

# Los Alamos National Laboratory

## Northern New Mexico Math and Science Academy

### History of MSA Activities 2000 to 2009 and Summary Evaluation Report for School Years 2006-2009

#### Introduction

The following is the MSA Evaluation Report spanning the school years (SY) between 2006-07, 2007-08, and 2008-09. The report also chronicles the activities of MSA from its beginnings in June of 2000 to the present, October 2009.

This Report documents the Framework, goals, performance, activities and the challenges of the Los Alamos National Laboratory Northern New Mexico Math and Science Academy (LANL-MSA) from its last external evaluation (delivered January 2007) to the present. The last formal MSA external evaluation was conducted by Ellen Osmundson and Joan Herman from the University of California, Los Angeles/National Center for Research on Evaluation, Standards, and Student Testing (UCLA/CRESST): *Math and Science Academy Year 6 Final Evaluation Report\** (Completed 2007).

The National Center for Research on Evaluation, Standards, and Student Testing and MSA's evaluation goals for the first three yearly external evaluations were designed to describe how the program was implemented, to assess the program's effects on teachers and students and to generate recommendations for the improvement and enhancement of the project.

- How was the program implemented?
- What were program effects on mentors, teachers, students and parents?
- How and in what ways did district administrative policies impact program implementation?
- How can the program be enhanced or improved?

Year 4 of the MSA evaluation included the same research questions as the previous evaluation years with the addition of a number of other questions designed to enhance and strengthen MSA program delivery. The following research questions were examined during Year 4:

- How did the MSA program evolve?
- What was the effect of MSA on teaching and learning?
- How can the program be refined and sustained?

Year 5 Evaluation added new research questions:

- How effective is the "scale-up" model [for] MSA?
- How does the cognitive coaching model function as a tool for professional development?
- How can the program to be refined to better support and enhance teacher professional development, administrative leadership, and student learning and achievement?

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\*Note: UCLA/CRESST Year 1-6 MSA Evaluation Reports can be accessed at <http://www.lanl.gov/education/teachers/mathsci.shtml>

The Year 6 Evaluation focused on program implementation, program effects on teachers and students, and the generation of suggestions and recommendations for the improvement and enhancement of the program.

- How does the refined cognitive coaching model work and how effective was it?
- How effective was the “scale-up” model of MSA?

Since the last CRESST evaluation for SY 2005-2006, MSA, through its partnership with the Los Alamos National Laboratory Foundation, selected a new evaluation vendor, but ultimately the arrangement was not well suited for either party and was mutually dissolved in November of 2008. In the first quarter of 2009, MSA through the LANLF issued a new call for external evaluators. In August 2009, Kokopelli Associates LLC of Santa Fe, New Mexico was selected as the new MSA external evaluator for SY 2009-2010.

Again, the intent of this bridge report is to describe, explain, and otherwise remark on MSA’s goals, activities, challenges, and performance from the last external evaluation by UCLA/CRESST to the present. But first a brief description of MSA’s framework and programs as extracted from the collective memories of the MSA master teachers and the Year 1-6 external evaluation by CRESST in order to set the background for this report. The program’s progress for Years 7, 8, and 9 are then described. Finally, the MSA’s internal evaluation scheme is described and documented with relevant New Mexico Standards-Based Assessment student data by district.

### ***MSA Framework, Partnerships, and Core Programs, Supporting Programs, and CRESST Evaluations***

#### **MSA Framework**

The MSA program is structured around the idea of standards-based education, which means that student learning is the focus of formal education. This is not to suggest that teaching is second to student learning, it means that the central idea of schools is to guarantee that students learn and not simply to guarantee a place where teachers teach. This is a seismic cultural shift from the norm of teachers teaching in isolated classrooms. The shift from “I taught it.” to “Did they get it?” And, ““If they didn’t get it,’ what do we do next as a department, as a school, and as a district?” “How do we intervene?” And, ““If they did get,’ what do we do then?”

Given the above, the MSA program seeks to use effective teacher professional development to improve educational practices to improve teacher quality that positively affect student achievement and learning. The program includes instruction in research-based best practices, support in the classrooms during the school year through math coaching, regularly scheduled professional development days and weekends, and structured time for collaboration among teachers.

The MSA staff develops, delivers, and coordinates all the instruction and follow-up in the classrooms as well as professional development days and weekends that make up the MSA model of professional development. The program uses MSA Summer Institutes in standards-based education and mathematics, four half-day professional development sessions during the school year, two MSA Days at the end of each semester in December and May, and weekend institutes during the school year to delivery professional development experiences for both teachers and principals.

## *The Management Plan and Partnerships*

### **Management Plan**

The Math and Science Academy is a formal program sponsored by Los Alamos National Laboratory (LANL) and its partners and operates under the direction of the fifteen member MSA Leadership Team, which includes senior education leaders from MSA school districts, the Northern New Mexico Regional Quality Center Director, LANL's MSA Master Teachers and other Laboratory senior education program leaders, the LANL Foundation CEO and other program managers, the Dean of the College of Education at Northern New Mexico College and a senior manager of the New Mexico Public Education Department Math and Science Bureau.

Project Management is ensured through the coordinating efforts of LANL's Education and Postdoc Office Program Manager who provides overall MSA program oversight as well as the review and approval of all program expenditures in concert with our fiscal agents, Northern New Mexico College and the LANL Foundation. To ensure a quality professional development program for all teachers and principals, the three MSA Master Teachers develop and conduct the three-week standards-based MSA Summer Institute education program based on NMNM-QMSEM and the PED-PD Framework as well as best practices strategies and models like Marzano's *Classroom Instruction That Works: Research-Based Strategies for Increasing Student Achievement*.

The completion of the program by all participants is assured through a three-year memorandum of understanding between MSA and the cooperating districts when they apply to MSA.

Districts requesting professional development are required to send principals with the school unit team of teachers to the MSA Summer Institutes to ensure that participants are fully informed and focused on the reform mathematics and that the science curricula and communications and follow-up observations among all stakeholders and the district leadership are effective and continuous. All of the above is managed under a system-wide professional development and implementation plan that is aligned with National Staff Development Council. Reporting responsibilities are handled by MSA Master Teachers.

### **Partnerships**

The Math and Science Academy program incorporates collaborative partnerships with several Northern New Mexico organizations. These include Los Alamos National Laboratory (LANL) that provides the overall sponsorship and day-to-day administration of MSA in close cooperation with the participating school districts and other partners. Los Alamos National Laboratory's contract manager Los Alamos National Security LLC (LANS) provides supporting funding for MSA via its Community Commitment Plan. The New Mexico Legislature and the New Mexico Public Education Department Math and Science Bureau are additional funding partners. The Mathematically Connected Communities (MC<sup>2</sup>) initiative sponsored by New Mexico State University (NMSU) complements and supports the Mathematics Excellence in Española (ME2) initiative and provides funding for one 6<sup>th</sup>-8<sup>th</sup> Española Public Schools (EPS) math coach. Additional close partnerships with NMSU, UNM, and NNMC provide additional mathematics and pedagogy expertise that is integrated into the MSA Summer Institute and school year

programs. Several private sector firms including IBM, Microsoft, Efinity Networks and Chevron provide supporting equipment or funding for the MSA program. In addition, MSA partners with other current participating MSA school districts including Chama, Taos, and Pojoaque. The Santa Fe School District sent a replication team to observe the 2009 MSA Summer Institute. The Math and Science Academy also partners with the National Science Resources Center in Washington (NSRC).

In April 2007, LANL/MSA and the National Science Resources Center conducted a national symposium for scientists and engineers with the goal to increase the public understanding of what is needed to establish effective K-20 science programs in districts and states. In the recent past, the Center assisted with the planning and launch of the new 2009 MSA Inquiry Science Initiative pilot program.

Strategic and tactical guidance and oversight of the MSA program is provided by the fifteen member MSA Leadership Team that meets monthly in the MSA Española offices; this group provides strategic and tactical direction consistent with the MSA Strategic Plan 2008-2012 and monitors progress against its documented goals and action plans which are updated frequently to incorporate new initiatives, the changing funding environment and evolving new pedagogical innovations.

### ***Core Programs***

*MSA teachers are expected to spend at least 200 hours over contract per year in training or collaboration through several venues, i.e., Summer Institutes, MathCitement, Yahoo! Groups©, MSA Days, Celebrations of Learning, and biweekly MSA Meetings.*

### **MSA Summer Institute**

The three-year MSA program for teachers starts in the summer with an intense three-week MSA Summer Institute, which is divided into 2 weeks of standards-based education instruction and 1 week of math content and pedagogy instruction.

The MSA Summer Institutes are the core of MSA instruction. This is where the MSA Master teachers have a continuous, concentrated period of time to deliver the content and pedagogical methods without interruption. In effect, MSA professional development is about changing teachers' personal epistemologies through the delivery of standards-based education practices, mathematics content, and neuroscientific research that applies to the classroom. As evidence of the transformational change that takes place after three years of MSA instruction, we offer the following quote from a third year kindergarten teacher:

*The last 3 years of MSA have afforded me a different perspective. I see assessments as a vital instrument for learning not only for myself but for the student as well....*

*Knowing and understanding that education has an emotional tag helps me see learning without my rose colored glasses.*

*Setting purposeful learning goals, making reflection an important part of learning will be priority. Collaboration across grade levels is vital, the need to know what is expected so that teaching occurs. The fundamentals of math, the deep thinking and processing, learning the steps in solving problems for better understanding so that I may teach it. I am learning to*

*write, it takes an enormous amount of effort, but I realize that it is a "Must Do."*

Summer Institute sessions are scheduled between June and July:

- MSA Summer Institutes – June-July
  - K-12, Three two-week sessions for 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> year Cohorts
- Principals' Summer Institute – June
  - K-8, One two-week session
- MathCitement – June-July
  - K-5<sup>th</sup> and 6<sup>th</sup> - 8<sup>th</sup>, Three one-week sessions
  - 9<sup>th</sup> – 12<sup>th</sup> One-week. High school mathematics teachers attend the South Valley Academy, Albuquerque or NMSU Mathematically Connected Communities (MC<sup>2</sup>), Las Vegas or NMSU, Las Cruces.

