

Creating Minnesota's Plan for
Career Development in Science,
Technology, Engineering and Math

A Call to Action

Final Report from the Governor's Roundtable
and Call to Action Meetings at the Science Museum of Minnesota,
March 31, 2006

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EXECUTIVE SUMMARY

Under an honor grant from the National Governor's Association (NGA grant), the Minnesota Department of Education (MDE) is leading a series of initiatives in high school reform designed to "help students achieve the skills they need to successfully gain employment and fully access life's opportunities in the 21st century." One of the goals for the NGA grant is to improve teaching and learning in science and math.

As part of the grant, MDE contracted with the Citizens League to convene a **Governor's Roundtable on Science, Technology, Engineering and Math** (STEM) for leaders in business, education, non-profit and civic organizations to assess statewide needs for knowledge and skills in math and science. In turn, the Citizens League partnered with the Science Museum of Minnesota to assist in organizing the meeting, which was held at the museum on **March 31, 2006**. The following recommendations, based on the input of summit participants and of members of the planning committee that guided the planning of the event, are intended to guide Minnesota toward becoming a national leader in STEM education.

Two aspects of the NGA grant received especially strong endorsement:

1. Communicate the Compelling Shared Need among Minnesotans for greater STEM achievement and career development through a public awareness campaign. In particular, participants recommended that the campaign engage parents and caregivers in order to bolster their support of children's educational achievement, especially in STEM education.
2. Increase the Level of STEM Knowledge among Students and Teachers: The NGA grant has a number of objectives to increase rigor in the curriculum. The group emphasized the importance of: Strengthening math teaching practices to prepare students to take algebra according to Minnesota standards by 8th grade; raising the graduation requirement to four years of rigorous math courses and at least three years of science according to high school standards; and establishing incentives for elementary teachers to strengthen their STEM content knowledge.

Three other recommendations also emerged:

3. Create a Clear Vision Statement and Goals Focused on STEM Achievement: The Governor's Education Council has developed an overall vision statement. In support of Governor Pawlenty's challenge to make Minnesota the national leader in STEM education, participants recommended creating a strong vision and quantifiable goal statements to crystallize our STEM education ambitions in terms people can readily understand.
4. "Link Learning to Life": Make science and math classes more experiential and relevant and connect classroom learning to the science and engineering of academia and the workplace. Participants found this phrase an excellent strategy statement.
5. Foster Continuing Cross-Sector Engagement and Accountability: Among the suggestions: Expand the Governor's Education Council to include more business and non-profit members. Organize an annual meeting for companies, organizations and institutions involved in the STEM initiative to align work, share accountability, report on and recognize progress, and build momentum. Inventory current efforts within each sector to reveal more partners and develop toolkits to expand use of top programs. Establish a minimal infrastructure such as a clearinghouse in order to match business and non-profit resources with education needs and communicate opportunities to students and their parents.

I. INTRODUCTION

Under an honor grant from the National Governor's Association (NGA grant), the Minnesota Department of Education (MDE) is leading a series of initiatives in high school reform designed to "help students achieve the skills they need to successfully gain employment and fully access life's opportunities in the 21st century." One of the goals for the NGA grant is to improve teaching and learning in science and math at the high school level.

As part of the grant, MDE contracted with the Citizens League to convene a Governor's Roundtable on Science, Technology, Engineering and Math for leaders in business, education, non-profit and civic organizations to assess statewide needs for knowledge and skills in math and science. In turn, the Citizens League partnered with the Science Museum of Minnesota to assist in organizing the meeting, which was held at the museum on March 31, 2006.

The daylong gathering included:

- A morning executive session with 25 key business, education and non-profit leaders, with the participation of Governor Tim Pawlenty.
- A speech by Governor Pawlenty to an invited audience of 120 representatives from all sectors.
- A luncheon, with remarks by Commissioner Alice Seagren and Eric Jolly, President of the Science Museum.
- Afternoon work-group sessions with over 100 leaders from business, education, and government, civic, philanthropic, and non-profit organizations.

A synopsis of the event is in Appendix A.

In his remarks, Governor Pawlenty challenged the participants to *get beyond describing the problem to proposing solutions*, acknowledging that Minnesota may have drifted into incremental actions versus bold new approaches. He urged that Minnesota aim not just *to catch up*, but **to become the nation's leader in STEM education**. The Governor asked for "help from outside the system" to create a "Minnesota model," a comprehensive strategy in which the business sector, education sectors, philanthropic community and non-profit sector come together around a joint action plan to:

- Raise student achievement in math and science
- Increase college readiness among students of all backgrounds
- Increase the pipeline of students pursuing scientific and technical careers

Commissioner Alice Seagren reported on the Governor's Vision for the Education of Minnesotans (Appendix B) and the major initiatives already underway under the NGA grant (Appendix C). For many attendees, this was their first introduction to the state's education reform agenda. Everyone came with a commitment to explore ideas for improving STEM education, but each sector brought a different set of questions and concerns. One frequent comment heard throughout the day was the value they found in having cross-sector dialogue.

