EVALUATION REPORT:

Math and Science Academy

Pilot: Year 1 Report

September 2001

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This evaluation report summarizes the implementation and impact of the Northern New Mexico Council on Excellence in Education's Math and Science Academy (MSA). Below, we present an overview of the project, describe the methodology used to conduct the evaluation, discuss findings from the pilot year of the program and conclude with recommendations and refinements for future years of MSA.

Background: Project Goals and Objectives

The Northern New Mexico Council on Excellence in Education (NNMCEE) developed the Math and Science Academy, with support from the University of California and the Department of Energy's Los Alamos National Laboratory (LANL). MSA's goal is to provide middle school teachers and their students the opportunity to work with exemplary science and math mentors and gain content knowledge, experience and expertise by working collaboratively with a cadre of other committed schools and teachers. The MSA project addresses multiple purposes, including providing 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. MSA targets middle school students, in an effort to stem the high drop out rate in 9th grade (8.1% in 1997, higher for Latino males), and to allow teachers adequate time to help their students develop the knowledge, interest and enthusiasm to enroll in challenging high school classes.. Finally, the project aims to improve the overall quality of education in middle schools in Northern New Mexico, by providing opportunities for all students to engage in high quality learning experiences taught by qualified, knowledgeable instructors.

Project Overview

The long-term goals of the project are ambitious and far reaching – student test scores and teacher competency surveys reveal a tremendous need for improving student achievement and teacher preparation in Northern New Mexico. Simultaneously, LANL has a need for hiring qualified employees to work in a wide variety of lab positions (scientific, technical and administrative) and views Northern New Mexico as a valuable and logical source for developing and cultivating a workforce and providing employment opportunities to the citizens of the region.

MSA was introduced in the summer of 2000. Teachers and mentors spent two weeks involved in intense professional development, discussing and developing curricula and instructional methods, and planning for the 2000-2001 academic year. The project was led by two mentor teachers, selected for the program based on their experience developing curriculum, professional development expertise, knowledge of standards and reform initiative, proficiency in the use of technology in education and experience working with middle school students.

MSA's pilot year has focused on three middle schools located in Northern New Mexico. These sites were selected for project participation based on a competitive application process. At each site a team of teachers (4 teachers from each site, 12 total teachers) worked with the two mentors during the school year to develop instruction strategies and implement curricula to support and strengthen student learning and achievement in math, science, social studies and language arts. Throughout the school year, mentors and teachers collaborated with each other, participated in on-going professional development sessions, and worked to develop curricula and teaching methods to support on-going efforts to improve the quality of math, science, language arts and social studies education at MSA schools. Project members also collaborated with school administrators and community members to inform them about the project and its' goals.

Evaluation and Design Issues

The UCLA/CRESST evaluation of the MSA project was designed to describe how the program was implemented, to assess its effects and to generate recommendations for the improvement and enhancement of the program. Four main questions guided the evaluation:

- 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?

The evaluation employed a multi-method approach to understand and assess program implementation and effects. Surveys, interviews, focus groups, program documents and observation of program activities were used as information sources on program implementation and impact. Regular communication (e-mail and phone) with project administrators and participants served as an additional source of project data.

Our approach to this evaluation was formative, that is, by systematically conferring with project participants throughout the year, our goal was to provide important information to project members regarding project successes and challenges. This report synthesizes results and observations from the initial year of the project and provides recommendations for strengthening MSA and increasing its impact on teachers and students during subsequent years of the project. The first year evaluation was designed to help project leaders further refine the programs' theory of action, to more clearly articulate a research design for subsequent years and to provide a better understanding of evaluation needs for additional years of the project.

Method

To address these evaluation objectives, multiple sources of information were collected. Table 1 displays the various data sources used to gauge project implementation and impact.

Table 1
MSA Pilot Year: Data sources

Surveys	Observations	Interviews	Student Data
• Teachers • Students • Parents	• Classrooms • Professional development sessions • Summer Institute (2001)	• Teachers • Principals • Administrators • Project mentors	• Standardized achievement scores (CTBS) - math composite - science - language composite - reading composite - social studies

Instruments. Items on the teacher surveys focused on the way/s in which participation in the Math and Science Academy influenced teachers' instructional practices and included a range of questions on topics related to teaching and learning. Classroom observations were designed to gather data on a number of dimensions, including grouping patterns and practices, assessment strategies and teacher-student interactions. Interviews with teachers including questions about the lessons observed and more general questions about participation in MSA. Principal and superintendent interviews included questions about project successes and barriers and general

impressions regarding project impact on teachers and students. Parent surveys were designed by MSA mentors and collected general affective data on parents' impressions of the project. Student surveys, also designed by MSA mentor teachers, included students' opinions about math and science, as well as general affective data on students' impressions of the project. Copies of all instruments can be found in Appendices A – G.

Formal evaluation of the project began in January 2000, 5 months after the initiation of MSA. As such, a number of opportunities to collect baseline data were lost (initial student and parent affective data, observation of classes prior to the introduction of MSA, etc.). Baseline data were collected on teacher instructional practices during the Summer Institute of 2000.

Participants

MSA Teachers. Twelve teachers from 3 school districts in Northern New Mexico were MSA participants in the 2000-2001 school year. Teachers had an average of 13 years of experience (range 3 to 28) and held multiple credentials (e.g., bilingual and single subject). Many MSA teachers (7/12) had advanced degrees. Interestingly, a number of teachers reported teaching outside their content area specialization. Indeed, many participants noted that they were teaching in content areas for which they had little formal training. At some schools, teachers taught 3 different subjects at 3 different grade levels. Most teachers reported English as the primary language of instruction. Additionally, classroom observations suggest that many teachers engaged in culturally appropriate code-switching (from English to Spanish and vice versa). When necessary, teachers often provided additional explanations or instructions to students in Spanish. Five of the twelve MSA teachers had previous experience with reform initiatives similar MSA (including FLAIR, Golden Apple Leadership and the NMNU Math and Science Academy). Table 2 displays demographic data for the 12 MSA teachers.

Table 2
MSA Teacher Demographic Information

Variable	***Descriptor***	***n=12***
Sex	Male:	3
	Female:	9
Ethnicity	White	1
	Hispanic/Latino	10
	Native American	1
Highest Degree Received	Bachelor's + Credential + units:	5
	Master's:	2
	Master's + Units Beyond:	5

Teaching Credential*	General Elementary General Secondary Special Emergency Multiple Subject Single Subject Bilingual Other: (K12, Spanish, Early Childhood)	6 4 0 5 3 3 3
Years of Experience	Average Number: Range	13 years 3 - 28 years
Previous participation in projects like MSA	Yes	5

*Note: teachers may hold multiple credentials.

MSA students. Approximately 200 7th grade students participated in the pilot year of the MSA project. At two of the project sites, all 7th grade students were MSA members. At the third site, one-third of the 7th grade students (approximately 100 students) participated in the Math and Science Academy. For purposes of comparison, only students enrolled in classes taught by 3 or 4 MSA teachers are included in our sample. Student ethnicity was primarily Hispanic/Latino (80%), with roughly 10 % Native American and 10% white and/or other ethnicities.

