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# A Strategic Action Plan for Advancing Math and Science Education in New Mexico 2007-2010

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## A Strategic Action Plan for Advancing Math and Science Education in New Mexico 2007-2010

**Introduction:** We are at a time in our history when education in general, and math and science education in particular, are more important to our young people than ever before. Faced with stiff and increasing national and international competition at all levels, it is critically important for New Mexicans to do a much better job educating all children. National reports such as *Quality Counts*[1] have indicated that nothing less than the future economic and societal well-being of New Mexico is at stake. For example, the National Center for Public Policy and Higher Education has stated that the "educational level of New Mexico's workforce [is] projected to decline" and that the "income of residents would drop as a result"[2]. The 2007 *Diplomas Count*[3] report, along with the 2007 strategic plan from the New Mexico Workforce Solutions Department[4], link higher levels of education with increased earning power.

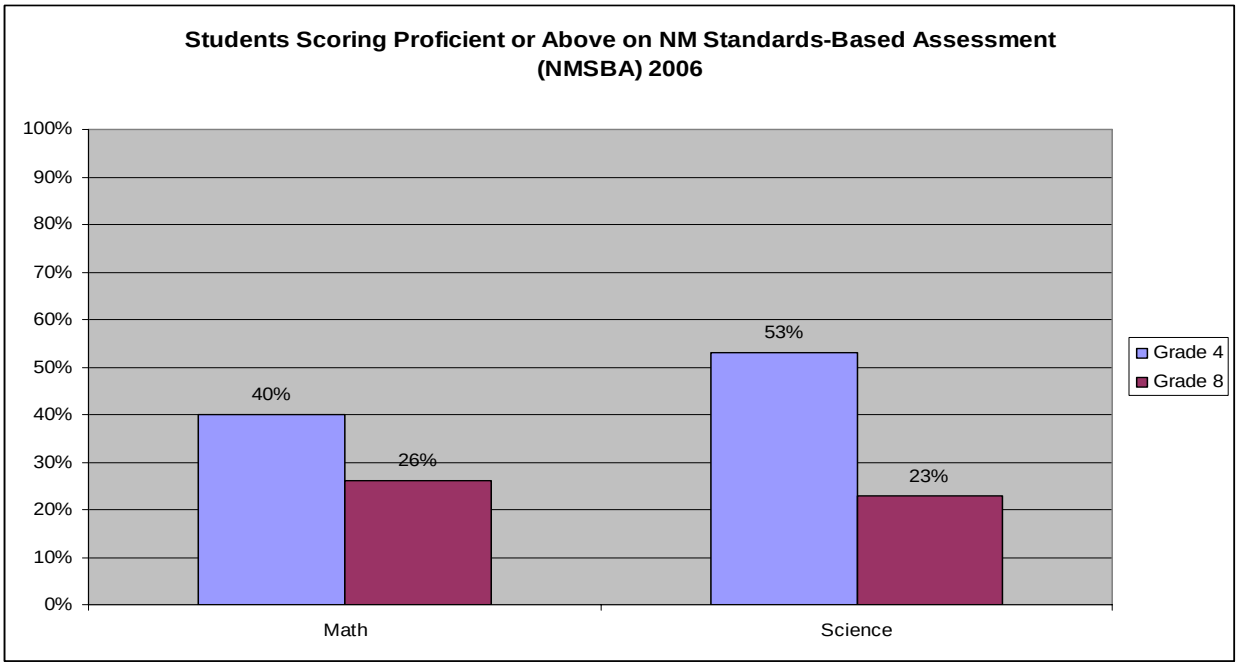
In November 2005 the New Mexico Partnership for Math and Science Education[5], in collaboration with New Mexico First[6], held a Town Hall on math and science education. Based on recommendations from that Town Hall, the Governor and State Legislature funded a Math and Science Bureau in the New Mexico Public Education Department. Education Secretary Veronica García created the bureau in July 2006 and appointed a Math and Science Advisory Committee (MSAC). Its first activity has been the creation of this Strategic Action Plan. It recommends a process of dramatic community-wide action to bring more rigor and relevance[7] into how we teach mathematics and science, and to improve our students' achievements in these areas. Success for our students is important for everyone because it enhances their future prospects as well as the economic health of communities across New Mexico.

**Where We Are Now:** New Mexico has **s**trong educational standards. The *New Mexico Science Content Standards, Benchmarks, and Performance Standards* have received an "A" from national groups, and those for math have received a "B." Our statewide tests for K–12 math and science education (New Mexico Standards-Based Assessments – NMSBA) are aligned to those standards. Also, the State has established seven goals for the Public Education system, all of which promote a strong math and science education[8]. However, student achievement is relatively low at all grade levels. In addition, the existing standards have not been implemented evenly across the state. Much information could be presented to show the breadth and depth of the problem, but we restrict ourselves to the sample shown in the tables on the next page.

These problems threaten the future prospects for our students as well as the well-being of our communities. Jobs in business and industry now require more skills and technical understanding than in the past. The general health of New Mexico's economy depends on having a workforce trained in science, technology, engineering and math (STEM[9]).

