

GADSDEN MATHEMATICS INITIATIVE, MAY 2000 – DECEMBER 2007 FINAL REPORT

In May of 2000, the Gadsden School District was considered one of the lowest achieving school districts in the state of New Mexico. Academic proficiency was dismal and the turnover rate of teachers was very high (about 100% every four years.) There was no district math curriculum to speak of and the professional development of teachers was sporadic and not well related to what teachers were doing in their classrooms. Today, Gadsden paints a much different picture. Its 14,000 plus students, who are predominantly from Spanish speaking, low-income homes, are educated in what is considered an up and coming school district. Principals and teachers across the district are regularly provided with high quality professional development, all K-8 schools are implementing a rigorous mathematics curriculum, teachers are provided classroom-based support by one of twenty district math coaches, and new teachers are required to participate in a new teacher induction program for mathematics. Most importantly, the academic proficiency of students is on the rise and the achievement gap between Gadsden students and the rest of the state is closing (See Figures 1-3). The district that was once among the lowest performing is now considered the most improved district in the state and other school districts and state leaders in mathematics education are looking to Gadsden to adopt its model for school reform.

MAJOR ACTIVITIES AND RESEARCH

During its first four years, the Gadsden Math Initiative was effective in providing minimum of 140 hours of curriculum based professional development for all K-8 teachers. The professional development was delivered through the following venues:

- **Math Academies:** District teachers participated in three Summer Math Academies. The first summer academy (5-7 days) introduced 3-8th grade teachers to the *Investigations* or *Connected Mathematics* curriculum resource and prepared them to begin using the resources in their classrooms. The focus of the academy was to deepen teacher understanding of the mathematics of a problem-solving based curriculum. The second summer academy (4 days) included all K-8th teachers and centered around strengthening teacher content knowledge and helping them to develop instructional strategies that leads to student conceptual learning of mathematics. The third academy (3 days) provided different topics of professional development which included an in depth study of one of the *Investigations* or *Connected Mathematics* units; managing a standards based classroom; and questioning and assessment to improve learning. Beginning with the second summer, all K-8 district teachers were required to participate the GMI Math Academies.
- **Principal Academies:** All Gadsden principals also participated in GMI professional development. Principals met monthly for three hours to develop their understanding of standards based math instruction; engage in mathematics learning; and share project information. The intent of principal academies was to develop principal and school ownership of the district math initiative. In order for the project to be successful principals needed to provide school based support through scheduling time for professional development, purchasing materials required for full implementation of the program, and holding teachers accountable for implementing a problem-solving based curriculum. Without principal buy-in the initiative would not be sustainable beyond NSF funding.
- **Math Process Trainers (Coaches):** In the elementary and middle grades, Math Process Trainers (MPTs) have been established in each school. The MPTs provide classroom

based support for teachers to implement the district curriculum, facilitate bi-weekly grade level planning meetings for teachers to collaboratively plan instruction, and provide a support structure for new teacher to learn to implement the district curriculum. The MPTs also design and facilitate mathematics workshops to allow district teachers to participate in addition professional development outside of the school day and during the summer. MPT receive monthly professional development to develop their own leadership skills and further develop their mathematical knowledge. The MPT structure is now fully established in the district and will continue to be funded beyond NSF funding.