MSA mentors. Two mentor teachers provided project leadership. These teachers were acknowledged experts in the areas of math and science instruction, and were experienced in working with teachers in supervisory and/or professional development capacities. Both mentors had extensive experience teaching middle school. The mentors were accomplished leaders as well: one mentor served as principal of a private school for three years, and the other worked for 3 years as a science consultant for the New Mexico State Department of Education. Additionally, mentors participated in leadership training sessions with well-known professional development experts (e.g., Susan Loucks-Horsely). One of the mentors had completed coursework in administrative certification, where she had exposure to topics and issues related to the supervision of instruction and curriculum development for administrators. As such, the mentors were well qualified for the position of math and science leaders for MSA.

MSA project coordinator. The MSA project coordinator was staffed 75% time, by a long-time employee of the lab. Significant time issues and scheduling conflicts prevented the coordinator from fully participating in the project.

Project Findings: Year 1

In this section we present a summary of findings from the project based on data collected during the pilot year of MSA. Results are organized around our four research questions. Specifically, we report findings based on project implementation, impact and recommendations for future years of MSA.

How Was the Program Implemented?

In the spring of 2000, a model for the Math and Science Academy was developed. This model incorporated a number of different features from various reform efforts (including an apprenticeship model, standards-based instruction, technological support and innovation); these program policies and philosophies were combined and refined to create a general "theory of action" for a 5-year project. Central to the program's vision was the notion of thematic or interdisciplinary instruction (defined in this project as the study of an essential question, problem or situation through the multiple lenses of mathematics, science, language arts and social studies) as a vehicle by which to improve instruction and student learning. The unstated but implied goal was that through the process of developing and using multidisciplinary units, teams of teachers would collaborate with each other and subsequently improve their instruction and increase student learning and performance.

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. However, work carried out during the pilot year has provided a great deal more direction, specificity, and clarity to MSA as a model for teacher professional development.

The project was initiated during the summer of 2000; MSA teachers and project mentors devoted 2 weeks (10 days) of time to intense professional development. Teachers participated in a series of sessions to introduce and familiarize them with new instructional approaches, to reinforce the use of standards based instruction and to discuss current research on learning and instruction. Specifically, at the Summer Institute mentors and teachers worked to: 1) establish the ground work for on-going collaboration between teams of teachers at each site and across sites; 2) develop a thematic unit; and 3) study and review recent developments in the area of learning and instruction, specifically cooperative learning groups and standards-based instruction. These overall program goals were then revisited and built upon throughout the academic year as MSA mentors continued their on-going collaboration and coaching of project teachers.

During the school year, mentor teachers visited each school once each week. During these visits, mentors observed MSA teachers in their classrooms, provided demonstration lessons when requested (primarily in math and science classrooms), substituted to allow teachers to visit other classrooms, and worked with students in small groups to answer questions and provide additional assistance and instruction. At the conclusion of these site visits, mentors met with the MSA team for 2 hours to debrief or discuss the lessons they observed, to discuss specific topics of study or teaching approaches and to provide general support for the teachers and the project. Mentors also gave presentations to school boards and to personnel at district offices to familiarize them with MSA and its objectives.

Over the course of the school year, MSA teachers met during their common planning time or after school to discuss instructional plans, student work and student performance on a weekly basis. Additionally, teachers from all sites met four times (a fifth meeting was cancelled due to inclement weather) during the school year for Saturday sessions to further extend their understandings of new ideas presented in the project and to collaborate with teachers at the other MSA sites. Mentors, teachers and students also gave MSA evening presentations for parents and community members. A final 3-day work session was culminating event of the pilot year for MSA

Overall, students, teachers, parents, administrators and mentors viewed MSA implementation as successful. As the school year progressed, each of the sites faced challenges and obstacles to project implementation. More specific information and a fuller discussion of MSA successes and challenges will be presented in the next section.

What Were Project Effects on Participants?

MSA teachers. Surveys results, observations and interviews of the twelve MSA teachers indicate that the project influenced teachers in a number of ways. Specifically, MSA had an impact on teacher's: 1) collaboration, planning and articulation; 2) knowledge and familiarity of current research on teaching and learning, including grouping practices; 3) types of assignments, activities and assessments used; and 4) understanding of content area standards and standards-based instruction. These areas of impact were observed and reported to varying degrees at individual sites and for individual teachers in the project.

Collaboration, Planning and Articulation. Teachers reported the greatest amount of MSA impact on their willingness and interest in collaborating and planning with their colleagues. This finding was substantiated in our observations of teachers at their sites. As the school year progressed, we heard teachers more frequently engaged in formal and informal conversations about teaching, learning and MSA.

Why was this activity important? Collaborating with colleagues in meaningful ways meant that teachers discussed student work and instructional needs rather than focusing on the more negative aspects of school life, such as student behavior, administrative issues and the like. Further, teachers reported a higher degree of articulation and alignment of performance and behavior standards for students at their school sites as a result of these on-going conversations.

Common planning time, an hour during each instructional day designated specifically for MSA work and objectives, was an important feature of the project. Unfortunately, due to scheduling conflicts, common planning time occurred at only 1 of the 3 MSA sites on a regular basis. At the other two sites, MSA teachers met before or after school to discuss MSA student work and issues. On occasion, teachers at all sites were pulled from their MSA planning time to work on other school projects. But meeting with the other team members provided teachers with opportunities to articulate curriculum, analyze their practices, and review their teaching on a more regular basis. As teachers noted:

> Because of MSA, my own planning has changed and we worked together on a thematic unit. But because of lack of time and specifically, lack of collaborative time, we could not do as many things together as we had hoped.

> Communication between colleagues has been greater this year because of MSA. We talk about students' strengths and not just students' weaknesses and problems they have.

> Collaboration on students' needs, curriculum and strategies have increased greatly. Articulation has always been very strong at our site, planning was done jointly, but not to a great extent.

Table 3 below displays the related areas of project collaboration, planning and articulation impact on MSA teachers.

Table 3
MSA Teacher Collaboration, Planning and Articulation (n=12).

To what extent do you agree with the following statements:	Mean (SD)
I develop yearlong and short-term goals for my students.	4.2 (0.3)
I select content and adapt and design curricula to meet the particular interests, knowledge, skills and experiences of my students.	4.3 (0.2)
I use strategies that develop student understanding and nurture a community of learners.	4.1 (0.2)

I work with my colleagues within and across and disciplines.	4.4 (0.2)

Note. Scale: 1=never, 3= sometimes, 5=always, NA=Not applicable.

Our interviews with teachers and observations of professional development sessions further support teachers' beliefs about the importance of collaboration and planning with colleagues. Indeed, between the beginning of the evaluation cycle (in January) and the end of the academic year, we more frequently observed teachers from different sites engaged in dialogue relative to student work, assessment practices and how to use cooperative learning strategies. As the year progressed, teachers appeared to have developed trust in their own ideas and observations and were more open to listening to experiences from teachers at other sites.