In fact, the foundation of a "Minnesota model" may be bringing about the strategic integration of business, P-16 education, non-profit, and government sectors. Under this model, every sector would have clear, meaningful roles and responsibilities.

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The contributions that the sectors *working together* can achieve are significant. We can connect the STEM content in the classroom to real-world situations and the workplace, making it more interesting and problem-focused. We can help teachers better understand an array of careers and the skills needed in today's workplace. We can encourage and support college and university faculty to more fully connect their programs with P-12 education and business and industry, and forge connections between faculty in teacher education and in math and the sciences. Businesses can communicate a world perspective on STEM challenges and opportunities and Minnesota's relative position for achieving success. Businessmen and women can apply their expertise in the classroom—from bringing real-world content into the classroom and introducing STEM careers, to mentoring students to succeed in math. Businesses can also offer expertise to school administrators as they work through changes that MDE and school districts might implement in order to increase the rigor in STEM disciplines.

Non-profits and college outreach programs are significant for helping each student find and develop the engagement (passion), capacity (knowledge base), and continuity (opportunities for career growth)¹ that they need in order to pursue a STEM discipline. They offer rich experiential learning opportunities for students, expose students to career role models, and provide much of the mid-career teacher professional development in STEM content knowledge and pedagogy.

At this time, many more Minnesota leaders involved in STEM education and workforce issues have a clear understanding of the scope of the changing nature of business and industry in the coming decades and global competition as well as trends in achievement and demographics and achievement gap issues. However, it is critical that this level of understanding be broadened throughout business, industry, government, education, and the community. The Fact Sheet of forecasts for growth in technical fields and trends in demographics and STEM achievement prepared for the events is in Appendix D.

Many individual organizations, businesses, and foundations are actively supporting student achievement programs and are having some successes. Because most of these efforts are independent of each other, however, they do not aggregate into coordinated solutions. Figuratively, there are lots of protons, neutrons, and electrons out there working on the problem, but no atomic organization. The Minnesota model is about working together in a way that has a quantum effect in influencing student achievement and career development. With the energy to move forward, stay focused, and augment the power of what the formal education system is already doing, joint action can raise the level of achievement and science literacy among all students and entice more to enter into STEM disciplines.

The Department's NGA plan is so comprehensive that it is difficult for "lay audiences" to absorb. As part of its communication planning, MDE may want to generate a brief statement that makes the NGA plan easier for the public, elected officials, business and civic leaders, and non-profit educational leaders to understand.

In the spirit of Governor Pawlenty's call for change, the following sections present feedback and recommendations to the Minnesota Department of Education from participants at the Governor's Roundtable and Call to Action events and from the planning committee that guided its organization. A list of the members is included in Appendix E. We thank them for their contributions to creating this program.

¹ From Jolly, Eric; Patricia Campbell, and Lesley Perlman, *Engagement, Capacity, and Continuity: A Trilogy for Student Success*, 2004. GE Foundation.

II. FEEDBACK AND RECOMMENDATIONS

A. Comments on Key Aspects of the National Governor's Association Grant

The Governor's Roundtable and Call to Action groups recommend further research and development of the following ideas for attaining the goals of greater STEM achievement and more STEM graduates.

1. Communicate the Compelling Shared Need among Minnesotans for Greater STEM Achievement and Career Development through a Public Awareness Campaign.

The group soundly endorsed the need for a public awareness or communications campaign on behalf of STEM education as planned for in the NGA grant. The attendees at the Governor's events were, for the most part, already engaged in STEM issues and committed to be part of a change effort. We know, however, that broad community understanding is a goal yet to be attained.

In order to create change, parents, students, and the community as a whole need to believe that change is necessary. A report by Public Agenda cited that parents' concern about math and science achievement has declined since the mid-1990s. Nearly 2/3 think that things are fine as they are. Students, except for minority groups, do not think that they are taking too little math and science.² Conveying a sense of urgency about increasing rigor in math and science, global competitiveness, and college readiness to parents and the general public will be a critical first step in implementing change.

An awareness campaign with teachers and administrators is necessary as well. They, too, need to deepen beliefs that ALL students can and must achieve high standards in STEM disciplines, rather than limiting participation in rigorous STEM learning to a relatively small sector of the student population. It is important to involve teachers and administrators early in implementation plans and support them as much as possible as they implement changes. It is also important that we all commit to the changes over a sustained period of time.

Suggestions for the campaign:

Business sector role:

- A corporate executive might serve as a leader and figurehead of this campaign to build its credibility and voice in the community.
- Business executives can speak about the STEM achievement and global competitiveness issues to their employees and public audiences. They can model for other businesses how to communicate key messages to their clients and public audiences.