In 2007, the Executive and the legislature worked to enact the redesign of the high school education system, which includes implications for math and science education throughout the state.[10] In addition, the Executive is leading efforts to develop a Science and Technology Plan in which improved math and science education is supported by enhanced educational technologies (e.g. expanded access to broadband Internet, computer hardware and software, public television) that play a critical role.

Data from the NMSBA indicate the current level of student achievement.




- As shown in the graph above students do not show adequate proficiency in math and science (according to Federal law 100% of students must be proficient in math by 2014).
- Student performance declines from grades 4 to 8.

Additional causes for concern include:

- On the National Assessment of Educational Progress (NAEP) grade 8 tests in 2005, New Mexico ranked 49th in the nation in math and 47th in science[11].
- About half as many New Mexico students are proficient on NAEP math and science tests as in the nation as whole[12].
- In 2004 only 54% of graduating New Mexico high school students had taken Algebra 2 or its equivalent[13].
- About 49% of New Mexico high school graduates who attended New Mexico colleges had to take remedial math courses (Elementary Algebra or lower)[14].
- Current production of secondary math and science teachers in New Mexico is inadequate to meet the need for replacements due to attrition at a time when the numbers of math and science courses needed for graduation is being increased.[15]
- Less than 60% of New Mexico students graduate from high school in 4 years[16].

**Where We Want to Go:** We envision high levels of student achievement and interest in math and science, and a system that offers all New Mexicans opportunities to become well-informed, productive citizens. Realizing this vision will require collaboration among students, parents, educators, business and industry leaders, legislators, and government officials.

**How We Will Get There:** This Strategic Action Plan for Advancing Math and Science Education is an initial outline of strategies, actions, measures of progress, resources needed, timelines and responsible parties. The Plan focuses on these three main goals:

1. *Increasing student interest, participation, and achievement in math and science;*
2. *Raising public support and awareness of the importance of science and math to New Mexico's economic health and security; and*
3. *Establishing effective collaborations with internal and external partners.*

After the community has had a chance to study the Plan's recommendations carefully, coordinated efforts will be needed to implement them. Specific, more detailed estimates of needed resources and timelines will be developed. We expect this Strategic Action Plan to evolve with time as actions are completed and barriers are better understood.

## Strategic Action Plan Summary: Goals and Strategies

### Goal 1: *Increase student interest, participation, and achievement in math and science.*

**Strategies:**

- **1.1** Provide all students with challenging curricula, engaging instruction and aligned yearly and short-cycle assessments that encourage real world, inquiry-based problem solving.
- **1.2** Improve the initial pre-service preparation of math and science educators.
- **1.3** Strengthen the content and pedagogical knowledge, and leadership skills of math and science educators and administrators to transform instruction to improve student engagement and achievement.
- **1.4** Strengthen the involvement of the higher education community in preK-12 math and science education.

### Goal 2: *Raise public support and awareness of the importance of science and math to New Mexico's economic health and security.*

**Strategies:**

- **2.1** Create a marketing and media campaign to raise public understanding, interest and enthusiasm for math and science.
- **2.2** Establish an ongoing dialogue with business and industry on the relationship between workforce needs and preK – 20 math and science education.
- **2.3** Provide the Governor, legislators, PED executives, teacher union officials, regional educational cooperatives (RECs), and school boards with information on issues in math and science education: new programs, assessment results, required resources.
- **2.4** Develop family-friendly resources to help families, teachers, and school counselors make informed decisions about math and science education for children.
- **2.5** Recognize excellence in teaching and learning in mathematics and science.

### Goal 3: *Establish effective collaborations with internal and external partners.*

**Strategies:**

- **3.1** Identify existing and potential partners in efforts to improve math and science education.
- **3.2** Clarify and specify resources and strengths of partners.
- **3.3** Develop a plan for integrating partnership efforts to maximize effective use of resources and to facilitate beneficial change.

## Goal 1: *Increase student interest, participation, and achievement in math and science.*

### Measures of Progress:

1.a. Evidence of increased interest: increase in (1) enrollment in Science, Technology, Engineering and Math (STEM) degree programs; (2) participation in the Mathematics, Engineering and Science Achievement (NM MESA)[17] programs; (3) participation in math/science clubs and "science fairs", and (4) participation in non-formal science experiences.

1.b. Evidence of increased participation: 5% enrollment increase per year in (1) Grade 8 Algebra 1[18], (2) Advanced Placement (AP) math and science courses[19], (3) a 4th course beyond Algebra 2[20], and (4) a 4th science course[21].

1.c. Evidence of increased achievement: (1) a 5% increase per year in statewide proficiency rates on the New Mexico Math and Science *Standards-Based Assessments* (NMSBA), (2) a 10% increase every two years in students proficient in math and science as measured by the National Assessment Educational Progress (NAEP), (3) a 5% increase per year in the number of students scoring 3, 4 or 5 on math and science AP exams, (4) a 5% increase per year in ACT[22] scores in math and science, (5) a 5% increase per year in enrollment in College Algebra and Calculus, and (6) a 5% increase in completion of STEM degree programs.

1.d. Evidence of improved teacher content knowledge: Improved performance on math and science sections of the New Mexico Teacher Assessments (NMTA)[23].