Further, MSA is explicitly focused on reform mathematics content that aligns with New Mexico Mathematics Content Standards, Benchmarks, and Performance Standards in math as well as science:

- MSA Summer Institutes devote a full week to math content and pedagogy instruction delivered by professors from the University of New Mexico (UNM) and New Mexico State University (NMSU), who focus on New Mexico Mathematics Content Standards and Math Process Standards through a National Science Foundation reform curriculum, i.e., *Investigations in Mathematics* (K5), *Connected Math Project* (6th-8th), and *Interactive Math Project* (9th-12th).
- First, Second, and Third Year Summer Institutes also focus on developing concept statements and essential questions from the performance standards at grade level, which then become integrated into the districts' mathematics curriculum. Summer Institute topics include:
  - Standards-Based Education, which focuses on curriculum and learning goals developed from New Mexico Standards, assessments aligned to learning goals, and instruction designed to help students meet standards and increase learning and achievement.
  - Math and Science Content and Pedagogy, which focuses on New Mexico Mathematics Content Standards with special emphasis on Math Process Standards.
  - Cognitive Coaching Training.
  - Technology as a tool for content delivery, thinking, learning, knowing, and creating, as well as, a tool for collecting, organizing, and analyzing data to inform practice and decision-making about student learning as well as teacher and principal professional learning.
  - Classroom Management, which creates a positive, safe and effective learning environment.
  - Collaboration in Professional Learning Communities, which includes the development of team norms, vision, mission, goals, values, common assessments, and timelines.

- Brain-based research that connects to classroom practice and promotes the teachers understanding of emotions and cognition as they both relate to thinking and understanding mathematics and science content.
- The connection of mathematical concepts through writing and multiple forms of representation to mathematical properties, and specifically, the NM Math Process Standards, is also emphasized in MSA’s instructional program to better assist teachers in understanding mathematical ideas, procedures, and communication of mathematical ideas. Further, journaling and note booking are an integral component of the new Inquiry Science Pilot Project’s curriculum and used to promote and develop scientific thinking, reasoning, and communicating scientific ideas, processes, and procedures.

### **MathCitement**

The New Mexico Mathematics and Science Content Standards have received high marks and praise for their relevance and rigor. However, our students need a tremendous amount of support and quality teachers in the classroom to meet our highly acclaimed math and science content standard. Our students’ mediocre achievement and proficiency levels on both national and state assessment instruments evidence the need. These mediocre scores call for a viable and sustained teacher professional development program in mathematics and science situated in Northern New Mexico. This need is obvious in light of our 4th and 8th grade students’ less than average performance on the National Educational Assessment Progress. Both math and science score show only slight improvement between 1992-2007.

The third week of the two-week MSA Summer Institute, MathCitement, one-week of math content instruction, began as a one-week stand-alone at the end of the 2004 Summer Institute.

As the MSA master teachers moved through the various math classrooms, it quickly became obvious that the students’ absence of mathematical understanding and lack of fluency with number was directly related to the teacher’s understanding of mathematics and pedagogy. Consequently the stand-alone MathCitement Week of August 2004 became a staple of the MSA professional development program the summer of 2005.

### **Asynchronous Internet-Based MSA Communication**

In addition to all the above, MSA teachers from all sites collaborate online and use technology as a way to enhance learning. MSA encourages teachers asynchronous collaboration across time and space through the [free] web-based “**Yahoo! Groups**”, community-driven Internet communication tool.” During the school year, teachers respond to timely posting of education articles and each other’s reflections and thoughts about current educational issue that relate to assessment, instruction, and curriculum.

### **MSA Days**

MSA teachers also have a chance to meet twice during the school year to strengthen inter and intra-district bonds and share the reflective portfolios they have

created during the current semester or over the course of the entire school year. This time reinforces the MSA teachers' commitment to MSA principles as well as celebrates their individual accomplishments. For example, the NMSU/MSA Master of Art in Teaching Mathematics and Science graduates are given a venue to present their action research projects. This day is a time to exchange instructional ideas and reflect on practice. Below are a couple of postings by three MSA teachers' after the end of school MSA Day in May 2009:

#### Reflection 1

*I thought the MSA DAY was fantastic and very significant day for all of us who are advocates of the Math Investigations Program. It was great and full of new learning experiences from the voices of the MSA Cohorts graduates, who shared their thoughts about their action research. I was really touched about the strong determination, hard work exerted by our MSA benefactors to make the program a reality to help the students of Northern New Mexico improve student learning.*

#### Reflection 2

*The last MSA Day was the best for me...the new venue...was just perfect place for that kind of activity. I learned a lot from the graduates' research presentations...This year's action research was more informative and comprehensive.*

*I really admire the people who spent their time, effort, knowledge, and expertise in making this magnificent program. Personally, MSA help me lot to become a more efficient and effective teacher, and help me discover myself on what I can give to my learners.*

#### Reflection 3

*The MSA Day was great this year. The research topics really made me think. I left feeling inspired. I thought about how research methods should be used all the time in our teaching. We should be looking in detail about what works and why it works. It is easy to get into comfortable routines when we teach the same grade year after year.*

MSA Days are scheduled on a Saturday toward the end of each semester, December and May, respectively.

### **Celebration of Learning**

MSA requires faculty at participating sites to hold two school-wide Celebration of Learning events for parents. These events give students an opportunity to explain to family members what they are learning and doing in school.

### **Biweekly MSA Teachers**

Biweekly MSA Teacher Team Meetings focused on defining learning goals developed from standards, developing common assessments based on standards, looking at student work, and gathering and analyzing data

## ***Supporting MSA Programs***

*Two programs that directly support and enhance the MSA Core Program are the Ir-Rational Number Institute and the NMSU/MSA Master of Arts in Teaching Mathematics and Science.*

### **The MSA Ir-Rational Number Institutes**

The Ir-rational Number Institute gets its name from a combination of the Irrational and Rational Number Systems, two number systems of the Real Number System. The idea behind The Ir-Rational Number Institute 3-weekend sessions is to create mathematics learning opportunities beyond the established mathematics curriculum for MSA teachers as well as other non-MSA teachers of mathematics. As our teachers come to understand the reform elementary mathematics programs as concept-based curricula, the subsequent professional development sessions must inherently carry relevant and substantive mathematics. Professional development must add to the teacher's profound understanding of mathematical concepts and teaching. Otherwise, the teacher becomes a rhetorical figure teaching to a passive classroom of students who struggle to understand the images, concepts, facts, language, and procedures that govern mathematics.

The first Ir-Rational Number Institute (Spring Semester 2009) introduced 29 Española Public School K-12 MSA and Non-MSA teachers to alternatives other than part/whole fraction instruction. Fractions are hard to learn and they are equally hard to teach, especially if the teachers lack the conceptual understanding of the Rational and Irrational Number Systems.

The second Ir-Rational Number Institute (Fall Semester 2009) focused on number theory and algebra as generalized arithmetic. Other than the value of teachers being instructed by a university professor whose life's work is mathematics and improving the quality of teacher mathematical knowledge, there is also a social and educational value in K-12 teachers of mathematics from the same district coming together to talk about mathematics. The 3<sup>rd</sup> Ir-Rational Number Institute is scheduled for February, March, and April of 2010.

### **NMSU/MSA Master of Arts in Teaching Mathematics and Science**

The Master of Arts in Teaching Mathematics and Science degree program was introduced in 2005 to provide rural northern New Mexico MSA teachers an optional opportunity to obtain a Masters degree through a partnership between MSA and New Mexico State University. It is based on principles drawn from the research on quality teacher development, building achievement in mathematics and science, and facilitating increased access to high quality mathematics and science learning opportunities. The following principles are adhered to as the foundational elements.

1. The most important influence on student learning in the classroom is the teacher; therefore, it is the goal of the Masters of Arts in Teaching to build the educational and professional capacity of the northern New Mexico classroom teacher.

2. The best teacher professional development and courses are centered on learning through reflective and collaborative practice, which results in student learning.
3. Quality mathematics and science teaching is based on a combination of strong content knowledge and related pedagogical knowledge. Higher education faculty worked with mathematics and science educators to assist teachers in building strong pedagogical content knowledge.
4. Building mathematics and science achievement in schools is based on alignment between what students need to learn, what teachers teach, what is being assessed, and the implementation of a research-based school-wide curriculum by administrators and teachers.
5. Learning about teaching is a process of combining theory and practice in authentic classroom settings where increasing student learning is the focus of practice. Theory needs to inform practice and practice needs to inform and modify theory.
6. The Masters of Arts in Teaching program combines learning content with learning about educational theory and practice.
7. Facilitating increased achievement for students in mathematics and science is impossible for one teacher alone but only through strategic partnerships between school administrators and teachers, teacher educators, and content specialists. Courses in this program will include opportunities for collaboration by school-based groups of teachers and administrators facilitated by LANL educational staff. More details about the MAT's teacher graduation levels are given in the History and Evaluation section below.