² Reality Check 2006, "Are Parents and Students Ready for More Math and Science?" Public Agenda, February, 2006.

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- Business can tell compelling stories about the problems that they are addressing, to bring to life what working in a research lab or high-tech company is really like.
- Business leaders experienced in managing change can work closely with school administrators to help them implement changes and use student data more effectively to monitor progress.

Education role:

- Similarly, P-16 and higher education can more clearly and specifically communicate with their alumni and other constituents about the need to support STEM initiatives and with prospective and enrolled students and their parents and teachers about the need to prepare adequately for a future in which STEM skills and knowledge will be increasingly essential.

Non-profit role:

- Non-profits can develop initiatives for parents that communicate the importance of taking more science and math courses and how to pursue a career in science or technical field, using their unique connections with specific audiences.

Collective role:

- Businesses, non-profits and higher education sectors can support targeted legislation which focuses on improved STEM education. Examples could include expanded teacher professional development, enhanced lab spaces, more math and science specialists in elementary schools, and career development for high school students. We also can support legislative initiatives for state participation in events such as the Third International Math and Science Study (TIMSS) that allow for international comparisons in educational achievement. Minnesota first participated in TIMSS in 1995, sparking debate among parents, policy-makers, and the media about how well our students were doing in math and science compared to students in many countries, especially competitors such as India, China, and Singapore.

2. Increase the Level of STEM Knowledge among Students and Teachers.

The participants supported the initiatives in the NGA grant designed to strengthen academic rigor in math and science for all students. Below are some specific suggestions:

a. Strengthen math teaching practices to prepare students to take algebra according to Minnesota standards in 8th grade.

To be ready for college engineering courses, students need to have completed calculus, which is achievable in high school only if students take algebra in 8th grade. Although not all students have to complete calculus in high school, all students need the mathematical foundation to be successful in calculus in college. Without appropriate preparation, much of the STEM career potential is lost before students enter high school.

b. Establish more rigor in course taking in high school math and science.

The NGA grant effort already asserts that to be globally competitive globally in the future, students need more math and science. The graduation requirements should be raised to taking four years of math courses and more science than required by current high school graduation requirements.

c. Establish incentives for elementary teachers to strengthen their STEM content knowledge. Elementary teachers' STEM content knowledge and attitude are a significant factor in student attitude and engagement in STEM subjects. School districts could offer significant salary incentives for teachers with 4 or more college courses in STEM subjects, or raise qualifications for hiring elementary teachers, as Rochester Public Schools did in the mid-1990s. Yet another alternative is to provide math and science specialists or "coaches," especially in elementary and middle schools, who can work with teachers and students in order to improve math teaching and learning. Overall, Minnesota will need a strategy to draw people into the STEM teaching profession and retain them. Between 1996 and 2000, the retention rate after four years for newly hired teachers was only 51%.

Business sector role:

- Businesses can mentor administrators on how to go about implementing the changes in STEM instruction and share training techniques of the workplace.

Higher education role:

- Colleges of education can strengthen pre-service programs so that pre-service teachers attain significantly more content knowledge in STEM and skills in how to teach students effectively with an array of learning styles and preferences.
- Colleges of education can also work closely with school districts to provide teacher professional development that will strengthen teachers' STEM content knowledge and teaching techniques.

Minnesota Board of Teaching role:

- The Board of Teaching can increase teacher licensure requirements in STEM areas.

Non-profit role:

- Museums can provide more teacher professional development to strengthen teachers' content knowledge and STEM teaching techniques.

Collective role:

- Together business, non-profit, and higher education sectors can support school districts in focusing on the development of teacher content knowledge of science and mathematics.
- Students and professionals can coach students in younger grades on their math achievement.

B. Additional Recommendations to Advance a "Minnesota Model"

1. Create a Clear Vision Statement and Goals Focused on STEM Achievement

The Governor's Education Council has drafted a comprehensive vision statement for student achievement. There was considerable enthusiasm for creating a vision for STEM education in order to build commitment to the substantial changes in STEM education that the Department of Education and many other partners are fostering. A STEM vision would not compete with the overall vision but would provide a clear focus that all sectors can stand behind. We think that kind of clarity is needed for communicating what the state hopes to achieve in its STEM education initiatives.

Likewise, a clear and quantifiable goal statement will crystallize these ambitions in terms that the general public can readily understand. Examples might be doubling the number of college graduates in STEM across all cultures and backgrounds, closing the achievement gaps in STEM, or reaching a top-ten national ranking in math/science college readiness.

2. "Link Learning to Life"-- Connect STEM Education to the Workplace

There was clear consensus that it is necessary to make science and math classes more experiential and relevant by connecting classroom learning to the science and engineering of academia and the workplace. The phrase "link learning to life" resonated with the participants as an effective statement of strategy for making what students learn in school more relevant in terms of future educational and work opportunities.