1.e. Evidence in the increase of fully-licensed math and science teachers: Increase by 5% per year the number of fully-licensed secondary math and science teachers.

**Strategy 1.1** Provide all students with challenging curricula, engaging instruction and aligned yearly and short-cycle assessments that encourage real world, inquiry-based problem solving.

| Action | Resources Needed | Timeline | Responsible Parties |
|---|---|---|---|
| 1.1.1 Refine the existing New Mexico Math *Content Standards, Benchmarks and Performance Standards*[24]. Refine the alignment of the *New Mexico Standards-Based Assessments* (NMSBA) with the Math and Science *Standards*. | Grades 9-12 math alignment by Math Development Group[25]. Harcourt[26] provides some resources for alignment. | 9-12 Math by Oct. 1, 2007. Alignment with NMSBA is ongoing. | MSB staff[27]. McREL[28] American Diploma Project[29] |
| 1.1.2 Implement math and science curricula that are aligned with the *Standards* and the NMSBA, and which engage students by capitalizing on today's exciting frontiers in math and science, including efforts from the museums, zoos, aquaria, national labs, etc. [See for example the "Curriculum Guidelines" from the *Quality Mathematics Education Model* (QMEM) in Appendix A.] | Study of currently adopted materials. Implementation guides for most common "reform" curricula[30]. MSB, project and district funds. Identify web-based materials and public television programs. | Nov. 1, 2007. CM2[31] Nov. 1, 2007. Others Aug. 1, 2008. | MSB staff. McREL |

| | | | |
|---|---|---|---|
| 1.1.3 Develop science curriculum guidelines as a basis for a parallel *Quality Science Education Model (QSEM).* | Bureau, project and district funds. | Oct. 1, 2007. | MSB Science Specialist and Science Development Group[32]. |
| 1.1.4 Identify math curricular options that meet the *Standards* for the 4-unit math requirement for high school graduation. | Funds to pilot new programs like "Ramp Up to Algebra[33]", "I Can Learn", "Algebra Rescue" for students not ready for Algebra 1 in Grade 9. | 2008 Legislature. | MSB Math Specialist. |
| 1.1.5 Identify integrated science curricula[34] that meet the *Standards*. | Funds to pilot new integrated science programs. | 2008 Legislature. | MSB Science Specialist and Science Development Group. |
| 1.1.6 Develop guidelines for what constitutes a laboratory component for high school science courses to meet New Mexico statutory requirements [22.13-1.1.F(3)][35]. | National guidelines: NSTA, College Board, etc. | Fall 2008. | MSB Science Specialist and Science Development Group. |
| 1.1.7 Prepare a report comparing the use of math and science content specialist teachers in grades K-5 with generalist teachers supported by math and science coaches/mentors[36]. | Funding. | Fall 2008. | MSB staff. |
| 1.1.8 Identify math and science curricular resources for English language learners (ELL), special education students and students with large gaps in achievement. | Involve ELL and Special Ed experts in facilitating professional development efforts.<br>Study Response to Intervention[37] (RTI) efforts in the state, such as Math Recovery and Success Tracker. | Ongoing. | All professional development providers.<br><br>MSB staff. |

| **Strategy 1.2** Improve the initial pre-service preparation of math and science educators. | | | |
|---|---|---|---|
| **Action** | **Resources Needed** | **Timeline** | **Responsible Parties** |
| 1.2.1 Develop a common vision of the content knowledge and pedagogy that pre-service teachers need in order to be effective teachers of math and science. | Statewide meeting for Math[38].<br>Statewide meeting for Science. | May 2007.<br>May 2008. | Kristin Umland<br>Matt Nyman and MSB staff |
| 1.2.2 Make recommendations for how to revise the required math and science courses so that they lead to the development of a more profound understanding of fundamental math[39] and science concepts. | Funds to implement changes suggested as the result of 1.2.1. | 2008 and 2009 Legislature. | MSB staff, HED, higher education math and science departments. |
| 1.2.3 Incorporate the *Standards* and K-12 curricula that encourage inquiry-based problem solving into teacher preparation programs. | Partnership with Colleges of Education. | Fall 2009. | Colleges of Education. |
| 1.2.4 Given Actions 1.2.1 to 1.2.3, revise the *Competencies for Entry-Level Math and Science Teachers*[40], and the math and science sections of the *New Mexico Teacher Assessments* (NMTA). | Travel funds for meetings.<br><br>Information on NMTA contract. | 2007-2008.<br><br>2008-2009. | Educator Support Center MSB staff and Educator Quality Division (PED).<br>MSB staff and Educator Quality Division. |
| 1.2.5 Improve recruitment and retention of highly-qualified math and science pre-service teachers with diverse backgrounds. | Review of literature on recruitment and retention<br>Identify attrition rates in higher education institutions.. | Fall 2007. | Southwest Comprehensive Center (SWCC)[41]<br>MSB staff |
| 1.2.6 "Develop training and other requirements to support the use of unlicensed content-area experts as resources in classrooms, team teaching, on-line instruction, curriculum development, and other purposes." (SB 211, 2007) | Explora!, the Santa Fe Alliance for Science[42] and other interested entities. | Fall 2007 | Educator Quality Division |

| **Strategy 1.3** Strengthen the content and pedagogical knowledge, and leadership skills of math and science educators and administrators to transform instruction to improve student engagement and achievement. | | | |
|---|---|---|---|
| **Action** | **Resources Needed** | **Timeline** | **Responsible Parties** |
| 1.3.1 Help math and science educators remain abreast of developments in other states and countries. Disseminate "best practices" for math and science teaching and learning through professional development activities and web pages. | Travel funds to relevant conferences; webpage development. Continuing professional development funds. | Ongoing | MSB staff and other stakeholders. |
| 1.3.2 Increase collaboration among professional development leaders and build capacity statewide. Establish an annual meeting for professional developers in math and science education. Maintain a list of professional development providers. | Funds to bring in presenter. Personal invitations.<br><br>Updated list of professional development providers. | Nov. 1, 2007.<br><br>June 1, 2007. | MSB staff with ad hoc committee.<br><br>MSB staff. |
| 1.3.3 Implement the "Professional Development" and "Leadership" guidelines from the *Quality Mathematics Education Model* (QMEM) and the *State Professional Development Framework*[43]. | Continuing professional development funds. | Ongoing. | MSB staff and other stakeholders. |
| 1.3.4 Create "Professional Development" and "Leadership" guidelines for the *Quality Science Education Model* (QSEM) that is under development. | Funds for travel and substitutes. | Jan. 1, 2008. | State Science Specialist and the Science Development Group. |
| 1.3.5 Promote practices that help teachers, administrators and policy makers use data more effectively in making decisions. | Continuing professional development funds. | Ongoing. | MSB staff and other stakeholders. |
| 1.3.6 Integrate research on how to incorporate strategies for addressing language acquisition, special education and large gaps in achievement into professional development efforts. | Continuing professional development funds. | Ongoing. | MSB staff and SWCC. |
| 1.3.7 Identify key strategies for recruiting and retaining qualified, effective math and science teachers and supportive administrators. | Review of literature on recruitment and retention<br>Identify turnover rates in districts. | Fall 2007. | SWCC.<br>MSB staff. |
| 1.3.8 Develop concrete ways for districts to demonstrate that teachers are keeping up with changes in "knowledge in their content area and approved curricula" (*New Mexico Teacher Competencies*[44]). | Partnership with PED's Educator Quality Division. | Fall 2008. | MSB staff and other stakeholders. |
| 1.3.9 Coordinate with and advise school districts on the alignment of local math and science projects (e.g., legislative requests, locally funded, etc.) with this Strategic Action Plan. | A voluntary analysis tool of math and science projects. | Fall 2009. | MSB staff. |

| **Strategy 1.4** Strengthen the involvement of the higher education community in preK-12 math and science education. | | | |
|---|---|---|---|
| **Action** | **Resources Needed** | **Timeline** | **Responsible Parties** |
| 1.4.1 Develop a statement on how STEM faculty involvement in K-12 education efforts could be fully recognized in higher education tenure, promotion and salary decisions. | Copies of current tenure, promotion and salary policies. | Aug. 1, 2008. | Higher education representatives on the MSAC[45]. |
| 1.4.2 Propose sustainable ways to include K-12 math and science teacher professional development programs in higher education funding. | Collaboration with the Higher Education Department and the Legislative Finance Committee. | 2009 legislative session. | MSB staff. |
| 1.4.3 Build on existing efforts in institutions of higher education to improve cross-college and cross-department collaboration in teacher education programs. | Inventory of current efforts. | Ongoing. | MSB staff and higher education representatives on the MSAC. |

**Goal 2:** ***Raise public support and awareness of the importance of science and math to New Mexico's economic health and security.***

**Measures of Progress:**

2.a. Number, duration, and timing of press and other promotions (TV, radio, newspaper) that have appeared.
2.b. Increased awareness (by stakeholder groups) as measured by surveys.
2.c. Amount of public and private money raised to support marketing and media campaign.
2.d. Number of bilingual print materials produced and disseminated.
2.e. Number of regional meetings on this Strategic Action Plan as it continuously evolves.
2.f. Number of hits, registrations, and other measures of use of the PED Math and Science website.
2.g. Number of exhibits and participants at "Math and Science Days"[46] (see 2.5.3).
2.h. Increased media coverage of math and science awards and recognition programs.
2.i. Increased attendance by community leaders at math and science award presentations.
2.j. Increased level of engagement of the business and professional scientific communities.

**Strategy 2.1** Create a marketing and media campaign to raise public understanding, interest and enthusiasm for math and science.

| Action | Resources Needed | Timeline | Responsible Parties |
|---|---|---|---|
| 2.1.1 Seek input from stakeholders as a basis for creating the Public Relations (PR) program. | PR firm and start-up funding.<br>Stakeholder focus group.<br>MSAC PR Subcommittee half-day meeting.<br>Meeting coordination (logistics and funding).<br>Non-MSB PED staff time.<br>Corporate contact list.<br>Non-MSB PED staff time.<br>Link to 3.3.<br>Private and state money to fund campaign.<br>NM Science and Technology Plan (Tom Bowles) | Nov. 1, 2007 | MSB staff and MSAC subcommittee. |
| 2.1.2 Seek advice from public relations professionals on how to conduct an effective marketing and media campaign. | | | MSB staff.<br>PR Firm. |
| 2.1.3 Communicate and coordinate a consistent theme and message, and identify pathways for continued stakeholder contributions. | | Ongoing | MSB staff and MSAC subcommittee. |
| 2.1.4 Develop a proposal and documentation for a media campaign (in commercial and public radio and television). | | Dec. 15, 2007 | MSB staff & MSAC.<br>PR firm. |
| 2.1.5 Find local and state-wide champions to support/fund marketing and media campaign. | | Dec. 15, 2007 | Ed Spivak. |
| 2.1.6 Find explicit ways to involve the Governor, the State Secretary of Education and State Legislators in this PR campaign. | | Dec. 15, 2007 | MSB staff. |

| **Strategy 2.2** Establish an ongoing dialogue with business and industry on the relationship between workforce needs and preK – 20 math and science education. | | | |
|---|---|---|---|
| **Action** | **Resources Needed** | **Timeline** | **Responsible Parties** |
| 2.2.1 Establish a contact list of business and industry leaders, and name an external steward to facilitate this dialogue. | Business Roundtable (NMBREE)[47] and Association of Commerce and Industry (ACI)[48]. | Name steward ASAP<br>Ongoing. | MSAC person and MSB staff. |
| 2.2.2 Establish dialogue with Chambers of Commerce and other business leaders to understand workforce needs. | Access. | Ongoing. | MSAC external steward. |
| 2.2.3 Share with business and industry the efforts to improve math and science education, and the challenges facing educators. | Power point presentation and brochure. | Ongoing. | MSAC external steward and MSB staff. |

| **Strategy 2.3** Provide the Governor, legislators, PED executives, teacher union officials, regional educational cooperatives (RECs), and school boards with information on issues in math and science education: new programs, assessment results, required resources. | | | |
|---|---|---|---|
| **Action** | **Resources Needed** | **Timeline** | **Responsible Parties** |
| 2.3.1 Create a math and science education newsletter, website, periodic publications, and resource database. | Webmaster.<br>PED PR Dept. | Kick off: Fall 2007, on-going. | MSB staff. |
| 2.3.2 Hold regional meetings and workshops to obtain feedback on this Strategic Action Plan as it continuously evolves. | Meeting logistics and funding | Summer 2007 and ongoing | MSB staff and MSAC |
| 2.3.3 Develop a timeline for input to decision makers on issues in math and science education. | Calendars from decision-making groups. | Ongoing; initial calendar by Nov. 1, 2007. | MSAC subcommittee. |
| 2.3.4 Based on this Strategic Action Plan, create a legislative request for submission to the Governor and State Legislature that includes (a) the financial and personnel resources required in each school district and more broadly, (b) where economies within existing resources can be realized, (c) the new resources required, (d) needed changes to existing bureaucratic structures, and (e) a schedule with associated milestones. | | November 2007. | MSAC and MSB staff. |

| **Strategy 2.4** Develop family-friendly resources to help families, teachers, and school counselors make informed decisions about math and science education for children. | | | |
|---|---|---|---|
| **Action** | **Resources Needed** | **Timeline** | **Responsible Parties** |
| 2.4.1 Create a family resource guide[49] to math and science education (in English and Spanish) based on the *PED Parent Toolkit* and other resources. | Toolkit, etc.<br>Translation services. | Completed by March 1, 2008. | State Math and Science Specialists. |
| 2.4.2 Field test the family resource guide and refine it based on feedback. | Funding for regional workshops | Fall 2008. | State Math and Science Specialists. |
| 2.4.3 Distribute the family resource guide statewide. | Printing, website design, and distribution | January 2009. | State Math and Science Specialists. |

| **Strategy 2.5** Recognize excellence in teaching and learning in mathematics and science. | | | |
|---|---|---|---|
| **Action** | **Resources Needed** | **Timeline** | **Responsible Parties** |
| 2.5.1 Promote statewide visibility of recognition and award programs related to math and science. | Awards page on website.<br>Articles in popular press, NMCTM and NMSTA newsletters[50]. | Ongoing. | MSB staff. |
| 2.5.2 Disseminate science education news notes, blurbs, web pieces, etc. for business, industry, labs and universities. | Distribution list. | Ongoing | Richard Nygren. |
| 2.5.3 Create a "Math and Science Day[51]" to take place during the legislative session. | Spot on legislative calendar.<br>Travel funds. | 2008 Legislative Session (Feb. 5, 2008) | MSB staff. |

## Goal 3: *Establish effective collaborations with internal and external partners.*

**Measures of Progress:**

3.a. Guidelines for developing effective partnerships published.
3.b. Inventory of existing partnerships developed.
3.c. Survey of potential partners completed.
3.d. Increase in number of collaborations between the K-12 educational system and (1) businesses and industry (e.g. students and teachers involved in internships), (2) institutions of higher education, (3) informal education institutions (e.g. museums, parks).
3.e. Completed inventory of collaborations that the Math and Science Bureau has established within the PED and with other stakeholders.
3.f. Increase in the amount of collaborative activity in projects funded by the Math and Science Bureau.
3.g. Case studies on collaborations prepared and analyzed.
3.h. Analyses of current and potential partnerships completed.
3.i. Webpage developed to showcase partnership efforts.

**Strategy 3.1:** Identify existing and potential partners in efforts to improve math and science education.

| Action | Resources Needed | Timeline | Responsible Parties |
|---|---|---|---|
| 3.1.1 Inventory existing partnerships. | | Ongoing. | MSB staff, MSAC |
| 3.1.2 Identify interested potential partners. | Professional research/polling firm. | Ongoing. | MSAC |
| 3.1.3 Develop a publicly accessible database of partnership information. | Website developers. | Dec. 2007. | MSB staff. |

**Strategy 3.2** Clarify and specify resources and strengths of partners.

| Action | Resources Needed | Timeline | Responsible Parties |
|---|---|---|---|
| 3.2.1 Analyze existing and potential partnerships via a ***S***trengths, ***W***eaknesses, ***O***pportunities, and ***T***hreats (SWOT)[52] framework. | Facilitator. | After 3.1 | MSAC with facilitator. |

**Strategy 3.3:** Develop a plan for integrating partnership efforts to maximize effective use of resources and to facilitate beneficial change.

| Action | Resources Needed | Timeline | Responsible Parties |
|---|---|---|---|
| 3.3.1 Develop guidelines for effective partnerships. | Pascal Buser | Fall 2007 | MSB staff |
| 3.3.2 Identify areas of overlap and gaps in current partnerships. | Pascal Buser, MSAC | With 3.2.1. | MSAC, MSB staff. |
| 3.3.3 Request the PED to act as a catalyst to sponsor ideological cross-fertilization among stakeholders (i.e. conferences/town halls). | Funding for conferences, conference coordinators, list of conferences and updates, websites, listservs | Fall 2007, ongoing | MSB staff, MSAC |
| 3.3.4 Encourage collaborative work as a component of all requests for funding to the Math and Science Bureau. | Modify RFPs to include collaboration | Ongoing. | MSB staff. |

Appendix A

# New Mexico Quality Mathematics Education Model Summary

The New Mexico Quality Mathematics Education Model (QMEM) was developed in response to recommendations at the New Mexico Town Hall on Mathematics and Science Education. It includes improved student learning through curriculum alignment, continued teacher development and strong leadership at all levels. The following are guidelines for developing, implementing and sustaining a local QMEM:

## Curriculum

***Adopt and implement a mathematics curriculum (a plan for what and how students learn) that is aligned to New Mexico Content and Process Standards, and Standards-Based Assessment.***

The curriculum needs to be mathematically rich, providing students with opportunities to learn important grade level concepts and procedures with a deep understanding. The Process Standards (problem-solving, representation, reasoning and proof, communication, connections) must be emphasized in the instruction and student learning of mathematics.

- Establish a K-12 district curriculum (what and how students learn) that is aligned to New Mexico Mathematics Content and Process Standards
- Adopt standards-based resources that are field-tested and support the New Mexico Math Content and Process Standards and are aligned vertically K-12
- Provide Professional Development opportunities for teachers to support implementation of standards-based teaching and learning
- Use state, district, school, and classroom data as tools to guide implementation of adopted curriculum and insure that the adopted curriculum is the taught curriculum

## Professional Development

***Educators must be active life-long learners in the pursuit of improving the teaching and learning of mathematics.***

The goal of professional development is to support teachers in that pursuit, thereby improving student learning in mathematics. Professional development is not a one-time event; it must be embedded in the daily work of all teachers. It is ongoing and multi-faceted. Therefore all professional development programs must:

- Include high quality, meaningful content (math content and pedagogy, learning theory, assessment) in summer institutes and during the school year
- Establish school-based collaborative professional learning communities for all teachers whose meetings are scheduled as part of the work week
- Develop and use teacher leaders to help guide improvement of student learning and facilitate the collaborative learning communities
- Align with the *New Mexico Standards,* selected curriculum materials, and assessment
- Be evaluated in terms of its impact on teacher and student learning

## Leadership

***Leadership is the guidance and direction of instructional improvement.***

Strong leaders who can act as change agents are essential for the implementation of a Quality Mathematics Education Model (QMEM). State and district leaders, including superintendents, principals and teacher leaders, need to:

- Establish structures for regular teacher collaboration during the school day
- Design and monitor a QMEM implementation plan in which all teachers must participate
- Ensure that all teachers and leaders receive ongoing, quality mathematics professional development
- Use data management structures to monitor implementation of the QMEM and ensure that data collection and analysis is part of the culture of the system
- Ensure that the system provides all students access to all the Standards
- Promote ongoing communication with all stakeholders (community, parents, staff, and students) about the vision and progress of the QMEM

[1] *Quality Counts* (from Education Week[1]) and *Measuring Up 2006* (from the National Center for Public Policy and Higher Education[1]) find New Mexico at or near the bottom of all the states in both academic progress and future economic prospects ("likelihood for success" measures).
[2] www.highereducation.org/reports/pa_decline/states/NM.pdf
[3] www.edweek.org/media/ew/dc/2007/nm_SGB07.pdf
[4] www.dol.state.nm.us/pdf/stateplanfy7DRAFT.pdf The New Mexico Department of Labor and the Governor's Office of Workforce Training and Development have merged into the Workforce Solutions Department.
[5] The NM Partnership for Math and Science Education (web.nmsu.edu/~pscott/partner.htm), is "an organization of individuals and institutions that are committed to improving the quality and the quantity of education in Science, Mathematics, Engineering, and other related fields". It is affiliated with the National Association of State Science and Mathematics Coalitions (NASSMC)".
[6] New Mexico First (www.nmfirst.org), organized in 1986, brings together citizens to "share their best ideas and develop consensus-driven recommendations for policymakers".
[7] The ACT report on *Rigor at Risk* indicates that, although more students are taking "college prep" courses, ACT scores are not up leading to the conclusion that often those courses have been "watered down" (www.act.org/path/policy/reports/rigor.html).
[8] 1) Close the student achievement gap in all subgroups identified by NCLB. 2) Increase academic excellence and student achievement. 3) All schools will make AYP. 4) Ensure all children are ready for kindergarten. 5) Ensure students graduate from high school better prepared to succeed in post secondary education and the world of work. 6) Ensure that all students attend school in a safe and healthy environment. 7) Increase access to and application of technology for student learning.
[9] STEM, SMET and MSET are widely-used acronyms for science, math, engineering and technology.
[10] For example, SB 561 (2007) requires four years of math for graduation starting with students entering the ninth grade in 2009. One of these courses must be at the Algebra 2 level or higher (unless the parent submitted written, signed permission for the student to complete a lesser math unit). Algebra 1 must be offered in the eighth grade either in "regular classroom settings or through on-line courses or agreements with high schools." The high school science requirement now reads "three units in science, two of which shall have a laboratory component," which is an increase of one course with a laboratory component.
[11] nces.ed.gov/nationsreportcard/nrc/reading_math_2005 and nationsreportcard.gov/science_2005
[12] The difference between the NMSBA and NAEP scores is a concern, but is actually much less in New Mexico than in many other states. A recent article in *Time* (www.time.com/time/2007/nochild) discusses that issue as does a report from NAEP (nces.ed.gov/nationsreportcard/pdf/studies/2007482.pdf).
[13] www.ccsso.org/content/pdfs/StateIndicatorsScienceMathEd2005.pdf
[14] education.nmdfa.state.nm.us/cms/kunde/rts/educationnmdfastatenmus/docs/347518765-06-25-2007-11-52-35.pdf
[15] To be a high school math (or science) teacher one must pass New Mexico Teacher Assessment (NMTA) Secondary Math (or Science) Content Assessment. In 2005 only 43 individuals took the math test (38 passed), and only 49 took science (45 passed).
[16] www.unitedhealthfoundation.org/ahr2006/survey2006.asp
[17] NM MESA was founded in 1982. It has grown to provide thousands of middle, junior high and high school students with year-round support and career guidance (www.nmmesa.org).
[18] Beginning with the 2008-2009, in 8th grade, algebra 1 shall be offered in regular classroom settings or through on-line courses or agreements with high schools (SB561, 2007). Unconfirmed data indicate 34% of 8th graders took Algebra 1 in 2005-6.
[19] AP math tests include Calculus, Computer Science and Statistics. AP science tests include Biology, Chemistry, Environmental Science. AP physics tests come in 3 versions.
[20] Beginning in 2009 4 math courses will be required. The point here is to find how many students take a 4th math course with an Algebra 2 prerequisite.
[21] Currently only 3 science courses are required for graduation.
[22] About 60% of NM high school students take the ACT, a college entrance exam (www.act.org).
[23] NMTA provides various exams that must be passed for entrance to teacher education programs and for receiving a teaching license (www.nmta.nesinc.com/).
[24] The Math and Science *Standards* identify what students should know and be able to do across all grade levels (www.nmlites.org/standards/index.html).
[25] The Math Development Group is a group of math educators which advises the Math and Science Bureau.
[26] Harcourt Assessment, Inc. is the company contracted to develop and score the NMSBAs (www.harcourtassessment.com/).
[27] The MSB (Math & Science Bureau) staff as of 7/1/07 includes Rick Scott (patrick.scott@state.nm.us) , Bureau Chief; Claudia Ahlstrom (claudia.ahlstrom@state.nm.us), State Math Specialist; MaryJo Daniel (maryjo.daniel@state.nm.us), State Science Specialist; Pascal Buser (pascal.buser@state.nm.us), Researcher; and Pollyanna Baca (pollyanna.baca1@state.nm.us) .
[28] www.mcrel.org/ has a contract to reformat the Math *Standards* and develop a voluntary statewide curriculum.
[29] www.achieve.org is reviewing the alignment of our 9-12 Math *Standards* with the American Diploma Project benchmarks.
[30] The term, "reform" curricula, is often used teaching materials developed with funding from the National Science Foundation (www.mathcurriculumcenter.org/).
[31] CM2, *Connected Mathematics 2*, is a middle school math program selected in many NM schools (www.phschool.com/cmp2/).

[32] The Science Development Group is a group of science educators which advises the Math and Science Bureau.
[33] *Ramp-Up Mathematics* programs from www.americaschoice.org/ are "designed to accelerate the mathematics achievement of low-performing middle and high school students so that they can get back on the path to college or prepare for a career", *I Can Learn* (www.icanlearn.org) is a system of math software and hardware being implemented in several NM middle and high schools, and "Algebra Rescue" is a somewhat generic name given to attempts to get under-prepared students to be successful in Algebra.
[34] Traditionally, in most high schools Biology, Chemistry and Physics have been taught in a prescribed sequence. There are current efforts to develop courses that address all the science standards in a more integrated approach.
[35] New Mexico laws (available at www.conwaygreene.com) have required for high school graduation "three units in science shall be required, one of which shall have a laboratory component". SB 561(2007) increases to two those courses which must have a laboratory component. No guidelines indicate what might constitute an acceptable "laboratory component".
[36] In 1989 in *Everybody Counts: A Report to the Nation on the Future of Mathematics Education* (www.nap.edu/catalog/1199.html) ) it was pointed out that "the United States is one of the few countries in the world that continues to pretend--despite substantial evidence to the contrary-that elementary school teachers are able to teach all subjects equally well. It is time to identify a cadre of teachers with special interests in mathematics and science who would be well prepared to teach young children both mathematics and science in an integrated, discovery-based environment". That idea has apparently never been widely accepted. Lately there has been some success with taking the best teachers out of the classroom and having them coach (mentor) less successful teachers. The coach/mentor model is more expensive. A study could be done in New Mexico to see which approach seems to be the most successful.
[37]"'Response to Intervention' (RTI) (www.jimwrightonline.com/php/rti/rti_wire.php) is an emerging approach to the diagnosis of learning disabilities that holds considerable promise. In the RTI model, a student with academic delays is given one or more research-validated interventions." *Math Recovery* (www.mathrecovery.com/) and *Success Tracker* are two such interventions.
[38] Kristin Umland of UNM's Department of Mathematics hosted a meeting on content and methodology for the math content courses for elementary teachers in Taos during the last week of May 2007.
[39] The term, "profound understanding of fundamental math (PUFM)", comes out of the doctoral work of Liping Ma (*Knowing and Teaching Elementary Mathematics*, Lawrence Erlbaum Associates, Mahwah, NJ, 1999). Ma states (p.124) that "PUFM is more than a sound conceptual understanding of elementary mathematics – it is the awareness of the conceptual structure and basic attitudes of mathematics inherent in elementary mathematics and the ability to provide a foundation for that conceptual structure and instill those basic aptitudes in students". A review is at www.aft.org/pubs-reports/american_educator/fall99/amed1.pdf.
[40] The state has *Competencies for Entry-Level Math and Science Teachers* listed in New Mexico Administrative Code (www.nmcpr.state.nm.us/NMAC/_title06/T06C064.htm). Those competencies have not been revised in over a decade.
[41] The SWCC (www.swcompcenter.org) is part of a federal network of 16 Regional Comprehensive Centers. It assists New Mexico's Public Education Dept to "to improve student achievement and close achievement gaps".
[42] Both ¡explora! (www.**explora**.mus.nm.us/) and the Santa Fe Alliance for Science (www.sfafs.org) have been coordinating efforts of science and engineering professionals in working with schools.
[43] State Professional Development Framework (www.teachnm.org/professional_development_framework.html) is closely aligned with the National Staff Development Council (NSDC) *Standards for Staff Development* (www.nsdc.org).
[44] The *New Mexico Teacher Competencies* are available at teachnm.org/nm_teacher_competencies.html.
[45] MSAC, the Math and Science Advisory Committee, is composed of four representatives from K-12, three from higher education, four from the private sector and one from the NM Partnership for Math and Science Education.
[46] Initial brainstorming has suggested that the following activities might become part of a "Math and Science Day" during the legislative session each year: recognition of Presidential Award Winners; Board Certified Teachers; college math and science faculty and other scientists and engineers who have done outstanding outreach work with schools; schools that have raised NMSBA scores; and Science Fair, Science Olympiad, Science Bowl and Math Counts winners. Establish a "Science Bowl" with members from the House Education Committee vs. the Senate Education Committee, with students integrated into the teams.
[47] The New Mexico Business Roundtable for Educational Excellence (NMBREE) (www.nmbree.org) is "a non-profit and non-partisan business collaborative dedicated to improving public education in New Mexico".
[48] The Association for Commerce and Industry (ACI) of New Mexico (aci.nm.org) is a statewide, legislative advocate of business interests. ACI is accredited by the U.S. Chamber of Commerce to serves as the state chamber.
[49] Some ideas for a family resource guide include suggested math and science activities, information about assessments, postsecondary entrance requirements, workforce needs in NM, etc.
[50] Newsletters from the NM Council of Teacher of Math (NMCTM) are available at education.nmsu.edu/**nmctm**/ and for the NM Science Teachers Association (NMSTA) at www.nmsta.org.
[51] See #46 above.
[52] "SWOT Analysis, is a strategic planning tool used to evaluate the *S*trengths, *W*eaknesses, *O*pportunities, and *T*hreats involved in a project or in a business venture. It involves specifying the objective of the business venture or project and identifying the internal and external factors that are favorable and unfavorable to achieving that objective." (en.wikipedia.org/wiki/SWOT_analysis).