### **Professional Doctorate (Proposed)**

The Math and Science Academy is advocating and nurturing the establishment of a professional doctorate program and partnership between MSA and a New Mexico university; specifically, the establishment of a new education leadership degree for the development of scholarly principals.

Presently, Española Public School's leadership situation is of concern because 6 of 12 principals in the district are *return-to-work* educators and 80% of the central administration personnel are of retirement age. Obviously the district is in a precarious situation with regard to instructional and central administration leadership—a significant number of leadership personnel can retire at any time or on any given day.

It is critical to the future success of our Northern New Mexico K-12 schools to have experienced, knowledgeable leaders at the helm of individual school units and school districts. We are in need of leaders who can effectively use their classroom and academic experiences along with powerful assessment programs, comprehensive and timely student data, the most current educational research on teaching and learning, and a well-informed and professionally developed faculty to build effective academic programs that positively shape student learning and achievement.

New Mexico is in need of individuals with the leadership skills and educational knowledge required to lead a school unit or school district in continuous improvement. We are in need of leaders who will create a school culture where students are successful. Where students are able to choose their own career destinies and choices and shape their

own opportunities, as opposed to succumbing to fatalistic world-views with regard to life's choices because of a limiting K-12 education.

It is imperative to the future success and lives of our students to establish an education leadership program that will increase the number of effective K-12 leaders for Northern New Mexico who are good stewards and scholars of the field.

### ***A Brief History of MSA from Inception to the Year 6 Evaluation and Beyond to Years 7, 8, and 9***

The Math and Science Academy is in its 10<sup>th</sup> year of working along side five Northern New Mexico school districts and partnering with community organizations and New Mexico higher education institutions to deliver its unique educator professional development program. But its meager beginnings were in the summer of 2000.

The Los Alamos National Laboratory (LANL) in partnership with area superintendents, community organizations, businesses, and some state higher education institutions, created MSA to operate in a school district as a school-approved professional development program with the intent to assist school districts improve teacher quality and educational leadership, which directly impact student learning and achievement in mathematics and science.

The MSA program has gradually evolved since its inception in the summer of 2000 when 12 middle school teachers from three middle schools from the Chama Valley Independent Schools, the Española Public Schools, and the Mora Independent Schools joined the young program and its two MSA Master Teachers in the first two-week MSA Summer Institute. Today, MSA continues its significantly expanded partnership with the Española, Chama, Taos, and Pojoaque school districts, with a primary current focus upon expanded reform mathematics initiatives with the Española district. After completing its four year reform math partnership with Chama and Mora in 2007, MSA, NMSU's Mathematically Connected Communities, and Northern New Mexico Network For Rural Education formed a new partnership to plan and deliver a K-12 reform curricula and corresponding professional development opportunities for all K-12 Española Public School teachers of mathematics (See Appendix C for ME2 Flow Chart). The Network opted out of the reform mathematics agreement after the first year but continued as the coordinator of an educational leadership component for the district. With the introduction of MSA's new Inquiry Science Initiative pilot program in 2009, Chama, Taos, and Española began another new MSA curriculum expansion journey that may lead to expanded inquiry-science programs in those and potentially other northern NM districts in the future.

#### **Year 1 (July 2000 – May 2001)**

##### ***1<sup>st</sup> Summer Institute (July 2000)***

At the onset of the MSA program, the selection of the participating K-12 schools was based on a competitive application process. Initially, the goal of MSA, as envisioned by its creators, was to fashion a middle school thematic curriculum combining mathematics, science, social studies, and language arts content from the existing districts' curricula, instruct teachers on its use, and follow up throughout the year with regular classroom observations and modeling by the MSA Master Teachers. Also, another "reason for focusing MSA on middle school teachers was that expansion could take

place in either direction – toward high school or toward elementary” (MSA 4<sup>th</sup> Year Report, P. 1). In addition, MSA was to provide:

*[Middle School] teachers with access to rich professional development sessions to increase content and pedagogical knowledge; stimulating teachers to consider how well their instruction is preparing students for high school academics and how it can better do so; providing tools and conceptual structures for content area instruction that can be integrated directly into classroom teaching and learning practices; and providing students with opportunities to engage in high quality science, math, social studies and language arts learning experiences (Osmundson & Herman, September 2001, p. 3).*

However, within 6 months the Master Teacher team was down to only one Master Teacher—another MSA Master Teacher was hired three months later.

Although the 2000 Summer Institute had been dedicated to developing collaboration among teacher teams, a thematic unit, cooperative learning strategies, and standards-based instruction, “This original MSA model was somewhat vague, without a clearly articulated program ‘it’. Left unspecified were how the development and use of thematic units would ultimately serve to improve teaching and learning in the MSA schools” (Osmundson & Herman, September 2001, p. 8).

## **Year 2 (SY August 2001– May 2002)** **2<sup>nd</sup> Summer Institute (June – July 2001)**

In Year 2, the 2001-2002 school year, MSA expanded to 23 teachers. The Summer Institute content remained mathematics, science, social studies, and language arts. “Of particular importance was the implementation of a practice known as “cognitive coaching”, a research-based approach to mentoring and professional development that guided mentors in their work and interactions with teachers and administrators (Costa & Garmston, 1994)” (Osmundson & Herman, September 2003, p. 8).

It was gradually becoming clear that MSA’s targeting of middle school teachers to halt the high drop out rate in 9th grade and “to allow teachers adequate time to help their students develop the knowledge, interest and enthusiasm to enroll in challenging high school classes” (Osmundson & Herman, 2001, p. 3) might have been misplaced. It was not aligned with the reality of the root cause of the situation, i.e., high dropout rate at 9th grade and low students’ achievement scores in mathematics and science. It seemed the problem was not at the middle school entirely.

## **Year 3 (SY August 2002 – May 2003)** **3<sup>rd</sup> Summer Institute (June – July 2002)**

Twenty-three teachers from three districts participated in Year 3 of the program. The twenty-three teachers represent four middle schools: two schools were 6th – 8th grade, one school was 7th grade only, and one school was 8th grade only.

“Years 1-3 of the project primary focused primary was on middle school teachers (22) and students in an effort to assist students gain the knowledge and skills necessary to participate in challenging high school classes” (Osmundson & Herman, September 2003).

Twenty-three teachers participated fully in Year 3. The MSA program now had nine 3<sup>rd</sup> Year teachers, eight 2<sup>nd</sup> Year teachers and six 1<sup>st</sup> Year teachers.

“In the summer of 2002, mentors prepared and facilitated two Summer Institutes: one institute—the Leadership Institute—was dedicated to MSA administrators, and the other institute focused on MSA teachers” (Osmundson & Herman, 2003, p. 9). The MSA team continued to use and refine the cognitive coaching model with its accompanying protocol.

Year 3 was an important year for MSA funding. Representative Jeanette Wallace, Senator Richard Martinez and Representative Nick Salazar successfully worked for legislative funding for MSA. This year marks the first year that MSA was successful in its quest for legislative funding for its professional development efforts. As a result of this allotment, MSA was able to more than double the number of MSA teachers from 22 to 53 in Year 4 of the project.

#### **Year 4 (SY August 2003 – May 2004)**

##### ***4th Summer Institute (June – July 2003)***

Year 4 of the MSA project saw an increase in the number of schools, school districts, teachers, and MSA mentors: 9 schools in 4 districts, and 53 teachers. Also, a third MSA Master Teacher was added in April 2003 to the MSA team. “As the project has grown, program goals have been refined and more clearly articulated, and MSA members (teachers and master teachers) have become more savvy and sophisticated in understanding the ways in which to maximize project impact.” (Osmundson & Herman, March 2004, p. 2). In addition, methods and protocols were developed to increase implementation of project goals and better support teachers, administrators, and schools. Teachers were observed and cognitive coached by MSA Master Teachers at least six times per year.

It was becoming increasingly apparent that the focus of MSA should turn to the teacher, the school administrator, and the elementary grade levels and not the student. As the MSA team circulated through the various classrooms, it was evident that the teacher was the one element in the classroom that determined the students’ learning and achievement levels. It was also becoming increasingly clear that the unit administrator exerts great influence on student learning and achievement through school policies and day-to-day decisions. Finally, it is obvious that three mentors could not affect the learning and achievement of scores of students when the common denominator is the quality of the teacher in the classroom. The focus had to be on improving the quality of the teacher in math content and pedagogy as well as informing the school administrator in the finer aspects of reform mathematics and the observation of it.

So a mathematics workshop for all MSA teachers regardless of content area specialty was initiated—3<sup>rd</sup> to 5<sup>th</sup> grade teacher were instructed in the use of the AIMS curriculum that relies heavily on mathematics manipulatives. The 6<sup>th</sup> – 9<sup>th</sup> grade teachers were instructed by a university professor of mathematics in the NCTM *Navigating Through Algebra in Grades 6-8 Series*. This was the beginning of the MSA MathCitement Week. The MathCitement weekend was eventually added to all future MSA Summer Institutes as the third MSA Summer Institute week.

**Year 5 (SY August 2004 – May 2005)**  
***5<sup>th</sup> Summer Institute (June – July 2004)***

Year 5 was a pivotal year for MSA because of the realization that the problem was systemic and not localized at the 7th grade as initially thought, the program expanded to include two high schools, five middle schools, and ten elementary schools in Year 5.

“The focus for MSA Year 5 continued to be refinement of instructional strategies, collaboration among teachers and more instruction in formative assessment of student learning as well as mentor modeling and exploring way to improve upon the cognitive coaching model” (Osmundson & Herman, 2006). The newly administered statewide criterion-reference test, the New Mexico Standards-based Assessment (NMSBA), however, exposed discerning information confirming what the MSA Master Teachers were witnessing in the classrooms.