Career education opportunities, connecting high school students to role models from academia and business, are significant for every student. Several excellent career development experiences now exist in our region, but reach a minimal number of students. We hope that all students will be provided some type of STEM career development experience. Besides participating in specific programs, professionals can also work one-on-one with students. In Ohio, for example, to offset extreme shortages in guidance counselors, professionals from the community help guide students to college choices and majors. In other cases, teachers are given opportunities to work more closely with a small number of students on academic and career planning.

We hope to develop stronger connections between classroom learning and workplace learning, to build in students the knowledge and skills necessary for the workplace and a passion to pursue STEM careers.

Business role:

- Businesses can offer teachers summer opportunities to observe STEM in the workplace and more job-shadowing opportunities for high school and college students.
- Businesses can encourage its STEM professionals to contribute time and effort to:
 - work with teachers on units related to their expertise
 - mentor students in academic subjects and career planning
 - represent careers at career development events
 - volunteer in non-profit and after-school programs, such as Minnesota First Lego League, Science Technology and Engineering Preview Summer Camp for Girls (STEPS), Destination Imagination, etc.

These and other ideas can be collected and developed into a toolkit based on models from leading corporations which other businesses can readily use.

K-12 education role:

- After-school programs based within school districts can create more extended STEM projects with longer amounts of time invested for experiments and inquiry thinking by students. There is much potential for building achievement through after-school programs in a way that fits the environment of these programs and supports in-school learning.

Higher education role:

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- Colleges and universities can work toward aligning STEM content and relaying feedback on workplace needs between K-12 schools and the business sector.
- Higher education can offer more opportunities for high school students to shadow college students, faculty, and staff or deliver "college in the schools" programs within high schools through Minnesota's Post-Secondary Education Options program.
- Similar to community service, higher education can expect or reward students to contribute to the success of high school students. Undergraduates can mentor their younger peers in content as well as career steps. Their time in schools or classrooms might encourage these students to pursue STEM teaching, which will be in even greater demand in the future.

Non-profit role:

- Non-profits can host career development events for students and families and also support teachers with ways to enliven STEM education.

Collective role:

- All sectors can provide real-world examples to be incorporated in STEM curricula.
- Together higher education outreach and non-profits can collaborate to create a database that maps programs and audiences. This database will allow students and their parents can locate all the optional STEM and career programming across Minnesota.
- All the sectors can set priorities for key programs. Such alignment of goals will extend the reach of non-profit programs to many more students. For example, if we declare a priority for career education, we can each use our venues to connect role models from workplaces with students, and monitor how many students we have reached across the state.

3. Foster Continuing Cross Sector Engagement and Accountability

There is much enthusiasm for improving STEM education and working across sectors, as exemplified at the March 31st Governor's Roundtable and Call to Action on STEM education. Many businesses, foundations, schools and organizations are actively engaged in efforts to improve STEM education. But we are not working together sufficiently on strategic goals, nor compounding our reach or coordinating efforts. Achieving the Minnesota model is predicated upon the sectors working together in a coordinated fashion to leverage the resources now being invested. Also, a clearinghouse-type of infrastructure is suggested in order to connect easily businesses and schools as well as to connect parents, teachers, and funders with existing high-quality STEM outreach programs. There was clear consensus on the need to focus and align efforts.

Other ideas for reinforcing cross-sector participation include:

a. Expand the Governor's Education Council

We understand that the Council has been operating for about six months, but we noted that the group does not include any representatives with specific background in math and science education or any representatives of organization that provide extracurricular math and science programming. Eric Jolly, Ph.D., President of the Science Museum of Minnesota, would be a clear choice for representation from the non-profit sector.

The Governor's Education Council could also establish a steering committee to refine the strategic involvement of business and non-profit sectors toward STEM goals within the broad scope of changes in the National Governor's Association grant.

b. Organize an Annual Meeting for Companies, Organizations, and Institutions Involved in the STEM Initiative

At an annual meeting, companies and organizations would align work, share accountability, report on and recognize progress, and build momentum. There was great enthusiasm among the participants for continuing the dialogue. This could take place through these means:

- A special meeting called like the March 31st event.
- A convening of key organizations such as the High Tech Association, MN Business Partnership, MN Chamber of Commerce, and SciMath MN, on a date held in common.

c. Establish a Minimal Infrastructure

We recommend a minimal amount of infrastructure to facilitate cross-sector engagement. Initially, inventorying current STEM education investments within each sector will reveal more partners, clarify funding opportunities, and provide a means to identify top programs. Leading businesses in STEM education initiatives can promote their most successful models through toolkits for other businesses, thus expanding the network. Also, it will be valuable to inventory current efforts in other state STEM initiatives, and structural frameworks such as the National Science Board.³

This inventory should develop into a dynamic clearinghouse to facilitate interaction among businesses, non-profits and education outreach, and schools. Without it, individual schools have no resource or easy leads for locating community connections. In several cases staff positions that had made such arrangements have been eliminated from both K-12 and university budgets. In another case, plans for more elaborate internship programs between business and technical colleges were not established because the essential investment in infrastructure to match needs with resources was not made.