- **District Wide Adoption of Problem-Solving Based Curriculum Resources:** All K-12 schools in the Gadsden school district have fully adopted a problem-solving based curriculum as a result of the GMI. Adoption of resources began with elementary and middle grades, gradually phasing out the conventional mathematics curriculum that emphasized procedural knowledge to full adoption of *Investigations* and *Connected Mathematics* which provided for both the development of conceptual understanding as well and skill in using procedures/algorithms. It took three years of gradually phasing in the problem-solving based curriculum before all of grades K-8 were using *Investigations* and *Connected Mathematics* as the core school curriculum resource. In 2006, the high schools also adopted a problem-solving based curriculum, *Math Connections*, as part of the GMI scaling up and sustainability plan. The adoption of *Math Connections* along with extensive teacher professional development helped to create a vertically aligned math curriculum grades K-12.
- **Partnership with University:** By design, the GMI is a partnership between New Mexico State University (NMSU) and the Gadsden Independent School District. The partnership provides for additional support and expertise in implementing and sustaining the GMI efforts.
 - Gadsden district continues to partner with NMSU to seek state legislative funds and federal funds to continue to provide summer math academies for teachers. Although the NSF funding cycle is completed, the district continues to sponsor summer math academies for teachers and math leadership academies for principals through NMSU.
 - NMSU also designed and implemented the Student Outcome Study to research the effectiveness of the Gadsden Math Initiative. The study led to the development of Model for School Improvement that has been adopted by other New Mexico districts.
 - NMSU provides Summer Math Academies for grades 6th-12th mathematics teachers sponsored by Mathematically-Connected Communities (MC²)
 - The Gadsden School District partnered with the College of Education and the Department of Mathematical Sciences to offer a two year Master of Arts in Teaching Mathematics. Around 20 GISD mathematics teachers and mathematics coaches completed this.
 - Lesson Study was conducted during the last two years of the GMI. Courses were offered each semester in GISD. University researchers and math educators worked in the schools with teachers to implement and study the effect of lesson study. In one school, Dr. Cathy Kinzer, completed her dissertation on a whole school lesson study in a dual language school (Kinzer, 2007). A book has been written about how Lesson Study can increase achievement with diverse students (Wiburg & Brown, 2007)

FINDINGS

The GMI findings can be characterized under two main categories: the first is the effectiveness in improving the mathematics learning of the Gadsden students; the second is the GMI effectiveness in developing a model for district mathematics improvement that other districts could follow.

Student Achievement

This GMI was remarkably successful in improving K-8 students' mathematics achievement in a district with low-income (100% free and reduced lunch) and with 60% English Language Learners (ELLs). Student achievement steadily increased each year of the project in grades K-8 and the effects seem to be maintained in Grade 9. However, achievement was not sustained throughout high school; in eleventh grade mathematics achievement of Gadsden students remained way below the state average. The initiative was aimed at K-8 students in the first five years, but the results helped the district to realize the need to expand the GMI efforts to high schools if students were to have a successful mathematics experience for their entire K-12 education. Figure 1 shows where student achievement scores were when we started the project in 2000.

Figure 1: 2000 Achievement Scores for GISD Students as Compared to the State

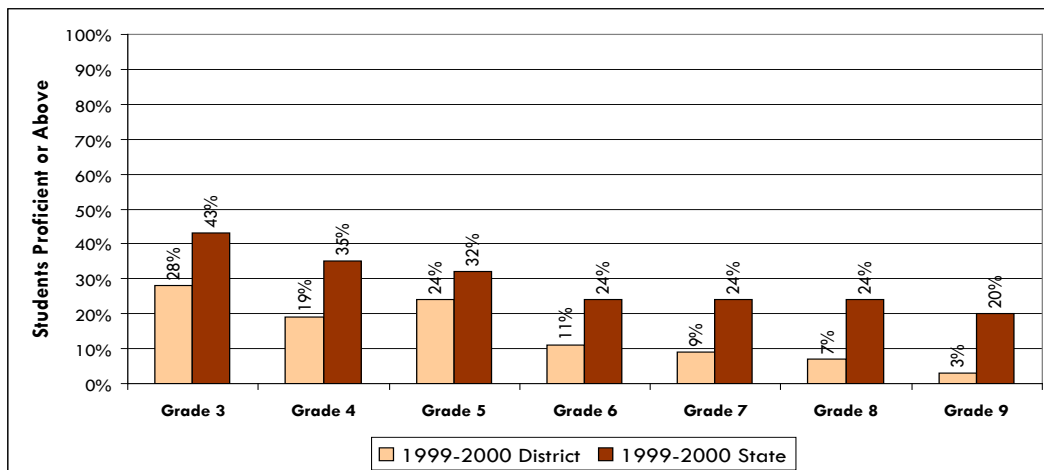
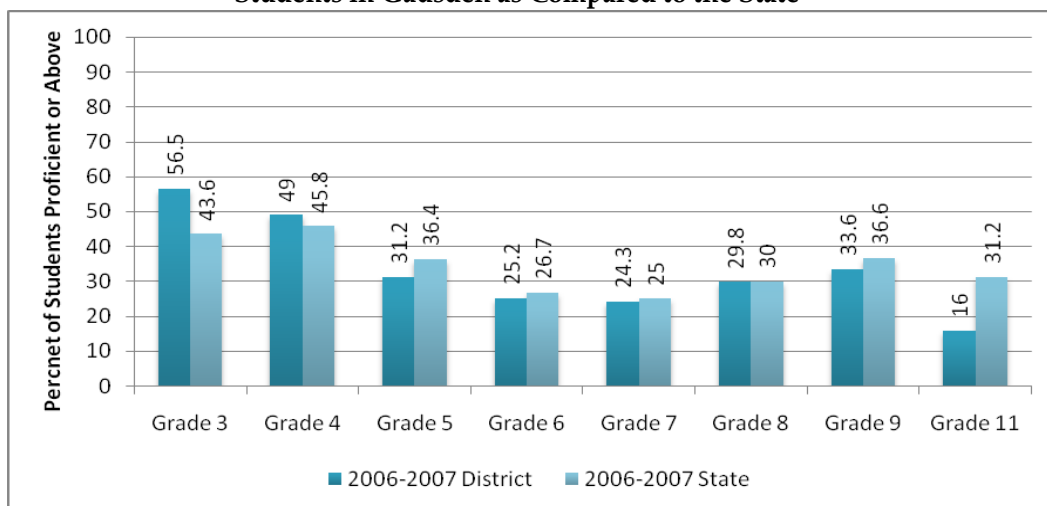