After reviewing, the 2004-2005 NMSBA Schools Proficiency and Above Percentage 3rd - 9th grades (Average 16.8) as compared to the 2005 New Mexico Percentage Proficient for Annual Yearly Progress (AYP) grades 3rd – 9th (Average 16.14) for all 5 districts and 17 schools, it was clear that a change in MSA strategy was necessary (See Appendix A for AYP Target Goals). Even though MSA schools were outperforming non-MSA schools at the 3rd – 5th grade levels, 6th – 9th grade level were identical to or slightly below non-MSA schools and still the difference was not statistical significance (Osmundson & Herman, 2006),

Specifically, some of the problem may rest in the preservice preparation of teachers by postsecondary institutions “where meaning was not a primary goal of learning, where rote learning of algorithms and procedures was not only acceptable but mandatory” (Armstrong & Bezuk, 1995, p. 87). Masingila (1998) agrees, “I find that many prospective teachers do not conceptually understand or know division by fractions even though they have already completed at least a bachelor’s degree in mathematics” (p. 3).

Further, survey results for New Mexico in the 1992, 1996, and 2000 National Association of Educational Progress (NAEP) confirmed the above statement by Armstrong, and Bezuk. The NAEP put forth the following question to New Mexico 4th and 8th graders: “How much do you agree with the statement, ‘Learning mathematics is mostly memorizing facts?’” Sixty-one percent, 60%, and 59% of New Mexico fourth-grade students taking the national survey, respectively, reported that they agreed, while 13%, 16%, and 17%, respectively, disagreed (National Assessment of Educational Progress, July 2001). Hence the problem is not only at the elementary level but a systemic problem, that is, PreK-20.

As a consequence of the depressed student achievement scores, MSA invited four math content specialists as instructors for MathCitement. These specialists, Dr. Rick Kitchen (UNM), Dr. Kathy Kinzer (NMSU), Susan Benjamin (NM Teacher of the Year 2002) and Rose Martin (Los Alamos Public Schools) taught MSA teachers the use of patterns, manipulatives, processes and language in the math classroom.

**Year 6 (SY August 2005 – May 2006)**  
***6<sup>th</sup> Summer Institute (June – July 2005)***

Year 6 continued with the impetus created in Years 4 and 5, “Twenty-two schools and their administrators, 80 teachers... participated in MSA during the 2005-2006 school

year” (Osmundson & Herman, 2007, p. 3).

As in previous years’ evaluation, the Year 6 evaluation plan employed a multi-faceted approach to understand and assess the MSA program. The MSA Master Teachers’ thinking, perceptions of progress and challenges of the program were gathered through monthly telephone conferences and program documents. Teacher and administrator data was collected through surveys, and NMSBA student data for SY 2005-2006 was compared to the corresponding 2004-2005.

In the spring of 2006, another coach was added to the team. The three MSA Master Teachers were still solely responsible for the management, development, and delivery of the MSA program and Summer Institutes, however. The 4th coach’s central responsibility was cognitive coaching of the increased number of participating MSA teachers between Year 4 and Year 6. As mentioned above, the program now had 80 fully participating teachers.

School Year 2005-2006 saw the addition of an Informal Observation Checklist (IOC) as a method for measuring the implementation of MSA’s professional development strategies and goals. The new IOC collected data on the quality and level of implementation of MSA’s project goals and focus areas: planning, collaboration, standards-based instruction, assessment, technology, and classroom management.

Also in order to sustain the addition of the MathCitement week added the summer of 2004, a partnership with New Mexico State University (NMSU), College of Education, Department of Curriculum and Instruction was fashioned. The partnership with NMSU brought a Master of Arts in Teaching Mathematics and Science (MAT) to the doorstep of the MSA teacher. A member of the MSA Master Teacher team was appointed as professor of record for 18-credits of the 33-credit program. Consequently, the MSA Summer Institute became a core element of the NMSU Master of Arts in Teaching Mathematics and Science.

Initially, 45 teachers matriculated into the program, in the end, however, 29 teachers completed the 2-½ year program in 2007 (See Table 1, below, for Cohort I Participants by school district and grade level). The 33-credit hour graduate program is unique because of its structure, delivery, and funding: 1) Half of the credits hours were delivered on line by NMSU instructors, and the other half of the program were delivered face-to-face on the Española Public School’s campus as part of the MSA Summer Institutes and MathCitement weeks for the next three summers. 2) The program was part of a contractual agreement between NMSU and the Los Alamos National Laboratory Foundation whereby MSA paid the teachers’ tuition costs upfront through regular installments to NMSU and then collected monthly payments from the teachers to recoup the tuition costs.

Table 1. 2005-2007 NMSU/MSA Cohort 1 Participants/Graduates According to School District and Grade Level.				
School District	Elementary School	Middle School	High School	Totals
Chama Valley Independent Schools	2	2	0	4
Española Public Schools	4	5	0	9
Mora Independent Schools	4	2	1	8
Pojoaque Valley Schools	1	3	0	4
Taos Municipal Schools	6	0	0	6
<b>Totals</b>	<b>17</b>	<b>11</b>	<b>1</b>	<b>29</b>

3) In addition, because a MSA team member was the professor of record and a salaried employee of Los Alamos National Laboratory, the tuition was half the regular cost of an on campus MAT program. 4) MSA also supported the teachers with mathematics tutors and purchased of all books as well as paid corresponding stipends for attending the three weeks of Summer Institute and MathCitement, respectfully. 5) Finally, instead of the typical masters' thesis and comprehensive examination of the NMSU/MSA masters candidates at the end of the program, NMSU and MSA introduced an action research project as the culminating rite of passage. The introduction of an action research project instead of the typical thesis and comprehensive examination focused the teachers' attention on student learning that demanded a scholarly approach to common classroom teaching and learning challenges.

Today, the NMSU/MSA teachers' action research project papers are used as exemplars of effective classroom practice and as guides for the next NMSU/MSA Cohort. (For a video presentation of the MSA program, see *Northern New Mexico Math & Science* LA-UR-07-5285).

### **Year 7 (SY August 2006 – May 2007)**

#### ***7<sup>th</sup> Summer Institute (June – July 2006)***

In early 2007, MSA's 7th year, its mission was still unchanged: A reform program that places student learning at the center of all educational activities and teacher professional development efforts. The MSA program was now seeing itself as transformational rather than additive in nature. That is, participants are required to show changes in classroom practice, instructional strategies, and use of formative assessment methods as evidenced during the cognitive coaching sessions with MSA staff.

In 2006-2007, MSA was still following the National Staff Development Council standards for professional development to ensure high value and high quality. MSA teachers were expected to meet weekly, as well as develop a reflective portfolio that showed evidence of student work, formative assessment, and the teacher's reflections on

student work and her practice. Teachers participating in the core MSA program were now receiving about 108 hours of Summer Institute and MathCitement instruction and continuing with least 36 contacts hours during the school year with some element of the MSA program. In addition, a second NMSU/MSA Master of Arts in Teaching cohort was started in June 2006, so, some MSA teacher were participating in an addition 150 hours of professional development inclusive of the NMSU/MSA Master of Arts program (See Appendix B).

The NMSU/MSA Master of Arts In Teaching Mathematics and Science cohort was organized with 23 teachers initially registering for the program—eventually 18 teachers graduated from the program in December 2008 bringing the total NMSU/MSA Master of Arts in Teaching Mathematics and Science graduates to 47 (See Table 2, below).

School District	Elementary School	Middle School	High School	Totals
Española Public Schools	10	0	2	12
Pojoaque Valley Schools	1		0	1
Taos Municipal Schools	5	0	0	5
<b>Totals</b>	<b>16</b>	<b>0</b>	<b>2</b>	<b>18</b>

### **Year 8 (SY August 2007 – May 2008)**

#### ***8<sup>th</sup> Summer Institute (June – July 2007)***

A third NMSU/MSA Master of Arts In Teaching Mathematics and Science cohort was organized in Year 8, June of 2007. Eighteen teachers from two neighboring school districts started the MAT, but a competing masters program in educational leadership from a Northern New Mexico university siphoned off some teachers from the MAT and the MSA program and other teachers dropped for various reasons. Hence, nine MSA teachers will graduate from the NMSU/MSA Master of Art in December 2009 (See Table 3, below). Two more teachers from previous cohorts are also due to graduate with a MAT in May 2010. The total number of Master of Arts In Teaching Mathematics and Science realized since the program’s began in 2005 will be 58.

School District	Elementary School	Middle School	High School	Totals
Española Public Schools	7	1		8
Pojoaque Valley Schools	1	1	1	3
<b>Totals</b>	<b>8</b>	<b>2</b>	<b>1</b>	<b>11</b>

In March of 2007, MSA and EPS created a professional development plan for teachers to support them in their efforts to help students meet New Mexico Mathematics Content Standards through two newly adopted reform mathematics curricula:

*Investigations* (grades K-5) and (*Connected Math Project* (grades 6-8).

The plan began the summer of 2007 with elementary teachers and middle and two high school math teachers participating in MSA Summer Institutes (SI) and MathCitement weeks (See Appendix C). During SI, teachers were trained in standards-based education with special emphasis on math content. The teachers worked in grade level teams and reviewed and studied the new district math curriculum as well as their new reform curricular materials, respectively: grades 4-5, *Investigations*; grades 6-8, reviewed the *Connected Math Project*; and the high school teachers (10-12) worked on their *Integrated Math Project* program. The teachers developed plans for the first 9 weeks of school using the new curriculum and new curriculum materials.