Use of Current Instructional Approaches**.** A second area of project impact was on teachers' knowledge and use of current research on learning and instruction. On the 2000 Summer Institute instructional practice inventory, teachers characterized their pre-MSA teaching as primarily teacher centered, teacher led and teacher driven. Work sessions during the Summer Institute and throughout the school year focused on introducing teachers to student centered instructional strategies, and aimed to help teachers incorporate strategies and philosophies such as Socratic questioning, middle-school theory, and needs-based assessments of students into their instructional repertoire.

However, this was an experienced group of teachers, with well-established teaching preferences and patterns. As such, there was some reluctance initially to try different instructional approaches, including cooperative learning groups, group projects and more student-centered assignments. As the school year progressed, a willingness to try new approaches and ideas was endorsed quickly by some MSA teachers and more slowly by others. The comments below highlight teacher's responses to using innovative and varied instructional techniques.

> MSA assists in the honing of teaching skills as well as being a source of additional techniques from which to select and implement. In general, MSA extends my networking range without having to experiment and fail as often.

> I've always attempted different strategies in my teaching. Every group of students seems to require different strategies based on their prior knowledge, experiences and interests. MSA allowed me to continue experimenting and discovering what may or may not work. There are a few new strategies, including cooperative learning and group work that I have incorporated into my teaching from MSA.

Table 4 below displays teachers responses to questions about how they guide and facilitate learning. In general, teachers viewed themselves as providing a great deal of individualization and assistance to students in support of their learning.

Table 4
Guiding and Facilitating Learning (n=12).

Please answer the following statements based on your participation in MSA:	Mean (SD)
I focus and support inquiry as I interact with my students.	4.1 (0.2)
I orchestrate discourse among students about ideas.	3.7 (0.2)
I challenge students to take responsibility for their learning and to work collaboratively.	4.4 (0.1)
I recognize and respond to student diversity and encourage all students to participate fully in learning.	4.8 (0.1)
I encourage and model the skills of inquiry as well as curiosity, openness to new ideas, and skepticism that characterize continuous learning.	4.5 (0.1)

Note. Scale: 1=never, 3=sometimes, 5=always, NA=Not applicable.

A survey question asked teachers the extent to which MSA participation changed their approaches to guiding and facilitating student learning. Teachers reported only a moderate change in their practices based on MSA work (mean: 3.8, sd 0.3, scale: 1-5). Classroom observations at the 3 sites suggest there were varying levels of "innovativeness" in different classrooms. Many of the innovative instructional techniques teachers reported trying focused on group work and collaboration between students. Observations further suggest that in many instances, teachers are still learning how to best manage and facilitate student learning in group settings. The comments below highlight teachers ideas about what "reforming" instructional practices looks like in MSA classrooms.

> My classroom arrangement allows for more group/cooperative work, as opposed to having rows. I now ask students to discuss ideas with a partner much more often throughout the course of a lesson. Students use individual dry erase boards to write and share ideas with the class. I include more interactive activities in my teaching.

> I involve my students in working in a more cooperative learning environment. Also, more technology, in conjunction with research for projects and class work, is used.

> I have tried different ways of organizing my classroom to better meet the needs of groups of students and to support more interactive and collective lessons.

The following is an excerpt from a cooperative learning activity we observed during one of our site visits to a science classroom. It highlights one teacher's experience using a new teaching strategy, and demonstrates how and in what ways the MSA professional development model is impacting teachers and their teaching practices.

March, 2001: Learning about Cells.

As we enter the classroom, student desks are clustered in groups of 4 or 5. The teacher comments that this is the first time the"jigsaw" cooperative learning approach will be used, where students are assigned specific responsibilities in a learning situation (recorder, reader, encourager, counter and reader), and each student has a role in contributing to researching information on cells. The teacher then distributes cards and blank information sheets to students with questions about cells and their characteristics. Each student is responsible for contributing information to the group- one student reads the questions, another searches for information, one student facilitates the discussion to ensure that consensus is reached on the answer, one student records the answer and the fifth student reports the groups' findings to the class. The jobs rotate after completion of 3 questions, so that each student has an opportunity to function in each of the cooperative roles.

Students work industriously for approximately 25 minutes. They are focused, on task and are using scientific terminology and vocabulary. Words like "mitosis, cell walls and membranes" are floating around the room, into the conversation. The following conversation illustrates the kind of conversation students engage in while learning about cells.

> S1: Ok, here it says that when the cell changes then that's the part about the theory of the cells.
>
> S2: Well, I have the theory question.
>
> S1: Why is the cell theory called a theory?
>
> S3: Are you still trying to answer that question?
>
> S1: Well, we know that cells are the basic unit of life.
>
> S2: So you're asking what DNA is, right?
>
> S1: It says DNA is the center of the cell that controls what happens in the human body. It's like a blueprint or something for "replication", whatever that means.

The teacher and mentor circulate quietly throughout the room, answering questions and helping students to stay focused on the task. Unfortunately, the bell rings before the teacher can bring students back to share their "research" findings. As she

comments in a later interview: “My plan was to have them (students) come back together and disseminate the info they had discovered and recorded during their investigation today. We just ran out of time.”

This was the first time the teacher had used the jigsaw coopertative learning arrangement for studying cells and their structures. The teacher was simultaneously encouraged by student interest and performance in the task and discouraged by what she viewed as an assignment that “overloaded the students with information”. Each card contained more than 15 questions to be researched and reported. After careful analysis, the task seemed somewhat overwhelming to the teacher (and she believes to the students). Next time she commented, “I think I’ll really pare down the amount of information presented on each card, to make the task more manageable for students.”

In a subsequent conversation, the mentor present during the learning activity noted that this teacher had previously experimented with cooperative learning, primarily for project work. But there were problems with students not “pulling their weight” or simply not being present in class to the their part of the job. For the learning activity we observed today, the teacher wanted to ensure that each student would participate and contribute to the group. Her goal was to ensure that “each student does something. I don’t want to see them goofing off, not paying attention.”

That objective led to the teacher to experiment with a different type of cooperative learning activity, in this instance, the “jigsaw” approach. Mentors modeled the “jigsaw” concept at the Summer Institute and other MSA work sessions, which focuses on student interaction with each other and not on the creation or development of a final product. Each student plays an important role in the research or learning process, and is required to verbalize or share and explain the information orally. Each student’s contribution is necessary for successful completion of the assignment (C.H. Brown, personal correspondence, 9/11/01). As such, the classroom teacher believed that this approach would lend itself to learning new material, by making sure that each student was responsible for contributing in the learning setting.

This classroom example highlights the way or ways in which MSA functions as a model for teacher professional development. Teachers learn a new instructional approach and the theory behind it, implement it in their classroom, “debrief” the concept with the mentor at the conclusion of the lesson, and then refine the instructional approach, lesson structure or strategy for future lessons. By following this iterative process for refining teaching practices, teachers are engaged in a learning process that is experiential in nature.

Types of assignments, activities and assessments**.** Many teachers reported that MSA had an impact on the types of assignments and activities they utilized in their classrooms. Work during the Summer Institute and follow-up sessions with project mentors highlighted the importance of providing a wide variety of learning settings and opportunities for students, in particular to provide learning settings in which students were involved with generative learning experiences. Teachers also were encouraged to experiment with project-based approaches to teaching and learning.

Teacher comments about this change in the nature student work focused on the difficulty of moving from a teacher-centered classroom to a student-centered classroom.

> I still have a hard time letting go of the teacher driven instruction. I have to learn to be more of a facilitator.

> MSA has given me more tools (methodology and technology) to facilitate more interactive and creative lessons, but it's a slow process.

> My students now work in groups that collaborate, but I'm not sure what they are learning. I need to learn more about how to monitor student work and learning in these group settings.

The use of varied assessment strategies (including rubrics and performance assessments) to better understand student learning was addressed during the first year of MSA, but it was not a strong focus. Still, many teachers made the connection between assessment and instruction. They realized the importance of aligning assessments with the activities in which students were engaged. Teachers began to understand that their "old" or traditional methods of assessing student learning were limited in the kinds of information about student learning that could be gleaned from these tasks. Teachers noted:

> I have learned that paper/pencil assessments alone are not adequate to get the full picture of what students know. I have tried more performance-based assessments and team tests this year.

> I have learned to ask myself why I'm teaching what I'm teaching and get more relevant information out of the assessments I use with/for my students.

> I have now begun to implement the use of rubrics. I had not been using them before. I am also using more performance-based assessments. Graphic organizers have also become part of my assessments.

Another change for MSA teachers occurred in the nature of assignments teachers developed for instruction in their content areas. At the 2000 Summer Institute, each site team of teachers developed a thematic, multidisciplinary unit entitled “Who I Am”. Table 5 below outlines the basic format for this thematic unit.

Table 5
MSA Multidisciplinary Unit: Who am I?

	Week 1 Self	**Week 2 Family & Home**	**Week 3 School**	**Week 4 Community**	**Week 5 Culmination**
Social Studies	"It's your world": ethnicity, race, native component		Meeting of 2 Worlds: Informal vs. Formal Schooling		Local History
Language Arts	Autobiography: focus on writing process				
Math	Measurement and Graphing		Mapping school campus, scale drawings, ratio/proportion		Timelines using info from social studies
Science	Body Systems	Cells and Genetics	Ecosystems around the school	Water quality testing, plant and animal surveys	

Teacher response to the thematic unit was mixed. Some teachers reported that it helped to focus instruction during the first 3-5 weeks of school, while others saw this as a "forced situation" to try to meet the needs and interests of all 3 MSA sites. Some teachers noted that what was most important about the interdisciplinary units were the thought processes they came to understand as interconnected in the curriculum, rather than the content of the units themselves.

> I was concerned about the development of a scientific component in my social studies class-especially 1st semester. Second semester I learned that it was the thought process, and the analyses that should be cultivated. Those processes are what tie the content areas together. I was already doing that in my classes-whew!

> In my language arts class, I have tried to instill in students that science is all around them, and want to make them better observers, and through that observation process, better writers.

One social studies teacher who implemented the thematic lesson was particularly enthusiastic about the unit. He used information students gathered in research on their families to guide students on a "field trip" of their town. Students were fascinated and inspired to learn as they looked at their familiar surroundings from a historical perspective. In the context of the multidisciplinary unit, they were able to gain a deeper understanding and appreciation of "who they are" in a community that has been inhabited for 400 years.

Absent from these thematic units was team teaching and/or a more natural connection of the content areas to one another. For example, when students were researching their family history, the documents they generated and produced were not used in another content area, such as math (where an opportunity to explore statistics and probability could naturally arise) or in science (where a discussion of genetics, dominant and recessive genes in the realm of disease, physical characteristics, etc.) could have conceivably arisen. However, this type of cross-curricular integration requires time, experience and exposure to successful implementation to develop, so it should not come as a surprise that teachers' first attempts at thematic instruction were limited in impact.

The development and implementation of a thematic unit offered certain advantages to MSA members– for example, because of planing together, teachers knew the area of focus for each of the related content areas, and in limited instances, groups "shared information". However, the thematic unit failed to create the rich opportunities for cross-curricular learning and instruction that mentors had envisioned. In fact, the unit had almost the opposite effect, of creating the impression that a specific "unit" had to be followed, regardless of whether it worked or not.

This is another example of how the MSA project evolved this year to a more clearly envisioned model for professional development. Teachers and mentors realized after the initial interdisciplinary unit experience that a thematic curriculum was not the only aspect or approach needed to strengthen instructional practices and student learning, but rather an important strand in successful, on-going professional development. The inclusion of thematic units and multidisciplinary studies is one of many critical components of the MSA model for professional development, but is not nor should it be, the project's exclusive focus.

Standards-based Instruction. The final area in which teachers reported project impact was standards-based instruction. Between August 1996 and August 1997, New Mexico adopted new standards for science, mathematics, social studies and language arts. Copies of the state standards and benchmarks and how to use standards-based instruction were presented to MSA teachers through a series of workshops and demonstration lessons. But as researchers have reported on the introduction of standards-based instruction (e.g., Linda Darling-Hammond 1996, "Restructuring Schools for High Performance", 1996), providing standards and benchmarks to teachers is merely the first step in a multi-year process for aligning curriculum with standards and benchmarks. Combine the need for time or"hatching understandings" with many districts' continued use of curricula not aligned with more rigorous standards and benchmarks (in some instances because the materials have not yet been developed, and in other cases, because

of limited financial resources to purchase new materials), the likelihood and prevalence of teachers fully understanding and fully implementing standards-based instruction is very low.

With support, however, teachers are more likely to align their instruction with standards and benchmarks. MSA provided teachers with the first step, the support, in moving towards standards-based instruction. During the Summer Institute and throughout the school year, MSA teachers spent a great deal of time reviewing and discussing specific standards and benchmarks. This activity had the combined effect of helping teachers develop fluency with the terminology of standards-based instruction and the instructional sequence outlined in the frameworks, and making clear the goals and expectations for each of the content areas.

Teachers designed curriculum to support these content area standards and benchmarks. Additionally, MSA mentors modeled lessons that embodied standards-based instruction. Principals also noted the presence and influence of standards and benchmarks in instruction.

> My " classroom walks" (a 5-minute observation of instruction) indicates that content standards and benchmarks are being addressed, and that students really know what they're doing and why they are doing it.

> When I ask students which standard or benchmark they are working on during a particular lesson, they can tell me. It's important for them to have that understanding, I think.

