and linked themes between the factoring surveys and the teacher-leaders' analyses.

Findings/progress to date:

- Definite patterns emerged from the qualitative analysis. For instance, multiple surveys revealed a leaning toward the use of mathematically unmotivated acronyms for factoring (such as the MUSTANG method).
- MTFs recognized faulty factoring methods but did not demonstrate a clear understanding of how to address these misunderstandings with teacher colleagues.
- Interest in the results from this effort between university mathematics faculty and graduate students prompted the development of accessible literature explaining these 'variant' factoring methods, and also presenting a geometrically motivated alternative.

Analysis of case study

One of the goals of developing teacher-leaders is to give them training and materials they can use immediately. Using Katherine K. Merseth's *Windows on Teaching Math: Cases of Middle and Secondary Classrooms*, MTFs were instructed in the development and implementation of case studies for classroom instruction. MTFs led and critiqued case study presentations, noting implication for the classroom.

Deliverables from the case study investigations were embedded into professional development modules, presented by MTFs to district administrators, and prepared for delivery within districts to provide high impact professional development sessions for teachers within partner districts and across the region.

Challenges and Resolutions

Related to student success, the Texas Middle and Secondary Mathematics Project encountered challenges, both anticipated and unanticipated, many of which have been resolved but some with remaining questions. Those challenges include:

| Challenges | Resolutions |
|--|---|
| Severe deficiencies in content knowledge of under-prepared teachers, inertia resulting from exclusive emphasis on standardized test results, and issues related to time constraints that limit class time available for rich mathematical tasks. | <ul style="list-style-type: none">• Courses and materials were designed to address the content deficiencies of middle and secondary teachers that included applications to the classroom and implications for instruction. |
| | <ul style="list-style-type: none">• Professional development sessions were designed specifically for district administrators to address issues related to effective mathematics instruction and utilization of data for school improvement. These sessions were held on a regular basis. |
| | <ul style="list-style-type: none">• Investigations of case studies and reviews of recommended curricular materials for mathematics instruction were conducted with teachers to develop their understanding of rich mathematical tasks. |
| Obtaining school data to analyze student achievement is difficult at best. | <ul style="list-style-type: none">• Project evaluators collaborated with region service centers to obtain disaggregated school data specific to campus and teacher. Analyses of results were performed by the evaluation team and submitted to NSF. |
| Continual turnover in district personnel, especially at the administrative levels. | <ul style="list-style-type: none">• Professional development sessions for administrators were conducted on a regular basis. As personnel changed, phone conversations, email correspondence, and online materials were utilized to bring incoming district administrators up to speed on project goals, activities, and deliverables. Frequent visits to district campuses were also effective. |
| SFASU mathematics faculty are, in general, not trained to conduct research in mathematics education and are somewhat hesitant to engage in research activity "outside" of their area of expertise. | <ul style="list-style-type: none">• Through TxMSMP efforts, a team of 6 SFASU mathematics faculty have formed a mathematics education research team. Although products of these efforts are not readily available in published form, progress in ongoing with results in sight. |