The next phase of the plan occurred during the in-service week prior to the start of school. The MSA master teachers guided and facilitated the K-3 teachers so that they, too, had a time to become acquainted with the new curriculum and materials.

During the school year, grade level teams attempted to meet weekly with MSA master teachers and newly hired district math coaches to discuss their progress and challenges of the previous week, revisit goals for the next week, and get professional development on math concepts that they will be addressing the next week, otherwise the discussion of goals and challenges occurred during classroom observation by MSA master teachers and district math coaches.

Once a month, full day in-services were held in order for the teachers to continually plan for the year. It was understood that this first year was a trial year to test the strengths of the new curriculum as well as test the resolve of the teachers and principals, and to provide feedback for improvement for the next year. The teachers incorporated the improvements into the curriculum and plans of the second and third years while continuing to refine the plans. Teachers continued their MSA professional development through MSA Summer Institutes and MathCitement Weeks. And for the most part they also continued to meet after school in grade-level teams during the second and third years as necessary.

The results of all the preparation paid off. A comparison between MSA Classrooms vs. Non-MSA Classrooms in Española Public Schools (2007-2008) who shared the same math curriculum, textbooks, and the same type of student, shows that MSA students outperformed non-MSA students on the Math subtest of the NMSBA in 2007-08 (See Figure 1, below).

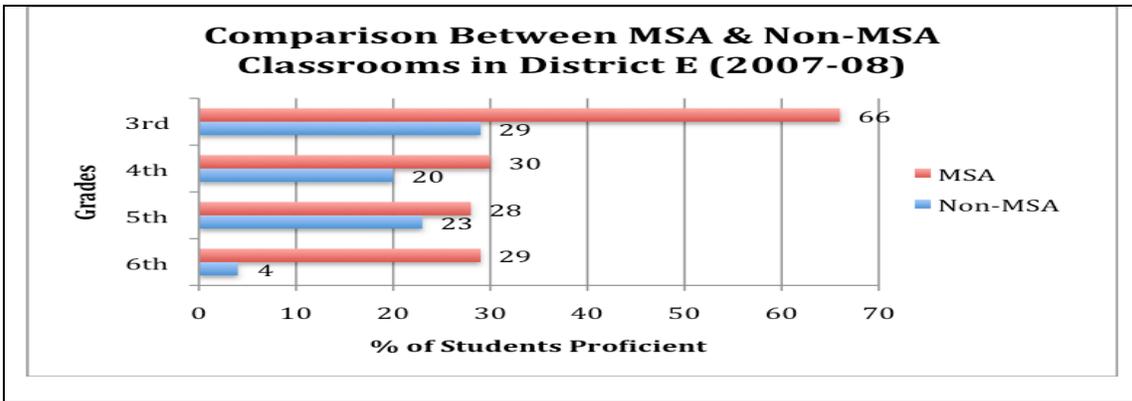


Figure 1. A comparison between MSA Classrooms vs. Non-MSA Classrooms in Española Public Schools (NMSBA 2007-08).

After MSA and Espanola Public School formed their 2006-2007 partnership to implement a reform mathematics curriculum, Pearson’s *Investigations: in Number, Data and Space*<sup>TM</sup>, complemented by professional development for teacher and principals, substantial increases in student proficiency levels were realized. For example, between Spring 2005 and Spring 2008, the average proficient and above levels for 3rd-5th grades in math increased from 22% to 32%, and during the same time period a 10.5% increase in math proficiency from 5% to 15% was also realized in grades 6th-8th between Spring 2005 and Spring 2008. Also, Native American students in grades 3rd-5th increased dramatically in math proficiency from 11% to 38% in 2005-08, significantly above the NM Student average of 26% (See Figure 2).

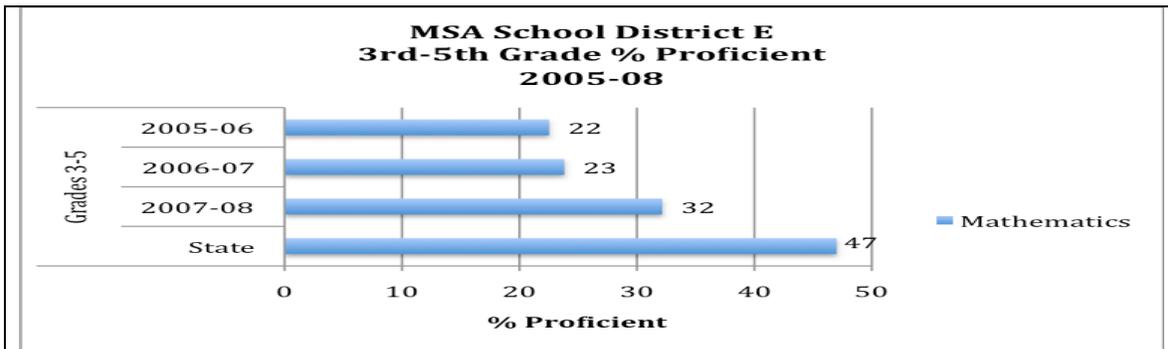


Figure 2. Between Spring 2005 and Spring 2008, the average proficient and above levels for 3<sup>rd</sup>-5<sup>th</sup> grades in math increased from 22% to 32%.

The EPS 6<sup>th</sup> – 7<sup>th</sup> grades witnessed noteworthy gains between SY 2005 and 2008 (See Figure 3, below), however, when compared to the state AYP target of 34 percent proficient, the 10% increase from 5 percent proficient to 15 percent proficient means that only 1.5 students out of 10 are proficient in mathematics (See Figure 3).

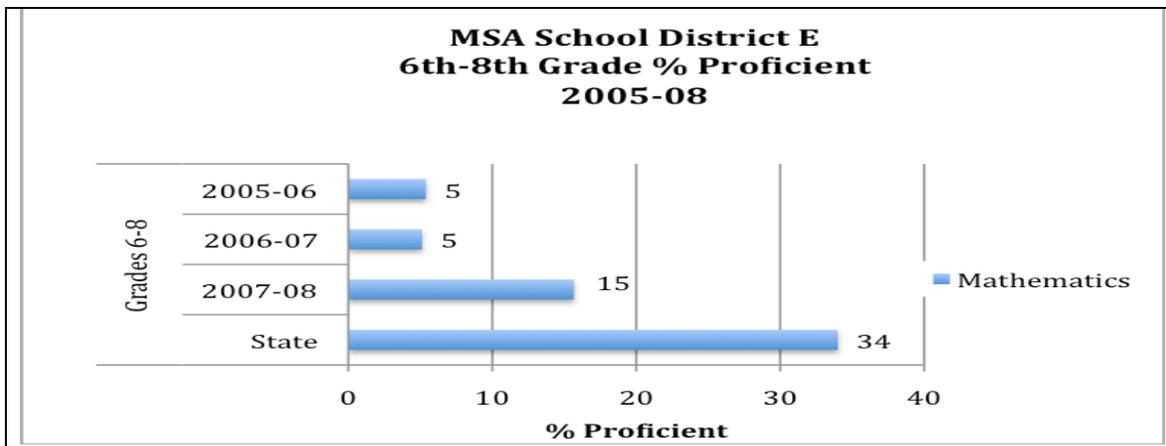


Figure 3. A 10% increase in math proficiency from 5% to 15% was also realized in grades 6th-8<sup>th</sup> between Spring 2005 and Spring 2008.

The Chama Valley School District is the second school district in which MSA was fully committed K-8. By the end of school year 2007 most K-8 Chama Valley Independent Schools teachers had graduated from the MSA program.

Between Spring 2005 and Spring 2008, *all* Chama Elementary and Tierra Amarilla Elementary grades between 3<sup>rd</sup> through 5<sup>th</sup> met Annual Yearly Progress (AYP) in math proficiency. *This compares with only 21.3% of New Mexico elementary schools in 2008 meeting AYP. Also, between Spring 2005 and Spring 2008, all* Chama Middle School and Tierra Amarilla Schools 6<sup>th</sup> and 8<sup>th</sup> grades met AYP in math proficiency. *This compares with only 3% of New Mexico middle schools making AYP in math proficiency in 2008.*

Finally, Velarde Elementary, Española Public Schools, received the designation as a **Blue Ribbon School from the U.S. Department of Education**. This award recognizes dramatic achievement of students in mathematics and reading: *approximately 50% of Velarde's students scored proficient or better in math and approximately 60% of students scored proficient or better in reading.* The Math and Science Bureau, PED recognized the same year, Beth Sanchez, MSA teacher at Velarde Elementary, for having the highest percent proficient in New Mexico at the 6<sup>th</sup> grade level.

### **Year 9 (SY August 2008 – May 2009)**

#### ***9<sup>th</sup> Summer Institute (June – July 2008)***

The nine-year partnership with Northern New Mexico School Districts now includes six school districts and 22 K-12 school units. The emphasis is still on K-8 grades (See Table 4., below).

Table 4. MSA Full Time Participants Numbers Between 2000-2009

Year	Districts/Schools	Teachers/MathCitement	Principals
Year 1: 2000-2001	3/3	12	0
Year 2: 2001-2002	3/3	23	5
Year 3: 2002-2003	3/3	27	11
Year 4: 2003-2004	4/9	53*	6
Year 5: 2004-2005	5/17	72*	3
Year 6: 2005-2006	5/23	65*	9
Year 7: 2006-2007	5/23	92*/25	6
Year 8: 2007-2008	3/14	87*/25	6
Year 9: 2008-2009	6/22	77*/16	3

\*Note: Between Year 7 and 9, EPS-ME2 teachers can opt to attend only MathCitement Week.