What the impact of having students articulate the standards or benchmarks a particular lesson addressed actually means for student learning is still unfolding. Suffice it to say that teachers are beginning the process of understanding standards-based instruction and how to implement it, but there is much work to be done.

Project effects on teachers. MSA teachers rated the project effectiveness along a number of different dimensions. Teachers reported that the project was "moderately effective" in achieving many of the program's goals. Below, Table 6 displays teachers' ideas about MSA effectiveness.

Table 6
MSA Effectiveness (n=12).

How effective was MSA in the following areas	Mean (SD)
Familiarizing you with standards-based instruction	3.9 (0.3)
Developing your knowledge of state frameworks for content areas	3.9 (0.3)

	Helping you develop interdisciplinary curriculum units	3.9 (0.3)
	Providing demonstration lessons that were meaningful and relevant to you and your students	3.7 (0.3)
	Sharing assessment strategies	3.8 (0.3)
	Informing/involving the community about MSA goals and objectives	3.5 (0.9)

Note: Scale-1=Not effective; 3=Somewhat Effective; 5=Highly Effective.

Effects on MSA students: standardized test results. Another source of data on project success was student achievement scores for MSA students on the CTBS/Terra Nova. Data were collected from all three sites for MSA students in 6th grade (prior to MSA) and in 7th grade. A comparison was made between student scores for the past two years, based on Normal Curve Equivalent Scores (NCE), which convert percentile scores to equal interval scales to allow for computation of means and standard deviations. At two of the sites, data for non-MSA students was unavailable because all 7th grade students were MSA participants. In these sites the analyses only included results for students for whom there were two years of data**.** An incomplete data set from the third site prohibited comparisons of MSA student scores to non-MSA student scores. At the third site, only individual scores were available for MSA students, and not their non-MSA peers, so comparisons of MSA students to their non-MSA peers were not possible. State-wide results and trends for all New Mexico students were likewise unavailable, so it is difficult to know to what extent a leveling off or decrease in test scores is typical of this age group (students transition from elementary school, 6th grade to middle school, 7th grade).

Tables 7 – 9 below shows the data from each of the three sites. Scores are reported for a language arts composite, reading composite, math composite, science, and social studies. As the scores indicate, there were no significant increases in scores for MSA students from 6th to 7th grade.

Table 7
School A MSA CTBS/NCE Scores (n=90).

NCE Scores (Normal Curve Equivalent)	**1999-2000 6th**	**2000-2001 7th**	**Change**	**S's score increase (%, range)**	**S's scores decrease (%, range)**	**No Change**
Reading Composite (includes reading comprehension, vocabulary)	36.8	39.5	+ 2.7	52/90 10 pts. (+1 to + 57)	31/90 9.2 pts. (- 1 to – 24)	6/90
Language Composite (includes usage and mechanics)	42.1	41.2	- 0.9	43/90 9.2 (+1 to +24)	44/90 10.5 (-1 to –33)	3/90
Math Composite (includes computation and problem solving)	38.7	34.2	-4.5	30/90 8.0 (+1 to 25)	57/90 11.1 (-1 to –44)	3/90
Total Composite (includes reading, language and math composites)	NA	NA	NA	NA	NA	NA
Science	39.5	40.2	+0.7	43/90 11.3 (+1 to + 30)	44/90 10.0 -1 to –29)	3/90
Social Studies	40.6	39.3	-1.3	40/90 10.2 (+1 to +20)	45/90 11.2 (-1 to –38)	5/90

Note: Scores for 10 students were omitted from sample, due to incomplete data sets.

Table 8
School B MSA CTBS/NCE Scores (n=17).

NCE Scores (Normal Curve Equivalent)	**1999-2000 6th**	**2000-2001 7th**	**Change**	**Number S's score increase (range)**	**Number S's scores decrease (range)**
Reading Composite (includes reading comprehension, vocabulary)	50.2	47.2	- 3.0	10/18 6.9 pts. (+3 to +14)	8/18 8.9 pts. (-3 to –14)
Language Composite (includes usage and mechanics)	53	47	-6.0	4/18 11.5 pts. (+1 to +29)	14/18 11 pts. (-5 to –20)
Math Composite (includes computation and	50.1	44.2	-5.9	5/18 4.8 pts.	13/18

problem solving)				(+3 to +8)	10.1 pts. (-1 to –27)
Total Composite (includes reading, language and math composites)	51.2	46.1	-5.1	3/18 1 pt. (0 to +1)	15/18 6.9 pts. (-5 to –14)
Science	54.6	51	-3.6	7/18 4.9 pts. (+2 to +13)	11/18 9 pts. (- 3 to – 29)
Social Studies	51.5	53	+1.5	7/17 12.6 pts. (+10 to +18)	10/17 8.4 pts. (-3 to – 19)

Table 9
School C MSA CTBS/NCE Scores (n=30).

NCE Scores (Normal Curve Equivalent)	1999-2000 6th	2000-2001 7th	Change	Number S's score increase (range)	Number S's scores decrease (range)
Reading Composite (includes reading comprehension, vocabulary)	44.1	46.1	+2.0	NA	NA
Language Composite (includes usage and mechanics)	49.3	47.7	-1.6	NA	NA
Math Composite (includes computation and problem solving)	51.2	50.9	-0.3	NA	NA
Total Composite (includes reading, language and math composites)	48.2	48.2	0	NA	NA
Science	50.1	49.5	0.6	NA	NA
Social Studies	50.8	49.7	-1.1	NA	NA

Results from standardized achievement tests (CTBS Terra Nova) reveal no significant increase in scores or only a minimal increase of students' test scores in all subject areas.

A number of caveats about the validity of using standardized tests as a measure of program impact should be mentioned. First, MSA is a new project and as such, it will take time to see the results in test scores. Second, standardized tests have come under criticism for not being generally sensitive to instructional changes nor are they well aligned with what teachers are teaching and the standards to which teachers and schools are being held accountable. Finally, quality implementation of project goals requires complete teacher buy-in and time to learn new techniques and incorporate them effectively into the teaching and learning process. High quality implementation of new

strategies is required before significant changes in student learning can be expected, in particular on a general measure of student achievement, such as a standardized test.

Teacher and administrator comments echo some of these concerns: For example**,** some administrators were not surprised at the lack of significant improvement in test scores. One principal commented:

> There's a stronger instructional focus in MSA classrooms, in particular in the areas of critical thinking. Now I know that (critical thinking) won't show up as improvement on our standardized tests-more than likely there will be a drop in scores. Inclusion of the release items in class work seems important, like a positive.

MSA teachers also were dismayed at the lack of correspondence between the curriculum they taught during the year and what was tested on the standardized achievement tests. This was particularly true for one science teacher, who reported:

> I was so incredibly disappointed by the CTBS this year. My students have worked so hard and learned so much and none of what we covered in our curriculum this year was emphasized on the test. None of it! It's so discouraging to have this happen.

Effects on MSA students: other evidence. There is some anecdotal evidence that MSA students learned more about certain curricular areas than their non-MSA peers did. Further, based on classroom observations and reports from teachers, mentors and administrators, MSA students did develop clear understandings of standards and benchmarks, had opportunities to work collaboratively with their peers, and received on-going support and assistance from their MSA teachers when more rigid standards for performance and behavior were implemented in their classrooms.

Data from a MSA mentor created student survey indicate that students' overall affect towards math, science and school was moderately positive (see Table 10 below). Student ratings varied widely in response to the questions: for example, the range of responses to question #1 (I like my science class this year better than last year) was 1 to 5, with a fairly even distribution of scores. A comparison of MSA student affect to their non-MSA peers is an important data source and will be pursued in subsequent years of the project.

Table 10
MSA Student Survey (n=195).

	Please read each statement and respond carefully.	Mean (SD)
	I like my science class this year better than last year.	3.3 (1.3)

	I am learning a lot of science this year.	3.8 (1.3)
	I like the types of activities we do in science.	3.9 (1.2)
	I look forward to my science class.	3.2 (1.3)
	I am learning a lot of math this year.	4.4 (0.8)
	Math is more than doing problems from a book.	4.2 (1.1)
	I look forward to my math class.	3.6 (1.2)
	I feel positive about school this year.	3.7 (1.3)

Note. Scale: 1= disagree strongly, 2 = disagree somewhat, 3 = no opinion, 4 = agree somewhat, 5 = strongly agree.

Effects on MSA parents. Information in this section comes from a parent survey (with a limited sample size) conducted by MSA mentors, from conversations between project members and parents, and parent attendance of MSA events. Table 11 below displays results from a parent survey created by MSA mentors at one of the MSA sites. Survey data were not collected from parents at the other two MSA sites.

Table 11
MSA Parent Survey (n=11).

	Please read each statement and respond carefully.	Mean (SD)
	My child has shown improvement in performance in his/her math class.	3.5 (0.4)
	My child has shown increased understanding of math concepts in his/her math class.	3.5 (0.5)
	My child is learning a lot of math this year.	4.2 (0.3)
	My child likes the types of activities he/she does in science.	3.7 (0.4)
	Learning about science is important to my child's life	4.1 (0.4)
	My child enjoys working in cooperative groups	3.8 (0.3)
	My child has noted a positive difference in the approach to teaching that his/her core area (English, Math Social Studies, and Science) teachers are using this year compared to last year.	3.9 (0.3)
	I have noticed a significant difference in the learning that my child has been able to acquire this school year.	4.1 (0.2)

Note. Scale: 1= disagree strongly, 2 = disagree somewhat, 3 = no opinion, 4 = agree somewhat, 5 = strongly agree.

In addition to the parent data survey, we collected informal conversations with parents and teachers, and used attendance at MSA school-sponsored events as an indication of parent involvement and awareness of MSA. At one MSA site, parent turnout for school functions is typically around 25% of the population. For the MSA sponsored evening events this year – MSA Open House, Star Gazing Night, and Science Night, approximately 75% of the parents attended.

MSA teachers dedicated more time to meeting and conferencing with parents during this first year of the project. Teachers reported meeting with parents in record numbers this year. At one site, failing grades for MSA students were high (20 % higher than for non-MSA students), thus warranting and necessitating in increase in parent/teacher conferences. One teacher cited "increased parent contact due to MSA program" as a major program accomplishment during the first year of the program.

Informal conversations between parents and teachers, in school hallways and at school events, included many positive comments about MSA and its impact on students. One parent commented to an MSA mentor:

> You know, I'm so glad you are here this year doing work with MSA. It's really making a difference for my child. He is doing his homework and really likes what's happening in science.

> There's so much more working together and you know, he's so shy. But in these science groups he really has a chance to show what he knows.

Future plans for MSA will include the collection of more in-depth information about parents' perceptions and reactions to the project.

Effects on mentors. MSA mentors are an integral component of the project. As mentioned earlier in this report, one of the project mentors left MSA in mid-March for personal reasons. A second project mentor was not hired until June 2001. And while a great deal of project work was accomplished after the original mentor's departure, the absence of a key project leader impacted the degree to which MSA was implemented at various sites. What follows are one mentor's reflections on her growth as a professional during the pilot year of the project, and what she viewed as project achievements and challenges.

"This past year was a time of discovering what 'continuing professional development' and 'on-going support' really meant. The project started off the year with a vision and framework that belonged to someone else. There was very little time to understand it fully before implementing it, and actually transforming it into our own vision. Over this past year, I re-discovered that providing professional development on a certain topic does not ensure that the participants full understanding, nor does it ensure that the participants will implement what they have learned in their classroom."

The mentor teacher continued: "Conversations with some of the 2nd year teachers has been very encouraging, because of their attitude to some parts of our goals last year, such as cooperative learning, and because of the way they talk about these things. It is almost as if they were in an incubation period for most of last year, and they are 'hatching', if you can understand my analogy. It is still difficult, but they are much more comfortable with the ideas, and not as apprehensive about trying it out."

The challenges faced were by mentor/s included, but were not limited to: 1) starting the project with someone else's vision; 2) limited support in the area of assessment; 3) loss of mentor/partner in March; 4) limited participation by the project coordinator; 4) uncertainty about funding for the program; 5) physical demands of travel; 6) convincing the people "up the line" that it takes time to get results, and that premature expansion would harm the program integrity; and finally 7) impatience with some of the teachers' reluctance to buy into the program.

Principals' views of MSA effects. Principals and district administrators (Superintendents and Assistant Superintendent) were interviewed on several occasions about their knowledge of MSA and their perceptions of project impact on teachers and

students. Overall, principals were impressed with MSA, with teachers' commitment to the project and with the kinds of instruction they observed students engaging in. District administrators were likewise impressed, and viewed the project as a positive experience for the students in their districts.

MSA principals were generally supportive of the project. One principal told us that MSA was "much more intense" than originally anticipated. Teachers were seen as having "really embraced the project". This principal noted MSA's strong emphasis on content standards and benchmarks, and remarked on the impact of this focus.

> This project (MSA) has made my job easier as a principal because I have a better way of understanding the work teachers are accomplishing and the progress students are making.

Further, another principal observed a cohesive team approach to teaching that developed at her site, something previously unknown. The principal viewed teachers as really using their planning time constructively. Teachers were not just engaged in "mitote" (malicious, hurtful gossip). They were engaged in real, meaningful dialogue that focused on teaching and learning.

At another site, the principal told us that the interdisciplinary units teachers created were a positive aspect of MSA. The unit helped teachers to begin "talking and collaborating". The principal also reported MSA project impact on classroom management, in that teachers' had clearer ideas about how to manage students' behavior in a more positive, constructive manner. Further, she found a stronger instructional focus in MSA classrooms, in particular in the areas of critical thinking.

At this site, the principal also commented on the emergence of a strong team spirit. "The dynamics of the group is good – you can sense their support of each other and the work they are trying to accomplish", she commented. "It took them a while to get there. They had some obstacles to overcome."

The principal reported MSA impact was on the area of the school's instructional leadership. In the past, principals functioned as instructional leaders at schools. But with heavy administrative and disciplinary responsibilities, principals simply don't have time to visit classrooms and observe instruction on a regular basis. Prior to MSA, when principals did visit classrooms, teachers often viewed principals presence as punitive- "they're sort of afraid of us being in the classroom, because traditionally, classroom visits have meant sanctions or probation of some variety." But this year, after the introduction of MSA, principal visits were welcomed by the MSA teachers and students. One principal commented: "Students and teachers want to show me what is happening, what they are learning."

Finally, one of the biggest changes observed by principals was in general attitudes of MSA teachers.

> I've seen our MSA staff move away from the attitude of "here's a problem, give me a solution" to a model of them (the teachers) brainstorming a problem and coming to me with a set of possible solutions. That's a big change. Teachers are modeling a behavior and approach we'd like to see our students employ.

Principals noted some barriers to project success. One principal told us that at times, MSA teachers were frustrated and had encountered "more a than few bumps in the road". She reported a great deal of initial confusion about payment of the stipend for the project. This principal saw the stipend issue as having long term repercussions: project credibility was damaged, progress was hindered, and to a certain extent, teachers were demoralized. She commented: "Imagine devoting a significant portion of your summer and then not receiving compensation for that work. That issue really impacted teachers' trust".

Another issue, reported by the principal at one site was that of technology, specifically, who was responsible for providing the technology and who had access to it. At this site, a great deal of time was lost getting the technology in place. This principal's impression was that "things really started clicking in January, after the technology was in place" for MSA teachers at her site. A final comment from this principal about the type of administrative support necessary for project success is also important to remember for future years of MSA:

> For the future, I think it's important that, in addition to the stipends that teachers receive, the district and administrators do more to acknowledge the work and commitment MSA teachers have made to improve student learning.

Early in the project, principals reported that there were some feelings of animosity about the presence of MSA at the middle schools. It appeared as though the MSA team of teachers got computers, extra field trips and recognition "just for showing up". There was little realization of the time, energy and commitment MSA teachers made to the project. Principals also suggested that the project carefully consider how to strengthen communication about the program, so that "everyone knows and understands more clearly what the project involves".

Superintendents' views of MSA. Superintendents were interviewed about their impressions of MSA. In general, they were positive about the project and the impact

MSA had on teachers and students. Excerpts from two of those interviews are transcribed below.

Superintendent 1. "We've had really good reports on MSA here at the District office. We have a number of challenges here in our schools, because of the small size and limited number of teachers. We are forced to "share the wealth". That means that teachers have to move around and teach different grade levels and different subjects. I know that has created some conflict for the MSA teachers, but it (moving teachers) is really our only option".

Superintendent 2. "NNMCEE and its MSA project are doing good work. The feed-back I've been receiving about the program is really positive. It's an exciting program for teachers, students and parents. There has been a high level of participation from all those groups. At the MSA Science Night, we were all really impressed with the student presentations. The students showed a lot of energy and enthusiasm for their work. I think MSA can help to transform our students into high achieving students."

". . . Sure there have been problems and more than a little bit of jealousy or competition. I've been asked: Why do those teachers and students (MSA members) get computers, take field trips, etc., and my child doesn't get to do that? It's really important though for people to understand the time and work these teachers have put into MSA. They've spent hours and hours of extra time and energy to work on this project. So I'm glad they're getting support and recognition from the community."

How did District Administrative Policies Impact MSA?

Data in this section of the report are generated from document reviews and interviews with MSA participants. Prior to the introduction of MSA at each of the three sites, district administrators signed a Memorandum of Agreement (MOA). These agreements outlined the roles and responsibilities the districts were required to comply with as a commitment to the project. Overall, because this was a voluntary project, that is, districts applied for privilege of participation in MSA, most district policies regarding MSA were positive and compatible with regard to support of program goals and objectives. A copy of the MOA signed by the districts can be found in Appendix H.

Project mentors did struggle with a number of issues relative to these MOA's and various district policies at different times throughout the school year. First, access to technology, in particular access to the wiring necessary to set-up and maintain Internet access, proved to problematic for MSA schools. This was a not a district policy problem

per se, but rather reflects the significant and continuing challenges these districts face (and ones that will continue to have an impact on MSA) because of their geographical circumstances and the status of the physical facilities at the sites. At one of the MSA sites, wiring of classrooms to support Internet access is still not in place at the writing of this report. Inadequate electrical systems and outdated classroom facilities have prevented installation of the systems, and other demands on the districts have taken priority over providing or updating services to MSA classrooms.

Second, adherence to the schedule requests in the MOA, specifically for a common planning time for teachers, and release time for meetings and from other school level responsibilities, proved to be problematic for districts. Again, this was not a specific "policy" that created difficulties for MSA members, but rather site level demands that created challenges to the MSA project. For instance, limited staff at one MSA site meant that teachers had to be pulled from their MSA classrooms and responsibilities to work in non-MSA classes, thereby decreasing or diminishing teachers common planning time and ability to meet with MSA colleagues and mentors.

And finally, district policies relative to the payment of stipends for travel and per diem caused some frustration for MSA teachers. Mentors also were drawn into the fray and had to spend valuable time in helping to solve these problems. Delays in processing of stipends, confusion regarding the use of district vehicles for travel to MSA professional development sessions and which activities specifically constituted MSA events all contributed to lessening MSA project impact.

At one of the sites, the processing of purchase orders had an impact on how and in what ways material resources were distributed to MSA members. While this situation was not specific to MSA alone, MSA teachers were impacted by a school level policy in the procurement process of goods and services. The principal at this school commented:

> The other real barrier to a project success relates to the "procurement" process. It's really hard for us to get stuff here. Our business manager orders items for teachers and sometimes that order sits on his/her desk for 6 months. How are teachers supposed to include more hands-on, interesting types of materials if the ordering process is so flawed? This isn't really an issue that relates specifically to MSA, but it does have an impact on the overall flow of goods in our school.

Conclusions and Refinements for the Future of MSA

In this section, we present, in summary form, the accomplishments and challenges faced by the Math and Science Academy during their pilot year. One of the primary accomplishments of MSA was the establishment of teacher cadres with a commitment to improving student learning at individual school sites. Accompanying these groups was

the development of on-going professional discourse around issues of learning and instruction. At the classroom level, we saw the beginnings of reform in teaching practices, with a definite move towards standards-based instruction and the use of instructional strategies and assessments in line with current research and theories of teaching and learning. As a result of collaboration with their colleagues, more rigorous standards and expectations for student performance, learning and behavior were articulated in MSA classrooms. A clearer sense of how and in what ways to best support, encourage and facilitate on-going professional development to project teachers emerged during this pilot year. Administrators expressed moderate levels of support for the project and its objectives, while parents were more generally supportive of project work, in spite of more rigorous standards for performance and behavior. Finally, a more well-defined theory of action or model for MSA evolved during the course of the year.