More comments and ideas on implementation generated by the participants during the discussion sessions are found in Appendix F.

III. CONCLUSION

Despite significant investment in STEM education, trends in achievement are worsening and international competition is magnifying the effect. Achievement gaps are most apparent. We must turn the trends around for Minnesota's future.

The National Governor's Association grant is a great step forward for reforming Minnesota high schools and raising expectations for Minnesota graduates to continue successfully into higher education.

³ National Science Board, "America's Pressing Challenge—Building a Stronger Foundation," January, 2006.

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The Governor's Roundtable and Call to Action were convened to bring business and non-profit organizations together with education and government to propose a Minnesota model for becoming best in the nation for preparing students for the workplace in the 21st century. These leaders have recommended that, first, every student, parent, teacher, and leader must understand what is at stake for Minnesota if trends remain as they are. A public awareness campaign is a significant first step. Second, the rigor and expectations for STEM education must be increased, as must the preparation and on-going professional development of teachers. Both initiatives are underway through the NGA Honor Grant.

Third, business and non-profit sectors can make a substantial contribution to P-16 education through focused, coordinated involvement--enlivening STEM education, supporting achievement, providing career education, and creating transitions to the workplace. Such partnerships offer a yet-to-be explored set of exciting opportunities.

As evidenced by the March 31st events, the energy is high to advance together to a new level of success in STEM achievement and open opportunities for students of all Minnesota communities. It is up to all partners, collectively, to maintain and build upon this momentum.

July 11, 2006

Appendix A

Governor's Roundtable

Friday morning, March 31, 2006

A Call to Action

Friday afternoon, March 31

Synopsis

At the request of the Minnesota Dept. of Education, the Citizens League and Science Museum of Minnesota collaborated to convene executives across business, K-12 education, higher education, government, non-profits, and professional societies in order to advise Governor Tim Pawlenty on a model to make Minnesota a national leader in science, technology, engineering, and math (STEM) education. Commissioner Alice Seagren briefed the roundtable on the activities of the National Governors Association grant. Twenty-five participants discussed elements of the model before Governor Pawlenty joined the roundtable.

Desired Outcomes of the Roundtable

- To develop a common understanding of these challenges Minnesota faces in meeting the science, technology, engineering, and math (STEM) workforce needs of the future.
- To provide a forum to reveal, discuss, validate and recommend modifications as needed to increase the number of STEM graduates across all cultural groups and income levels and to promote a higher level of STEM literacy for all graduates.
- To recommend high-level priorities and strategies to implement this goal by involving business, education, government, and non-profit organizations within communities and across the state of Minnesota.

Governor Pawlenty then gave an address on being competitive in STEM disciplines, which was attended by over a hundred leaders across business, education, government, and non-profit sectors and professional societies. Following lunch, these leaders met as the Call to Action--discussion groups which addressed further the critical goals and strategies for Minnesota's model for leadership in STEM education. Groups also discussed key action steps, barriers to progress, coordination and collaboration, and key indicators of progress.

Desired Outcomes of the Call to Action

- To continue to raise visibility around a common understanding of the challenges Minnesota faces in meeting the science, technology, engineering, and math (STEM) workforce needs of the future.
- Set in motion a process for collaborating on a statewide STEM action plan across P-16, business and non-profit sectors, informed by the Minnesota Dept. of Education's initiatives to improve student achievement in STEM.
- Create a sense of ownership and accountability in individual business and non-profit organizations to collaborate with and support efforts in the P-16 community.

Appendix B

**Governor's Vision
for the Education of Minnesotans**

Minnesota's investment in education will help *all* students achieve, at a minimum, a P-14 education *that will enable them* to develop a strong work ethic, gain competitive employment, pursue life-long learning, become engaged citizens for the 21st Century, and *enhance their quality of life.*

To achieve this vision, all students shall:

- Engage in learning and progress to on-time graduation and advanced education
- Meet rigorous academic standards which prepare them to compete in a global economy
- Participate in out-of-school experiences to expand academic and physical skills, explore careers and contribute to society
- Do early career/postsecondary planning with parents and adult mentors
- Enroll in and complete a postsecondary education program that improves the student's earning capacity and quality of life

To achieve this vision, all high schools shall:

- Ensure student achievement at globally competitive levels
- Ensure more rigorous and relevant course taking for all students
- Create a personalized learning environment for each student with the support of parents and other adult mentors
- Ensure students use multiple pathways to postsecondary training or college to achieve a minimum K-14 education
- Support out-of-school opportunities for students to extend learning and career exploration
- Ensure high quality teacher and principal leadership and
- Report academic student achievement and progress benchmarks to the public

To achieve this vision, higher education shall:

- Improve success of all students, particularly students from groups underrepresented in higher education
- Create a responsive system that produces graduates at all levels who meet the demands of the economy
- Increase student learning and improve skill levels of students so they can compete effectively in the global market place
- Contribute to a state economy that is competitive in the global market through research and workforce development
- Provide access, affordability, and choice for all students

Appendix C



NGA Honor States Grant Award to Minnesota

"Learning in a Digital Age: Math and Science at the Heart of HS Reform"

Minnesota High School Initiative: Goals

- Improve high school rigor and student transitions to postsecondary education
 - Implement P-16 system accountability for improved student learning
 - Improve student motivation and programs for STEM education opportunities
-

Governor/Legislative Reforms were Signed into Law (2005, 2006)

- Schools expanded AP/IB programs, CLEP options, student access to earning college credit while in HS
- Basic skills tests were replaced with portions of higher level MCA II tests
- A computerized state HS biology test will be implemented (Spring, 2008)
- Schools will assess college readiness of students (EPAS in grades 8 and 10)
- All students will take Algebra I, II, and physics or chemistry (Class of 2015)

Governor's Education Council is Launched (October, 2005)

- Council will set statewide goals, benchmark targets for P-16 student achievement
- Regular reports will be made on NGA grant project outcomes measures
- A minimum education level of K-14 is being promoted for all students

Governor's Roundtable was Held on STEM (Science-Technology-Engineering-Math) Convenes Minnesota Leaders (March, 2006)

- The Minnesota Department of Education, Science Museum of Minnesota, and the Citizens' League convened a statewide meeting of business, government, nonprofit, and education leaders on March 31, 2006
- The Governor and participants identified challenges in meeting future Minnesota STEM workforce needs, created a shared vision and key strategies

2006 Summit on Math and Science is Held for Students and Teachers

- The Minnesota Department of Education and partners will convene an October summit for students and teachers about STEM career opportunities

2006 STEM Community/HS Forums

- 12 regional meetings will be held across the state (4 metro, 8 outstate) in October for HS's to partner/share ideas with higher ed/business leaders about STEM workforce needs and improving STEM programs for students

Minnesota Board of Teaching Improves Teacher Quality (2006)

- BPT will align teacher preparation requirements to student academic standards

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- More teachers will be prepared in key shortage areas (math and science)

Minnesota Joins the American Diploma Project Network of States (May, 2005)

- College and work readiness knowledge and skills in math, reading, and writing will be identified for students and then recommended as revisions to the state's required academic standards (math standards will be revised in 2006-07)
- Minnesota revised required credits for graduation and will encourage students to take courses that prepare them for college and advanced work
- Schools will implement early assessments (EPAS) to determine if students are on track to be ready for college (almost 100% signed up in first year)
- High schools and higher education will each be held accountable for students' academic performance and graduation

Minnesota's P-16 Education Partnership Improves Student Transitions to Postsecondary (Studies will be completed by Fall, 2006)

- A feasibility study and implementation plan is being completed for one P-16 system to better track student achievement and graduation
- Student college and work readiness knowledge and skills are being drafted for reading, writing, and mathematics to be folded into standards revision process
- Options to align the state mathematics assessment with postsecondary needs are being identified for implementation in 2006-07
- Plans are being developed to reduce student remediation in postsecondary
- Effective college access programs will be recommended to all high schools
- Web sites for career and postsecondary planning will be coordinated/linked to encourage student and parent use
- A higher education accountability system is being developed by the Minnesota Office of Higher Education in consultation with education and community leaders

Minnesota Department of Education Assistance To Schools (2005-2007)

- Digital content conferences will be held (October 18, 25) to assist the state's teachers on instruction using digital resources and technology innovations
- Teacher professional development (lesson study) is being provided in math and science
- Classroom teachers are being trained to align their own instruction to state standards
- Schools surveyed students about engagement in learning to make improvements
- State mentor programs are being offered for math and science teachers
- A state study was conducted to assess the rigor of science and mathematics in career and technical education courses and ideas distributed to schools for use
- Regional workforce needs will be identified by DEED, and current industry certification pathways programs will be surveyed to identify new programs needed
- Lighthouse high schools (13) received grants (\$10,000 per year) and training in action research to implement high school redesign leading to improved student achievement;
- High schools named to receive grants (\$20,000) to develop model programs in technology and engineering design (7), digital content (5), effective student remediation programs (5), and new industry certification pathways (5 awards to be made in fall, 2006)

Statewide Communications Campaign (2006-2007)

- 10 HS regional forums were held in Fall, 2005 to collect student/parent/community input
- A campaign will be targeted to students and parents about rigorous course taking, early career exploration, preparation for postsecondary, and achieving K-14 education levels
- An October, 2006 STEM Kick-Off event will begin the campaign to build a sense of urgency about future workforce preparation and STEM opportunities!

Economic forecasts project 20-33% increases in scientific and technical occupations in Minnesota in ten years.

- ↑ 14.7% projected growth in all occupations
- ↑ 32.9% projected growth in computer and mathematical occupations
- ↑ 19.8% projected growth in life and physical science occupations

Source: *Minnesota Dept of Employment and Economic Development*

The number of college graduates retiring from the MN workforce will grow from 9,000 to 25,000 per year.

Source: *US Census within Projections of High School Graduates*

Additionally, new job growth in professional and high tech industries will demand an extra 10,500 college graduates per year.

Source: *MN Dept. of Employment and Economic Development*

The number of Minnesota high school graduates is projected to decrease 10.3% between 2003 and 2013.

Within this overall decrease is a 52% *increase* in the number of minority graduates.

- ↑ Hispanic (173.4%),
African-American (40%),
Asian-Americans (24.9%)
- ↓ Caucasians graduates decline in number by 18.7%.
Native American graduates decline 15.6%.

The net effect is a loss of 3,000 college graduates per year, from 27,000 down to 24,000.

Source: *Data from Western Interstate Commission on Higher Education, within Projections of High School Graduates*

Minnesota's students of color are far less likely to take the ACT exam.

Number and percentage of 2005 Minnesota ACT-Tested High School Graduates

- ↔ These data are substantially unchanged over the last five years

41,646/100% All students
34,579/83% Caucasians (68% of graduating Caucasians)
3,209/8% No response to ethnicity

1,910/5%	Asian Americans/Pacific Islanders (67.6% of graduating Asians)
1,137/3%	African-Americans (42% of graduating African Americans)
609/1%	Hispanics (46% of graduating Hispanics)
202/0%	American Indians (24% of graduating American Indians)

Substantially fewer students of color are prepared to take college algebra and college biology.

Percent of ACT-tested 2005 Minnesota high school graduates ready for college algebra

- 53% of all students (N = 41,646)
- 55% of Caucasians
- 40% of Asian Americans/Pacific Islanders
- 35% of Hispanics
- 29% of American Indians
- 16% of African-Americans

Percent of ACT-tested 2005 Minnesota high school graduates ready for college biology

- 37% of all students
- 38% of Caucasians
- 25% of American Indians
- 24% of Asian Americans/Pacific Islanders
- 24% of Hispanics
- 8% of African-Americans

Sources: *Measuring College Readiness: The Minnesota Graduating Class of 2005 and 2004-2005 Graduates*, Minnesota Dept. of Education

High school graduates receiving a bachelor's degree or higher in 2000 compared to 1990 increased from 34.5% compared to 25.8%, an 8.7% improvement.

Minnesota was the most improved state.

Source: *Minnesota Data Profile*, Achieve, Inc., February 2005

Minnesota is behind the national average in percentage of 8th graders taking algebra, 2003

- 27% of Minnesota 8th graders
- 31% of United States 8th graders
- 43% of students in the top five states (median)

Source: nces.ed.gov/nationsreportcard/naepdata in the *Minnesota Data Profile, 2005*

More Minnesota high school students take lower level high school math classes, yet fewer are taking upper level math courses, compared to a decade ago.

In Minnesota in 2004:



73% of the students took Geometry/Integrated Mathematics 2 prior to graduation--an increase of 5% from 1996.

95% of the students took Algebra 1/Integrated Mathematics 1 prior to graduation--an increase of 14% from 1996.



37% of the students took Trigonometry/Pre-Calculus prior to graduation-- a decline of 4% from 1996.

59% of the students took Algebra 2/Integrated Mathematics 3 prior to graduation--a decline of 3% from 1996.

Source: State Indicators of Science and Mathematics Education - 2005 published by The Council of Chief State School Officers

Districts have difficulty filling science and math educator positions.

Filling science educator positions, superintendents report the effort as:

51% - very difficult

18% - difficult

Filling math educator positions, superintendents report the effort as:

33% - very difficult

26% - difficult

Source: Teacher Supply and Demand, Minnesota Dept. of Education, February, 2005

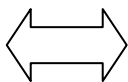
The four-year retention rates for the newly hired teachers in 1996 through to 2000 were 51.34%.

Minnesota's retention rate for new teachers may be significantly lower than national retention rates for the same period.

Source: Teacher Supply and Demand, Minnesota Dept. of Education, February, 2005

Nearly 60% of parents surveyed by Public Agenda say that their students are receiving enough math and science in school.

In 1994, in answering a similar survey, 52% thought that the amount of math and science taught in schools was a serious problem. Now that number is 32%. Three-quarters of



students also say that the math and science they are receiving in school is fine. Only minority students were much more likely to say they are not getting enough in school and that it is essential for future success.

Source: Education Insights Reality Check 2006, Public Agenda

Appendix E

**Governor's Roundtable
A Call to Action
Friday, March 31st**

The Roundtable was convened by the Minnesota Department of Education, the Citizens League (working with Anne Hornickel as a project consultant and report author), the Science Museum of Minnesota and a dedicated Planning Committee that helped to plan the event and revise the final report.