This 9<sup>th</sup> MSA Summer Institute expanded into the high school arena. The New Mexico Public Education Department Math and Science Bureau’s funding for 2009-2010 was used to expand the current K-8 mathematics content and pedagogy and MSA Summer Institutes to include the Española Valley High School mathematic department and launch a 4<sup>th</sup> grade Inquiry Science Initiative (ISI) Pilot Program in three Northern New Mexico School Districts (Taos (2), Chama (2), and Española (5)) with nine teachers. The new ISI Pilot Program will deliver science content and pedagogy instruction using the research-based inquiry science curriculum, Full Option Science System (FOSS). The 9<sup>th</sup> Summer Institute also added a 2009-2010 Leadership Program to assist principals “design and monitor a Quality Mathematics and Science Education Model” (NM-QMSEM, retrieved April 2009).

Also, a welcomed addition to the 9<sup>th</sup> Summer Institute was our sixth school district and twenty-second school from Santa Fe Public Schools, Larragoite Elementary (STEM Magnet School). Larragoite Elementary sent three teachers and its principal to the MSA Summer Institute and the MathCitement week. Additionally, the Larragoite math teacher is also attending the Fall 2009 Ir-Rational Number Institute. The Larragoite Elementary team is the first school to take advantage of MSA Replication Model. In 2008, the Legislative Oversight Committee for LANL requested that MSA develop a pathway for schools interested in simulating the MSA teacher professional development model. Hence, the MSA Replication Model was designed so that any school district in New Mexico can join MSA for a year and “walk away” with a model for teacher professional development and implementation at the respective school. All costs are incurred by the observer/replication team’s school district; this arrangement then does not burden MSA with additional programmatic costs.

Also, built upon generous donations from IBM, Microsoft and Efinity Networks, MSA also introduced a new MSA Laptop Initiative that is in use by 39 MSA teachers in four districts for SY 2009-10. This new technology provides an IBM laptop, document reader, computer projector and supporting software for use by the participating MSA teachers in their classrooms to enhance their teaching and their students' learning of math and science topics, enhanced further by in-classroom access and use of the expanding repertoire of online instructional courseware.

The four-year partnership with NMSU continues to deliver a blended (online and face-to-face) Master of Arts in Teaching Mathematics and Science program; although the NMSU/MSA Masters program will officially end in December 2009 when 11 Cohort III teachers will graduate bringing the total of NMSU/MSA Master of Arts in Teaching Mathematics and Science to 58 (See Table 3, Above). The tradition of the NMSU/MSA Master of Arts program still survives in a small contingent of Española teachers. Four Española teachers enrolled in the NMSU Master of Arts in Education program the summer of 2008 and were eligible to receive graduate credit through the MSA Summer Institute via NMSU/MSA Cohort III's Program of Study. The MSA program continues to support Cohort IV with tutors for the mathematics and science courses, purchase their books, and coordinate with Española Title for tuition payment. So, in total, MSA will have brought a masters program to the doorstep of 62 northern New Mexico teachers.

### ***MSA's Internal Assessment Scheme***

The MSA's internal assessment of its various components employs both quantitative (validation) and qualitative (inquiry) tools in a specific order as the school year and professional development sessions dictate, evolve, and move forward. The methods are detailed below:

- MSA/PED-MSB Participant Survey for MSA Summer Institutes and other PD sessions, i.e., The MSA IR-Rational Number Institute.
- The Northwest Evaluation Association (NWEA) Measure of Academic Progress are short-term assessments instruments for mathematics, science, and reading employed by partner school districts to discern students' mathematical progress and gap areas.
- MSA Customer Survey employed at mid-year after various math and science professional development sessions with teachers and principals to discern customers' satisfaction with MSA and math coach PD sessions (See Appendix D for copy of Customer Survey).
- Student Mathematics Assessment videotapes are currently being developed under the direction and training of Dr. Rick Kitchen, UNM, using Española Public Schools teachers. The mathematics assessment videotapes will be employed to train the district's mathematics teachers in the finer aspects of determining students' mathematical reasoning, a form of formative assessment. Student data will be collect from structured questioning, documented student responses and teacher's reflective responses and summaries (See Kitchen-Lorenzo Project Testing Video, Group One, Two, and Three, May 2009).
- New Mexico Standards-Based Assessment (NMSBA) is used as a summative assessment to determine individual students' progress and gap area in mathematics, science, and reading. The NMSBA is also used to correlate the

number of PD hours of professional development to student achievement. “While teachers typically need substantial professional development in a given area (close to 50 hours) to improve their skills and their students’ learning, most professional development opportunities in the U.S. are much shorter” (Darling-Hammond, L., Chung Wei, R., Andree, A., Richardson, N., and Orphanos, S. 2009). MSA teachers receive between 90-240 hours of professional development in standards-base education and content and pedagogy. Note: MSA to Non-MSA students’ NMSBA achievement scores are closing due to the continuous and embedded professional development our teachers are receiving (See Figure 1, Above).

- As noted above, the formal MSA program evaluation was conducted by the UCLA CRESST organization for the first six years. This report provides program activity and impact information for the last three years and our new evaluation contract with Kokopelli Associates LLC of Santa Fe NM will provide a formal evaluation assessment and report for the SY 2009-10.

## **Implications**

Ultimately, the proof of MSA’s value as a teacher professional development organization in northern New Mexico is evidenced in the change in teacher quality. But teacher quality as determined by increases in the teacher’s mathematical content, the teacher’s fluency with mathematical skills, or the teacher’s efficacy with mathematical instructional and assessment strategies is not readily measurable or easily recorded. The one component of this complex, and, at times, not so transparent, process that can be cited are student achievement levels as recorded on the New Mexico Standards-based Assessment. And, again, the NMSBA scores also have to be viewed with caution because they are representative of only a one data point in time, hence, can be subject to many extenuating variables.

The NMSBA is administered to all 3<sup>rd</sup>-8<sup>th</sup> grades and the 11<sup>th</sup> grade in late February and early March every school year. Below, Figure 4 documents the increased percent proficient and above achieved by Española Public School students between 2005 and 2009 (See Appendix E for list of MSA 2007-08 Highlights).

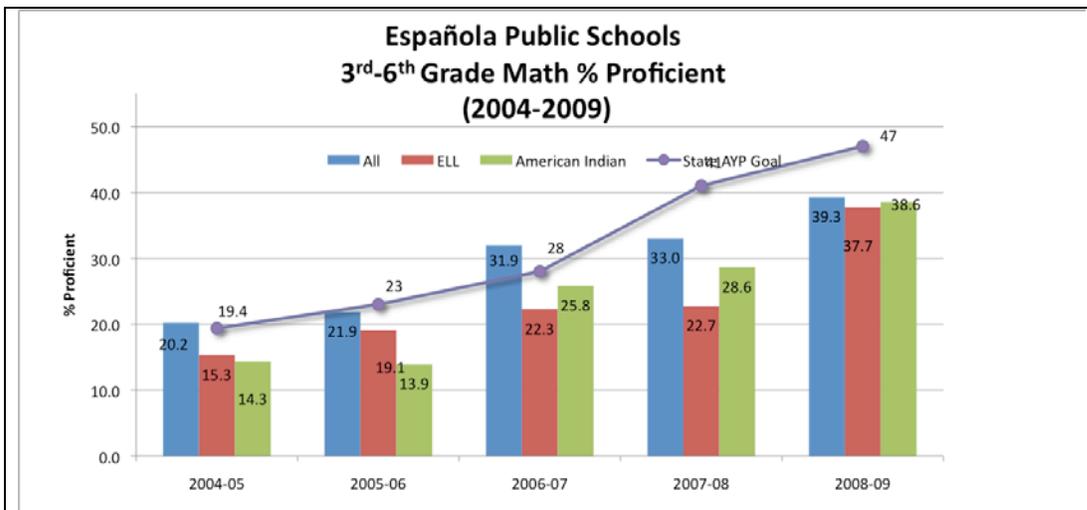


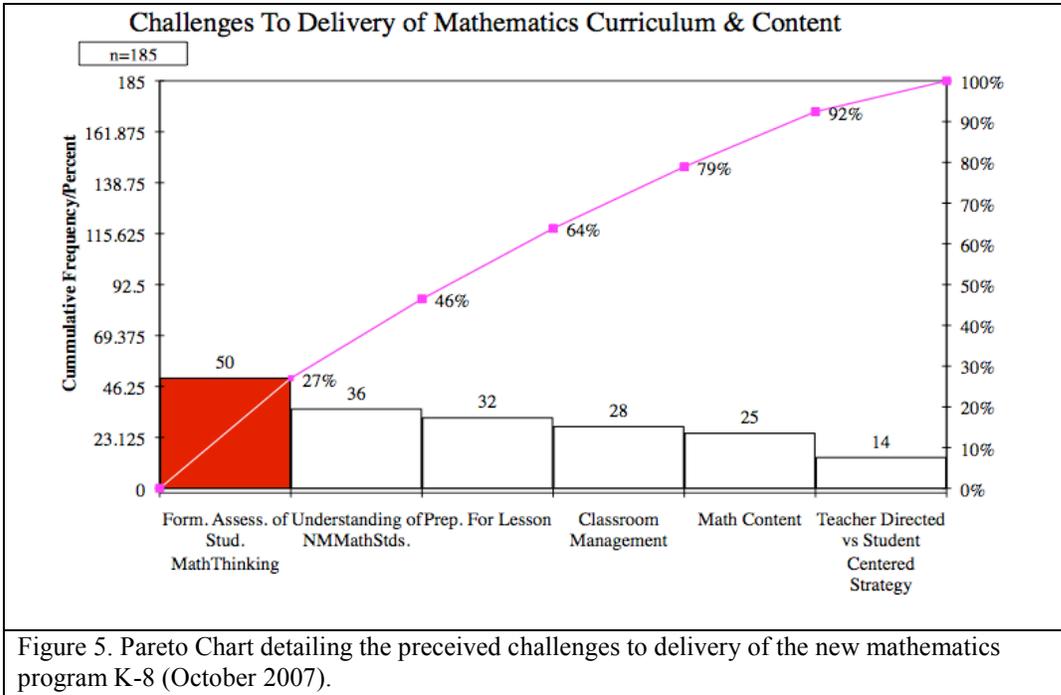
Figure 4. The closing of the achievement gap among the NMSBA subgroups of American Indian, English Language Learners, and All Students comes 2 years after the implementation of reform math curricula and sustained professional development for all teachers, and math coaches in 2007.