Some of the obstacles or barriers to success encountered by MSA members during this first year of the project were logistical. The lack of common planning time, or planning time being usurped for other purposes (such as parent conferences and other school commitments) made it difficult for MSA teachers to meet and collaborate during regular school hours. At one site, lack of coordination of student schedules or adhesion to the "family plan" by administrators lessened MSA impact on student learning and achievement. Another logistical concern was the perception of "entitlement" and special privileges being granted to MSA members from non-MSA staff created difficulties for MSA members and impacted teachers abilities to implement the program more fully. Second, geography, both within the school sites (geographically dispersed classrooms diminished the possibility of team teaching), and between the schools (long distance between the sites), making travel time-consuming for mentors and teachers, was another obstacle encountered by project members. And while administrators were generally supportive of MSA and its objectives, support was at times uneven. Lip service was paid to MSA goals, but at times there was insufficient "barrier removal" to allow MSA to grow and flourish. Simultaneously, schools faced multiple agendas for projects, rather than providing an exclusive, concentrated focus on MSA. Early in the project, there were conflicts regarding technology, stipends and transportation issues. The loss of an MSA mentor mid-stream in the project created a hole in leadership and caused an excessive workload for the remaining mentor. Some skepticism on part of participants as to the necessity and importance of on-going professional development, with initial reluctance to buy-in to MSA on the part of some teachers, was also apparent. Finally, community demands for traditional teaching, learning and assessments limited the extent to which teachers could implement wide-scale changes in their teaching and learning practices.

Perhaps the conclusion to this story is the MSA model for professional development has been refined and teachers are very positive about the project. Ten of the 12 original MSA teachers will continue with the project for the 2001-2002 school year (one teacher is returning to graduate school, and the second teacher changed to different content area and grade level). Mentors are beginning to see changes in teaching practices that may have an impact on future student achievement, when the new practices are implemented consistently (and with more attention to the quality of instruction) over the course of the year.

Obvious also is a clear need for measures that are more sensitive to project goals, and methods for more systematic assessment of growth in student knowledge and understandings. Alignment of project goals and objectives with measures that record and analyze the impact of various instructional strategies is critical to project success.

Recommendations

The recommendations that follow are organized around four central themes, topics that emerged as important areas of focus and concern in the three MSA school districts. At the writing of this report, many of these recommendations have already been implemented or are in the process of being implemented.

Professional Development

1) Continue to clarify the instructional principles guiding classroom coaching and mentoring. More systematically and thoroughly define model practices and consider how these intersect with the areas in which teachers want to refine their practices. As a step towards addressing this need, teachers and mentors have already developed an observation protocol to guide classroom observations and provide a common focus around which to provide instructional support and refinement.
2) Systematically phase in various reform elements, such as assessment strategies, cooperative learning approaches, and the like. Attempting to deal simultaneously with all elements of the project can be overwhelming for teachers.
3) Continue to refine cross-curricular teaching and learning opportunities. Look for units that lend themselves to a particular unit of study, and work to build interdisciplinary curriculum. Remember that it is not necessary to involve all 4 content areas (math, science, language arts, and social studies) simultaneously in a multidisciplinary unit.

4) Encourage teachers to visit classrooms more regularly with a specific purpose. Build observation time into the MSA teachers' schedules.
5) Provide more demonstration lessons to all teachers and/or include language arts and social studies mentors or specialists in the project.

Administrative Support and Policy

1) Invite principals, counselors, and district administrators to attend MSA meetings on a regular basis. Provide overview of project accomplishments and challenges to further strengthen program support and commitment to the project.
2) To the greatest extent possible, encourage districts and schools to honor teachers' time commitments to MSA by avoiding scheduling conflicts. This requires an increased level of communication and flexibility on the part of all participants with regard to MSA and its objectives.
3) Resolve the issue of transportation and stipends early in the school year to avoid conflicts and distrust of project administrators.

Logistics

1) Adhere to stipend and reimbursement schedule.
2) Consider how the project coordinator can more effectively work with districts, as a conduit of information between project members and school administration and as a means to resolve administrative and/or logistical issues.
3) Help schools to procure access to technology early in the school year, so that teachers and classrooms can correspond easily and share information more rapidly.
4) Consider how mentors can spend more time at each site, to focus more intensely on individual teachers and their practices.

Evaluation

1) Continue to support outside evaluation of the project to provide unbiased documentation of project accomplishments and pitfalls.
2) Develop a process for systematic data collection, at the classroom level and at the school level.
3) Work to assure that districts and schools honor their commitment to provide student level data. Consider whether districts/schools need additional technical assistance in this arena to more effectively understand project impact.

4) Investigate systems to help schools use data more effectively in making instructional and programmatic level decisions, and help schools to access assessment data that is sensitive to project goals and the standards being taught.

Conclusion

Recent studies have confirmed what many in education have always suspected: outside of home and family factors, teacher qualification and expertise account for approximately 40 percent of measurable variance in student test scores in math and reading across grades 1 through 11 (National Commission on Teaching and America's Future, 1996; Darling-Hammond, 1997a). Other studies point to teacher education as single most productive use of additional education dollars is to if the goal is to improve student learning (Greenwald, Hedges, and Laine, 1996).

The conclusion is clear: Knowledgeable, skilled teachers make the difference in student achievement. For reforms such as MSA to be successful, they must include standards-based learning, challenging curriculum and rigorous assessments. Further, teachers must be skilled to ensure successful reform implementation. Settings that foster and support teacher learning provide multiple opportunities for research and inquiry, multiple opportunities for trying out new ideas and approaches and for discussing and critiquing the results of this teaching and learning. In a report on teaching, Gary Fenstermacher wrote (1992):

> . . . it is more important than ever that teachers have the capacity to appraise their actions, evaluate their work, anticipate and control consequences, incorporate new theory and research into practice and possess the skills and understanding needed to explain their work to other teachers, to students and to parents . . . These reflective capacities are not innate to human beings, nor are they acquired quickly. They are not acquired during a planning period sandwiched somewhere in between classes, or during evening 'mini-courses' after a full day's work. They are, rather, the outcome of sustained and rigorous study and of dialogue and exchange with master teachers."

Refinements and revisions in MSA have been a feature of the project since its inception. Originally designed as an integrated curriculum project, the focus of MSA has evolved into a model for on-going professional development, with coaching or mentoring from expert teachers a key dimension. The Math and Science Academy model includes many of the professional development strategies proven to successfully improve teaching (Darling-Hammond and McLaughlin, 1995). Specifically, the MSA model has evolved to be:

- experiential in nature;
- theoretical, research driven;

- collaborative;
- oriented towards coaching, mentoring, and problem solving;
- sustained, intensive and on-going.

MSA has been refined from its original “develop integrated curriculum model”, to one that focuses on high-quality, on-going professional development around meaningful problems. Future years of the project are promising.