Figure 2 shows the proficiency levels for students in the district in spring 2007 compared to all students in New Mexico. While the state is making improvements as a whole, the Gadsden students are closing the achievement gap that was so prevalent in 2000.

Figure 2: 2007 Student Mathematics Achievement for Students in Gadsden as Compared to the State



Of special interest is the effect of the program on subgroups, especially among students who are economically disadvantaged and English language learners (ELLs) who are now scoring well above the state average for these same subgroups. See Figures 3-4.

Figure 3: 2007 Student Mathematics Achievement for Economically Disadvantaged Students in Gadsden as Compared to the State

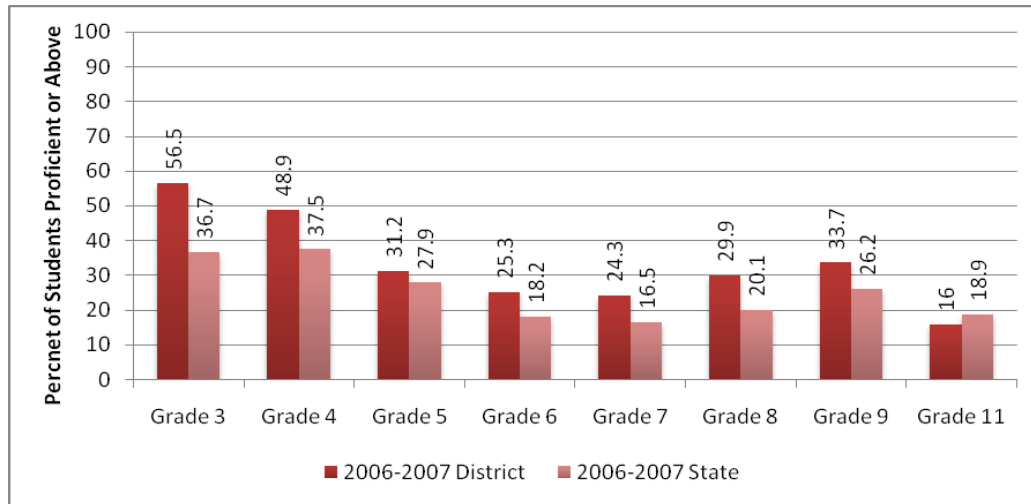
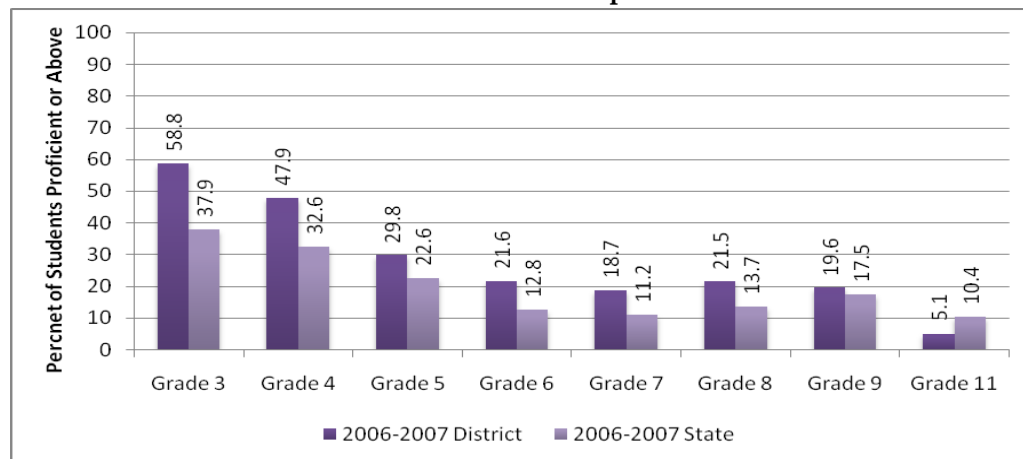


Figure 4: 2007 Student Mathematics Achievement for ELL Students in Gadsden as Compared to the State



Along with student achievement data, teachers and parents also report that students have greater interest in mathematics and enjoy being in their mathematics classroom. As the mathematics program improves, teacher satisfaction has also increased which is evidenced by the now low turnover rate. In 2000, Gadsden lost about 25% of its staff each year. In 2007, the rate has dropped to about 5%.

Developing a Capacity Building Model for District Change

Over the course of the GMI project, as the district began to transform and student achievement began to increase, education researchers and other high need districts began to inquire of the GMI mod

Below is a table that describes the final GMI model that emerged from continuous adjustments to the project. The model was refined through extensive data feedback loops based on 1) district evaluation, 2) feedback from district teachers, staff and administrators, 3) district-hired external evaluators in year 3 of the grant, 4) NSF-required random classroom observations by external, trained Horizon evaluators each year, and 5) feedback from the Student Outcomes Study (Wiburg et al., 2007) which begun in year two. The model is still being used and is being further developed to address the lack of educational achievement in the high school

Teacher Quality and Collaboration

Problems Prior to GMI	Successive changes in the System	Critical Elements of the System
<ul style="list-style-type: none"> ▪ High teacher turnover, as much as 100% every four years or 25% per year ▪ Teachers working as individuals, not as a part of a professional team ▪ Little consistent district-wide professional development in math or other subjects ▪ Little work in understanding standards or assessment tools 	<ul style="list-style-type: none"> ▪ Extensive professional development for all teachers including a teacher induction program into the GMI for all new teachers every year ▪ The use of unit or lesson study to help teachers work together to address student learning problem ▪ 130 -150 hours of PD over the grant ▪ One week orientation required to teaching curriculum in years one and two ▪ Math specialists for each school in year three ▪ Math coaches in ALL schools in fifth year, Coaches in high schools in year 6 of the project. 	<ul style="list-style-type: none"> ▪ Almost no turnover in the current district of teachers (5% turnover of teachers in last two years) ▪ Dedicated professional learning community time during the school day for teachers to work together to study and align their teaching around student learning needs, 2 hrs/week ▪ Site-based mathematics coaching by instructional specialists ▪ Monitoring of instructional coaching and collaboration by principals and other administrators

Quality Aligned Curriculum

Problems Prior to GMI	Successive changes in the System	Critical Elements of the System
<ul style="list-style-type: none"> ▪ Each school used a different mathematics curriculum and each teacher was basically “doing their own thing” ▪ Results of student learning assessments were not used to guide instruction ▪ Low expectations for students, especially Spanish-speaking students ▪ Deficit thinking ▪ Very low achievement 	<ul style="list-style-type: none"> ▪ Year 1 and 2 focused heavily on helping people at all levels of the system to align the state math standards, mathematics teaching and learning processes and the assessment of learning using formative and summative assessments and standards. ▪ Years 3-5 PD moved to site-based work with more emphasis on formative assessment, and teachers’ ability to learn about student understanding from student work and through a lesson 	<ul style="list-style-type: none"> ▪ Quality aligned math curricula that meets the needs of all students. ▪ High expectations for all students. ▪ High levels of student engagement (shown by classroom observations) ▪ Students engaged in generative learning and problem solving. ▪ Extensive math discourse in the classroom with teachers able to build on students’ multiple approaches to solving math problems. ▪ 2006 achievement scores for

<p>especially for students in SPED and ELL sub-groups and for middle school students, as low as 7% competency in math at 8th grade</p>	<p>study/unit study process</p> <ul style="list-style-type: none"> ▪ Implementation of a rich, rigorous curriculum with high expectations for all students to think and write about mathematics ▪ Integration and expansion of instructional strategies for ELL (K-8) and SPED education students (K-6) 	<p>ELL students K-8 equal or above the state average for all ELL students. Achievement scores for Special Education students in Grades K-6 equal or above state averages for all SPED students.</p>
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Administrative Support

Problems Prior to GMI	Successive changes in the System	Critical Elements of the System
<ul style="list-style-type: none"> ▪ Weak administrative structure with each principal doing his/her own thing ▪ Little professional development for administrators in instruction, assessment, and mathematics programs ▪ Principals needed support in how to monitor instruction and teacher collaboration ▪ No consistent time requirement for teacher collaboration 	<ul style="list-style-type: none"> ▪ Required professional development for all principals of 3 hours per month ▪ Top-down support and restructuring of the curriculum. Each district required to set core goals. For GISD, EPSS goals were focused on increasing 1) literacy and 2) mathematics abilities for all students ▪ Time required and processes developed for teaching and learning mathematics every day ▪ Monitoring of time and quality of instruction by evaluators, principals, central office administrators and math coaches (Math Process Trainers) 	<ul style="list-style-type: none"> ▪ All administrators supporting teachers in collaborating to provide a high quality mathematics curriculum ▪ All administrators monitoring time and quality of instruction as well as student achievement on a continuous basis.

Support from STEM/ Math Community

Problems Prior to GMI	Successive changes in the System	Critical Elements of the System
<ul style="list-style-type: none"> ▪ Teachers had low math skills and were uncomfortable without using a prescriptive mathematics program ▪ Little faith in students being able to answer and explain mathematics ▪ Teaching as telling rather than facilitating understanding ▪ Teachers could teach whole group or 	<ul style="list-style-type: none"> ▪ Professional development including learning more mathematics for teachers and principals as well as how to teach and learn mathematics ▪ Mathematicians from the university partnered with educators to support teacher math learning ▪ Math summer academies offered ▪ Masters programs in teaching math paid by the teachers ▪ Modeling of Lessons ▪ End of year math competencies 	<ul style="list-style-type: none"> ▪ Mathematicians working with educators to plan and implement professional development and support lesson or unit study ▪ Use of coaches with high levels of ability to teach mathematics ▪ Some use of technology for learning mathematics (games and computer-based activities as part of Investigations) ▪ Some web-based and math programs

individuals but didn't know how to support math discourse	for secondary students developed with mathematicians	
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TRAINING OPPORTUNITIES AND OUTREACH ACTIVITIES

The GMI staff and partners are committed to sharing the success of the project and assist other districts in their mathematics reform efforts. As part of the GMI outreach, the staff has presented the GMI model to various audiences including the following:

- the New Mexico Council of Teachers of Mathematics Conferences (2005-2007);
- AERA (Montreal, 2006);
- National Council of Supervisors of Mathematics Conference (Philadelphia, 2005 and Atlanta, 2007);
- New Mexico Town Hall Meeting, (2004)
- New Mexico Public Education Bureau for Mathematics and Science (2007)
- New Mexico Legislative Education Study Council (2007)
- Cheryl Coyle (GMI Coordinator) now serves on the K-12 Advisory Committee for Mathematics for the New Mexico State Public Education's Mathematics and Science Bureau and is assisting in the development of an initiative called 2012 which is attempting to reverse the low student achievement in math and science in New Mexico through promising research-based practices.
- Wanda Guzman (GMI PI) now serves as project director and Co-PI is the federally funded Math Science Partnership project (Mathematically Connected Communities) and is helping to disseminate the GMI model to 25 other districts throughout New Mexico.

The GMI staff has also provided numerous workshops in standards-based instruction to districts across New Mexico.

CONTRIBUTIONS

The GMI project provided a unique opportunity to study a whole district in-depth as it adopted and implemented a new standards-based mathematics program across all schools from Kindergarten -8th grade. Through a process of continuous study and feedback by the cohesive district/university team working on the Gadsden Mathematics Initiative a district site-based approach for systemic change in mathematics teaching and learning evolved that provided a promising approach to improving achievement for all students. The model soon became known as the “Gadsden Model” and was introduced to the state through a state-wide Town Hall held in 2004. The model clearly identifies elements of change that are needed to move a district toward quality mathematics alignment, teaching, and administrative support. This “building capacity model” has most recently served as the basis for a new NSF research grant in a neighboring district (SUMA, September 2007, NSF #0733690). The Scaling Up Mathematics Achievement (SUMA) project is part of a university-wide STEM Success Alliance to improve K-12 education in science, technology, engineering, and mathematics.

b) Observations of student learning within classrooms. While this grant began as a professional development grant to help teachers implement new standards-based curricula in their classrooms because of the addition of the requirement for a student outcomes study a systematic effort was made to closely observe mathematics learning in classrooms. From these observational findings the GMI researchers began to develop a clear picture of the strengths and weaknesses of the

implementation of the new mathematics program in terms of student learning and challenges for teachers and administrators. The findings confirm that it is necessary to have both a rich curriculum and a standards-based learning environment for students to increase their achievement. A curriculum by itself without changes in standards-based classroom learning environments and schools will have little effect on achievement (Tarr et.al, 2008)

c) Administrative instructional support emerged as a critical component during the Gadsden Mathematics Initiative. Principals received training along with their teachers. This result influenced the state Math and Science Partnership (MSP) project, Mathematically Connected Communities to work only with whole district partners. Previous projects that had pulled in teachers for summer academies without working with the district administration had not shown success in sustainable achievement. In contrast the Gadsden Independent School District continued to sustain gains even after the end of the GMI project. Additional support was also provided in the form of full-time mathematics process trainers (MPTs) administrators who facilitated teacher collaborative implementation on standards-based instruction in schools. The district has now hired MPTs for the high schools because of the success they found in providing a mathematics specialist at each K-8 school site.

d) One of the unique and powerful aspects of this project was that as a result of true university and public school collaboration the Gadsden Mathematics Initiative was able to combine the practical wisdom of experienced practitioners with the expertise of university mathematics educators and researchers. The GMI project was in fact an early experiment in building expertise and sustainability within a district so that the university, while continuing to be a partner in professional development, would no longer be needed to sustain the project. In fact, Yvonne Lozano, Associate Superintendent in the district, and Karin Wiburg, university researcher for the Student Outcomes Study wrote a chapter in a book that outlined how a district and a university could work together to create sustainable change.(Wiburg & Lozano, 2001)

e) The structure of GMI required intensive professional development especially in the first two years, this required collaboration across the state.

Contributions to Human Resource Development

The GMI project made a change in how teacher professional development is approached in a district. The aim of the PD in Gadsden became how to mentor teachers so they can then work as mentors in their own schools thus adding a strong structure for continued professional groups by teachers. This is demonstrated by some of the teachers from this rural and poor district actually were able to move into coaching and professional development positions. The Gadsden MPTs are now being hired directly by other districts in New Mexico to help with mathematics professional development. While they are developing as mathematics leaders we are also learning a great deal from them related to how district-wide implementation can be understood and improved. The nature of this partnership project between the district and the university will build new structures in which schools will work collaboratively with teacher educators at the university to improve teacher preparation. There is continued collaboration between the district and the university. The university currently has a lab school in the district that supports teacher candidates in learning how to teach English Language Learners and is currently working with the district to build 21st century communities of learning for after-school services for underserved students and families.

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