Notice that between SY 2004-2005 and 2005-2006 only a 3.6 percent increase in proficiency level was realized for grades 3<sup>rd</sup> – 6<sup>th</sup>. But, a five-percentage point increase was seen between 2005-2006 and 2006-2007 and an even larger jump in students’ mathematics proficiency level was seen between 2007-2008 and 2008-2009. The factors contributing to this boost in students’ gains are the increasing numbers of Española teachers participating in MSA every year.

In June of 2000, Española Public Schools partnered with MSA with 4 teachers and by SY 2007-2008 the number had grown to 62 “teachers in the MSA program; another 55 Española teachers have had one to three years of MSA training, and 16 of those remain in the district” (See Appendix E for more details on EPS participation and milestones.). In addition, another 25 teachers went through the one-week MathCitement training. Also, the implementation of the reform Pearson’s *Investigations: in Number, Data and Space*<sup>TM</sup> by the district and the subsequent professional development by MSA to the mathematics embedded in the content of the *Investigation* K-5 curriculum were possible contributing factors to the increase in student gains between 2006 and 2008. The identical process was followed with the 6<sup>th</sup> – 8<sup>th</sup> grade teachers using the reform NSF Connected Math Project, but the 7<sup>th</sup> and 8<sup>th</sup> grade teachers did not fully participate in the initial training, or in the subsequent MSA Summer Institutes or the MathCitement weeks. Finally, another contributing factor to the rise in student NMSBA scores were the 31 Española teachers participating in our optional NMSU/MSA Masters of Arts in Teaching Mathematics and Science between 2005 and 2008. By 2008, 7 Española teachers had already completed their MAT degree program.

The implementation of the new reform mathematics curricula along with the embedded, complimentary professional development have yield results, but the 39 percent proficient and above is well below the 2009 Annual Measurable Objective of 47. Also, 39% proficient and above in classroom numbers means that only about 4 out of 10 students are proficient in any given classroom. This is still unacceptable.

A Pareto Chart of a Fall 2007 survey asking teachers “What are the Challenges to the Delivery of the New Reform Curriculum?” 27 percent of the K-8 EPS teachers responded that their greatest challenge was assessing the students’ mathematical thinking. This is not totally unexpected because to see the mathematics in the mind of the student as she grapples with the math, the teachers needs a profound understanding of the mathematics herself. Further, 19 percent and 18 percent stated that understanding the New Mexico Mathematics Content and Standards and the extensive preparation for the individual lessons, respectively, also posed challenges (See Figure 5, below).



The intriguing notion of the teachers’ responses to the survey is that only 25 out of 185 teachers survey stated that the math content posed a challenge. This goes contrary to the math coaches perceptions—based on classroom visits and many professional development sessions over the years—that suggest the teachers’ less than profound understanding of mathematics concepts. The challenge then is to aligning the teachers’ perception of their math content with that of the math coaches’ perception through embedded and continuous professional development in mathematics.

Figure 6, below, shows the SY 2008-2009 combined average proficiency and above student scores of the Chama Elementary School and Tierra Amarilla Elementary Schools (3<sup>rd</sup>–6<sup>th</sup> grades) as compared to the State Average scores. All grades are at or

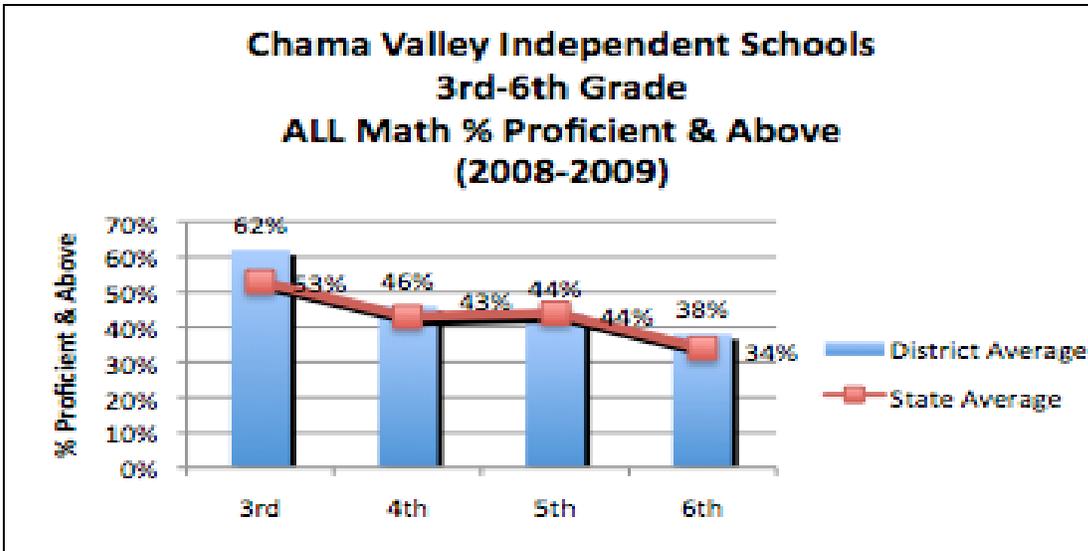


Figure 6. Chama Valley Independent Schools 3<sup>rd</sup>–6<sup>th</sup> grade All Student Percent Proficient and Above for 2008-2009.

above the state target or Average Measurable Objective (AMO). With the exception of two new teachers to the Chama Valley Schools’ staff, all K-8 teachers completed the three-years MSA program in 2007. Again, it can be assumed that the professional development in standards-based education and mathematics content as well as the adoption of the NSF reform mathematics program, Pearson’s *Investigations: in Number, Data and Space*<sup>TM</sup>, has made a positive impact on student learning and achievement in Chama.

Finally, Figure 7, below, shows Chama Valley Independent Schools’ grades 3rd – 5th increasing in the Proficient and Above Levels. In SY 2004-05, the average Proficient and Above average score was 25% slightly above the State AYP Goal of 24%.

The 3rd-5th grade Proficiency and Above average scores steadily increased until the last NMSBA SY 2008-09 when the 3rd-5th grade average scores reached 52%, two point above the state average of 50%. Although the professional development in standards-based education and the mathematics content area and the adoption of Pearson’s *Investigations: in Number, Data and Space*<sup>TM</sup>, this average Proficient and Above score converts is still only 5 out of 10 students being proficient, which inform us that teachers still lack a profound understanding of mathematics.

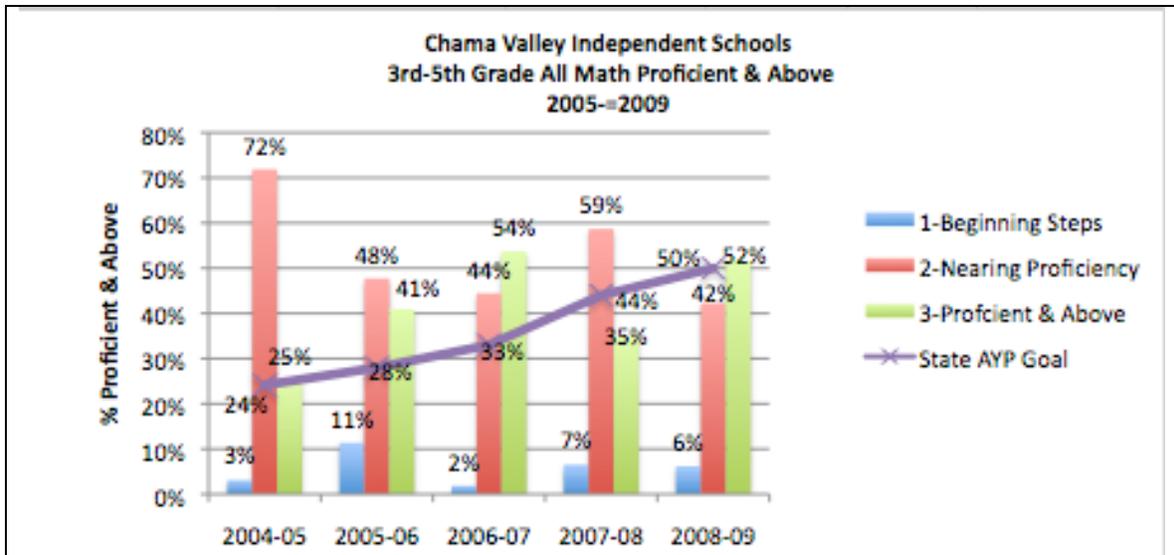


Figure 7. Chama Valley Independent Schools 3<sup>rd</sup>–6<sup>th</sup> grade All Student Percent Proficient and Above for 2005-2009.

Again, a greater and more sustained effort is needed to over years of education in rote learning of algorithms and procedure.