Planning Committee:

Jim Bartholomew, Minnesota Business Partnership

Victor Bloomfield, University of Minnesota

Cyndy Crist, Minnesota State Colleges and Universities

Jennifer Godinez, Minnesota Minority Education Partnership

Susan Heegaard, Minnesota Office of Higher Education

Anne Hornickel, College of St. Catherine, on contract to the Citizens League

Eric Jolly, Science Museum of Minnesota

Barbara Kaufmann, 3M Foundation

Sean Kershaw, Citizens League

Jeremy Lenz, Minnesota Biobusiness Alliance

Nancy Nutting, SciMath Minnesota

Gail O'Kane, Minnesota State Colleges and Universities

Kathleen O'Keefe, Medtronic Foundation

Colleen Riley, Minnesota High Tech Association

Stacia Smith, Minnesota Chamber of Commerce

Michael Wilhelmi, Minnesota Private Colleges Council and Foundation

Kathleen Wilson, Science Museum of Minnesota

Appendix F Concerns of Implementation

Comments and ideas from participants in the Call to Action, March 31, 2006:

What Are the Perceived Barriers within Systems and Infrastructures?

By Business

- K-8 educators do not have enough background in STEM content.
- Too many demands are placed on educators and classroom time- managing difficult behavior, lack of parent support
- Teachers are apprehensive in using technology in the classroom. They need support, training, and assistance.

By Education

- Independent, sovereign school districts make it difficult for the state to mandate 4-year math requirement in high school.
- We need more funding for science specialists in schools.
- There is not enough media attention. We should counter with "celebrity, sex appeal and sizzle!"
- In some schools, reading occupies 120 minutes, which has decreased the amount of science being taught.
- Problems with low aspirations toward STEM achievement. Need to rebuild intrinsic rewards of learning and acknowledging hard work. Make the relevance clear.
- Structure for hiring teachers and related issues, e.g. PELRA; low teacher salaries
- Student attitudes. Instead, provide more relevance, involvement, and creativity.
- Teachers have too much content to cover.

By Government

- Difficulty communicating about STEM to teachers, principals, and families;
- Complexities about licensure
- Interdisciplinary nature makes STEM challenging
- Need to emphasize career education more
- There is no coordination with businesses and MDE
- If we implement demands, will there be enough teachers to meet the demands?
- There are still challenges in teachers believing that all students can succeed
- Funding from both K-12 and the University of Minnesota has been removed which provided infrastructure that once connected them better.

What do sectors need to know of their own sector and others to advance work?

Business

What are the most successful STEM programs? What are the best business programs in the schools? What is their cost and effectiveness?

What government and legislative regulations apply?

What are the challenges that teachers face?

Non-profits

What do non-profits need to know from government?

Creating Minnesota's Plan for Career Development in Science, Technology, Engineering, and Math

- What STEM programs do they have?
- Need more support for more STEM organizations throughout the state
- Stronger support for STEM-related businesses

What do non-profits need to know from business?

- What STEM programs do they do? Need an inventory of corporate programs
- Need financial support and involvement
- Collaborative partnerships
- Philosophy of support for their employees as parents
- Conservation about strategic distribution of donor/corporate dollars—promote philanthropies for STEM

What we need to know from our own non-profit sector?

- An inventory of STEM resources and activities
- Mechanisms for sharing/collaboration
- Multi-sector gatherings/conferences
- Cross sector activities
- Best practices/modes to garner public attention (collaborative PR)
- Best practices/modes for engaging/involving communities

What existing networks are there?

- MN High Tech Association will do a math/science inventory)
- MN College Access Network is doing an inventory
- MN Museum Association

What Will Be the Key Indicators of Progress?

Concerning Desired Outcomes

- Percentage of students taking 8th grade algebra, across cultures
- Percentage of students taking 4 years of math in high school, across cultures
- Percentage of students taking at least 3 years of science, across cultures
- Percentage of students “passing” related MCA-II and GRAD assessments
- Percentage of students taking and passing AP/IB STEM related courses and programs
- Percentage of students entering post-secondary institutions that need remediation coursework
- Percentage of students enrolling in college in STEM degree programs
- Number of colleges with industry liaisons and advisory boards
- Number of companies with active science encouragement programs
- Measuring what matters, using data better to understand students’ progress in learning
- Numeracy literacy measures of the National Council of Teachers of Mathematics

Concerning Advancing the Initiative

- A coordinating body with leadership and enough financial support to convene meetings
- A corporate leader identified to be a figurehead of the public awareness campaign
- An annual meeting for sectors to remain accountable to their implementation plans
- Inventories are carried out within each sector and a clearinghouse develops
- The initiative reaches greater Minnesota cities and rural counties.