#### Awards/Distinctions

- September 2005 – LANL Director’s Distinguished Performance Award, MSA Master Teacher Team, the only non-technical award
- January 2006 – Mentioned by Dr. Veronica Garcia as one of two distinguished professional development programs in New Mexico, in Testimony before US Senate, January 2006
- 2007 Secretary of Energy EEO & Diversity Best Practices Award in recognition of outstanding service to the community
- February 2009 – Math and Science Academy Schools Recognized for Individual Achievement in Mathematics Education
  - Tierra Amarilla Middle School, Chama Valley Independent Schools, was 1 of 13 New Mexico schools recognized for coming off of No Child Left Behind Annual Yearly Progress Designation (SY 2008-09). These specially recognized schools removed from designation made AYP two years in a row after entering the corrective action cycle.
- June 2009 -- MSA was highlighted on the NM Public Education Department Math and Science Bureau website for its reform math & science teacher professional development programs leadership
- September 2009 – Dave Foster (STB Education and Postdoc Office Program Manager) and the Northern NM Math and Science Academy received the newly created Outstanding STEM (Science, Technology, Engineering, and Mathematics) Mentorship award from the Federal Laboratory Consortium

# Appendices

## Appendix A. Math and Reading AYP Target Table

2005 New Mexico Percentage Proficient for AYP

School's Grade Configuration	Math Target	Reading Target
K-5	24.13	40.85
K-6	19.40	36.00
6-8	10.58	34.14
7-8	10.75	37.17
9-12	18.29	37.30
K-8	15.28	36.79
7-12	14.42	37.30
K-12	15.79	37.23

*Note.* Source: <http://www.ped.state.nm.us/>

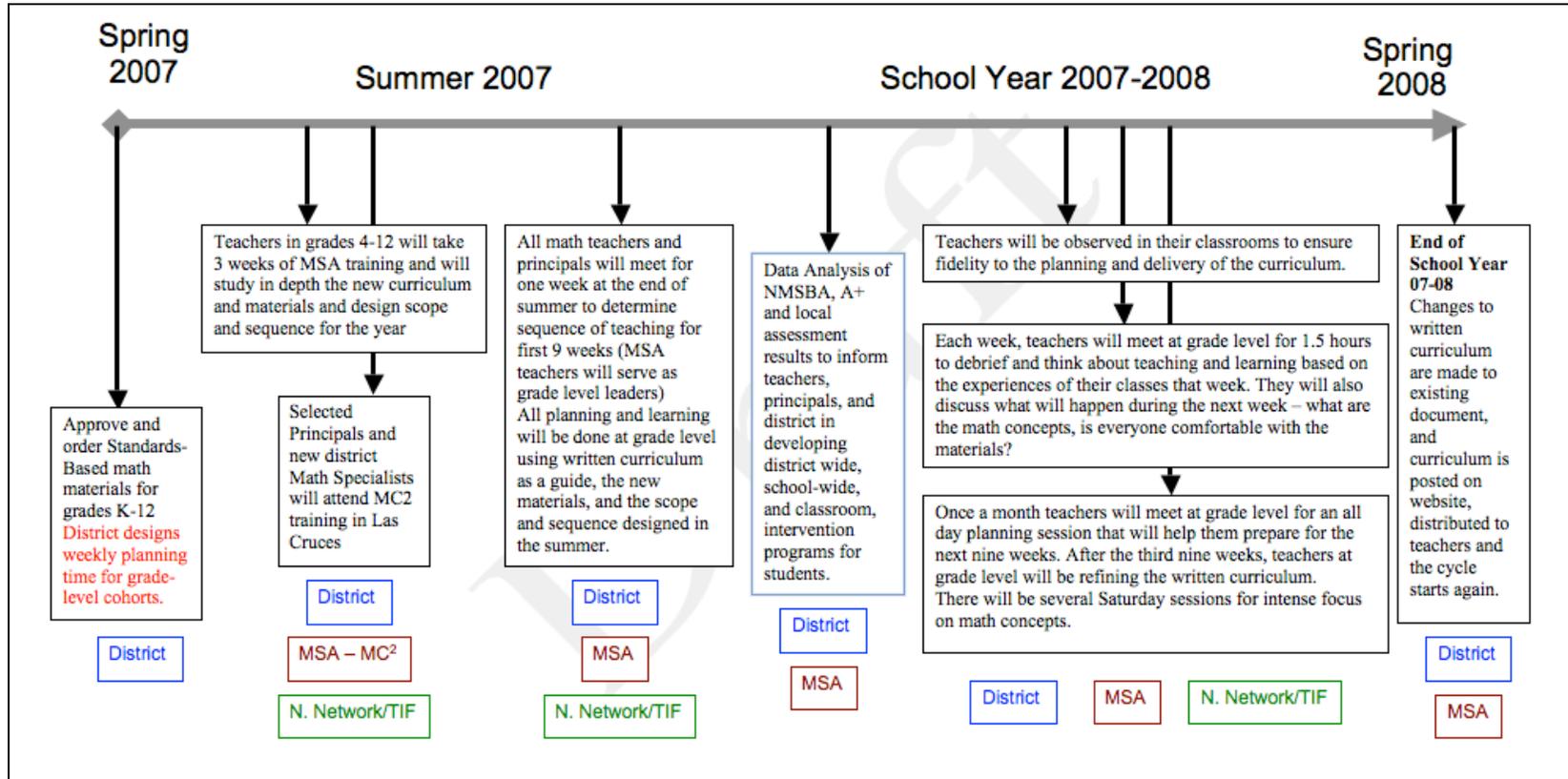
(From: Osmundson & Herman, January 2006, p. 13).

Appendix B. MSA Learning Communities Flow Chart

Table 1. MSA Input/Outcomes

Focus is on developing the culture and the capacity of the organization through MSA Learning Communities.				
Input	Standards-Based Education		Outcomes	
<p><b>Key Questions</b></p> <ul style="list-style-type: none"> <li>• What do we EXPECT students to learn?</li> <li>• How will we KNOW if students learned it?</li> <li>• How will we RESPOND when students don't learn?</li> </ul>	<p><b>Curriculum</b></p> <ul style="list-style-type: none"> <li>• District Curricula</li> <li>• New Mexico State Standards</li> <li>• Alignment of text and standards</li> <li>• Stated learning goals</li> <li>• Strategic presentation of curricular goals</li> </ul>	<p><b>Instruction/Learning Theory</b></p> <ul style="list-style-type: none"> <li>• Strategic processing</li> <li>• Strategic teaching</li> <li>• Research based strategies for learning efficiency</li> <li>• Plan for creating positive classroom atmosphere</li> </ul>	<p><b>Products:</b></p> <ul style="list-style-type: none"> <li>• Improved student learning</li> <li>• Raised student scores</li> <li>• Improved curriculum, instructional practice, &amp; assessment</li> <li>• Develop common assessment</li> <li>• Clarify 8-10 essential outcomes</li> </ul>	<p><b>Processes:</b></p> <ul style="list-style-type: none"> <li>• Teacher shared knowledge</li> <li>• Build professional capacity</li> <li>• Shared ownership</li> <li>• Leadership development</li> <li>• Inquiry into best practice</li> <li>• Continuous improvement</li> <li>• Decisions based on data</li> <li>• School-wide reform</li> <li>• Team/school norms</li> <li>• Creative Collaboration</li> </ul>
<ul style="list-style-type: none"> <li>• Vision/Mission</li> <li>• Students' math difficulties</li> <li>• NM Standards</li> <li>• District Curriculum</li> <li>• Clarify team &amp; student products (What do we want produced by teacher teams and students)</li> <li>• Define &amp; clarify goals</li> <li>• Brainstorming Tools</li> </ul>	<p><b>Interventions</b></p> <ul style="list-style-type: none"> <li>• After school tutorial</li> <li>• Homework and Practice</li> <li>• Others</li> </ul>		<p><b>From Thinking to Action</b></p>	
	<p><b>Assessment</b></p> <p><u>Diagnostic Assessment:</u> To ascertain, prior to instruction, each student's strengths, weaknesses, knowledge, and skills.</p> <ul style="list-style-type: none"> <li>• Based on the results, students' interventions are directed.</li> </ul> <p><u>Formative Assessments:</u> To guide and enhance student learning; ASSESSMENT FOR LEARNING.</p> <ul style="list-style-type: none"> <li>• Assessment for Learning- Pretest &amp; Teacher made tests</li> </ul> <p><u>Summative Assessment:</u> The purpose is evaluative; ASSESSMENT OF LEARNING</p> <ul style="list-style-type: none"> <li>• New Mexico Criterion Tests</li> </ul>			
<p><i>SHARED OWNERSHIP is the quality of the process</i></p>	<p><i>Focus on LEARNING...Interventions are TIMELY, SYSTEMATIC, and DIRECTIVE</i></p>		<p><i>Retain the focus on results through CAPACITY BUILDING</i></p>	

Appendix C. ME2 Organizational Flow Chart



Appendix D. MSA Customer Survey

	1 Poor	2	3 Average	4	5 Excellent	Office Use Only
1. Rate your current level of understanding of the components of the adopted math curriculum.						
2. Have the professional development opportunities provided to you last summer and this semester increased your skills in implementing the components of the adopted math program?						
3. Rate the value of the pacing guide in developing your classroom instructional plan?						
4. Rate the value of the math specialist coming into your classroom as well as leading the professional development sessions?						
5. What is your <b>professional</b> level of commitment in implementing the adopted math curriculum?						
6. Are you <b>conforming</b> to <b>all</b> the elements of the adopted math curriculum?						

7. *Things that support effective implementation (+Strengths)*

8. *Things that are barriers to effective implementation (Δ Opportunities for improvement)*

Comments: