Chapter 8
Moving from Vision to Reality: A Call to Action

Beyond Crossroads presents a vision, recommendations, and action items for mathematics professionals for implementing mathematics principles and standards for learning and teaching in mathematics in the first two years of college. The vision of *Beyond Crossroads* becomes reality when students, faculty, departments, and institutions work collaboratively toward the goal of improving student learning in mathematics by adopting a standards-based approach that includes:

- creating a learning environment that optimizes the learning of mathematics
- using a variety of proven instructional strategies
- developing curricula that enables students to be quantitatively literate and prepares them for their careers and lives
- using the results of ongoing assessment of student learning outcomes in mathematics to make improvements in classes, courses, and programs
  student learning outcomes in mathematics to make improvements
- engaging all faculty in ongoing professional development and service.

Putting the five Implmentation Standards of *Beyond Crossroads* in action, along with its principles and the 1995 Standards, is an ongoing process that focuses on student learning in mathematics and the professionalism of all faculty.

One individual or group of individuals cannot address the complex issues of learning, teaching, course and program content, and professionalism in isolation. Students, faculty, and institutions, must make connections with extended communities to maximize student learning, to influence and enhance mathematics education for all students, and to respond to the mathematical needs of the community. The vision outlined in this document becomes reality when:

> Change is good…you go first.
> Bumper sticker

- preK-12 institutions, two-year colleges, and four-year colleges and universities collaborate and mathematics departments are linked to other disciplines
- business and industry communicate desired employee skills to the mathematics community
- publishers and developers of instructional material support and create standards-based instructional resources
- professional societies and government agencies work together to build consensus and provide guidance to practitioners
- the mathematics community nurtures public understanding of and support for improvements in mathematics.

The responsibility for achieving the vision and creating a seamless mathematics education experience for students across sectors must be shared by, preK-16 and higher education institutions and personnel, business and industry, publishers, professional boards and societies, government agencies, and the public. Everyone has a vested interest in improving student success in mathematics by responding to the Call to Action of *Beyond Crossroads*.

> ***Call to Action*: All stakeholders will collaborate to improve mathematics programs in the first two years of college to maximize student learning and respond to the mathematical needs of the community.**

Connections with preK-12 School Districts

Dialogue and collaboration must occur between preK-12 districts and two-year colleges to develop and maintain a consistent, positive, and significant mathematical experience for all students. Institutions that collaborate, benefit from each others' resources. Two-year college faculty can learn from middle and high school faculty using integrated curricula. Two-year college teacher preparation programs can benefit by incorporating preK-12 classroom experiences into their courses. Mathematics faculty can learn lessons from teacher preparation programs and provide hands-on experiences in schools for future teachers.

Collaborative efforts are necessary to address differences in preK-12 mathematics curricula and instructional strategies, and the content of higher education mathematics placement tests. Local efforts on the readiness of students for college mathematics must be examined to help decrease the need for remediation in mathematics when high school students transition to higher education. Differences involving the use of technology also need to be addressed. Many students in high school experience mathematics in context, using technology. A majority of high school exit examinations allow the use of graphing calculators and emphasize problem solving.[88] In contrast, some higher education mathematics placement exams test only basic arithmetic and algebraic computation without technology.

Dual enrollment programs are programs where a high school student enrolls in a postsecondary institution and may earn credit in both sectors simultaneously. These programs promote connections between high schools and postsecondary institutions, but also present challenges in assuring appropriate content and pedagogy. The high school mathematics courses may be taught on a college campus or collegiate courses may be taught in high schools. Regardless of the dual enrollment model used, mathematics faculty and institutions must agree on student outcomes in mathematics courses and programs, and develop appropriate curricula and instructional strategies.

Connections with Four-Year Colleges and Universities

Two-year and four-year institutions must collaborate to build and enhance mathematics programs and develop articulation agreements regarding exit and entrance requirements, course content, pedagogy, the use of technology, and assessment strategies. Open communication among institutions is a prerequisite for successful transition from one higher education sector to another.

Articulation agreements are important in ensuring programmatic integrity and decreasing duplication in course content for students. Effective articulation agreements are the result of ongoing communication and consensus-building activities. Assessment strategies and instruments, exit and entrance requirements, instructional strategies, the use of technology, and the inclusion of real-world applications must be agreed upon and aligned across sectors. Expectations of students and faculty must be communicated broadly and implemented at all institutions.

> Students who can think mathematically and reason through problems are better able to face the challenges of careers in other disciplines – including those in non-scientific areas.
>
> Curriculum Renewal Across the First Two Years Subcommittee (CRAFTY), MAA, 2003

Publishers and Instructional Resource Developers

The mathematical and instructional standards and strategies presented in *Beyond Crossroads* need to be incorporated into instructional materials for students. These materials may be in print, video, digital, or some other, as yet unforeseen form. Faculty need materials to implement the renewed vision.

> To get texts to change, faculty must tell publishers' representatives what they want and what they need.
>
> Mary Ann Hovis, Robert Kimball, John Peterson, *Mathematics for the Emerging Technologies,* 2003, p. 15

Incorporating the recommendations of *Beyond Crossroads* into instructional materials must benefit all parties – students, faculty, and publishers. Faculty must collaborate with publishers, as both writers and users of standards-based materials, so that research becomes practice and guides instructional design. Only through cooperation between faculty and publishers, will standards-based materials become the norm. "…there is a wealth of mathematical material on the internet that could be used effectively in mathematics instruction and learning."[89] A clearinghouse for programs and materials that incorporate the principles and standards of *Beyond Crossroads* is needed as a resource for implementing standards-based mathematics instruction in the first two years of college.

Creating a Bond with the Workplace

Two-year colleges, business, and industry need to collaborate and identify the mathematical needs of the workplace in the 21st century. Business and industry expect employees to possess a high level of quantitative literacy and specific mathematical skills. Directly or indirectly, higher education institutions, especially two-year colleges, educate and train a significant number of prospective employees for business and industry. Since little is known about where students go after completing mathematics courses in two-year colleges,[90] it is important that institutions find ways to track their students after enrollment or graduation to determine whether or not mathematics courses and programs met students' educational or career needs.

Mathematics departments should not work in isolation. In order to be responsive to workforce needs, departments should establish advisory committees including representatives from business and industry to engage in regular conversations about the mathematical expectations of prospective employers. Discussions should focus on incorporating current content strategies, sharing useful information for planning and assessment, identifying opportunities for recruiting guest speakers and adjunct faculty with unique qualifications, and understanding the language and culture of education and business. Business and industry partnerships must provide opportunities for offering specialized mathematics courses and programs for the workforce and aligning courses with employee expectations.

Connections with Professional Societies and Government Agencies

Implementing policy in mathematics education is the responsibility of all sectors and should be designed after careful dialogue and active involvement among all stakeholders. The mission and uniqueness of each entity should be respected, while putting forth a unified voice in support of mathematics curriculum, teaching and learning and improvement of student performance.

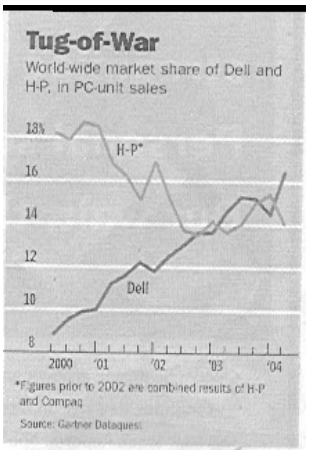
AMATYC, as the principal voice for two-year college mathematics, must establish and enhance relationships with stakeholders that impact two-year college mathematics. AMATYC must keep national leaders in government, education, and on professional boards informed of the two-year college mathematics agenda so that these leaders' influences on policy and funding are used to further the goals of the Standards. Garnering support from professional organizations, federal agencies, foundations, and businesses will significantly help to further implement *Beyond Crossroads*.

Building Public Understanding and Support

The mathematics community needs to communicate to the public the nature and scope of mathematics and the importance of quantitative literacy. "Math literacy is the key to the future of disenfranchised communities."[91] The ability to reason analytically and do mathematics impacts:

- an individual's career options in a global and technological society;
- consumers ability to make decisions and solve problems (e.g. comparison shopping, selection of a car loan or mortgage option, use data on past usage to decide on the best cell phone plan); and
- a citizen's ability to choose between various policy options (e.g. comparing environmental impact versus economic gain, where to use limited funds) or political candidates (e.g. determining consequences of different stands on important issues such as the economy).

Business, industry, and the government use mathematics to make informed decisions and then use the language of mathematics to communicate those decisions. Analyzing and describing data and statistics require mathematical analysis, representations, and manipulations, although the users seldom identify it as mathematics. Technical careers require more mathematics. Technically trained workers from overseas are being recruited for unfilled positions. To be economically competitive and secure, the United States needs to prepare citizens who are mathematically literate and able to fill these jobs.



An example of a chart in the *Wall Street Journal,* May 26, 2004, p. A1

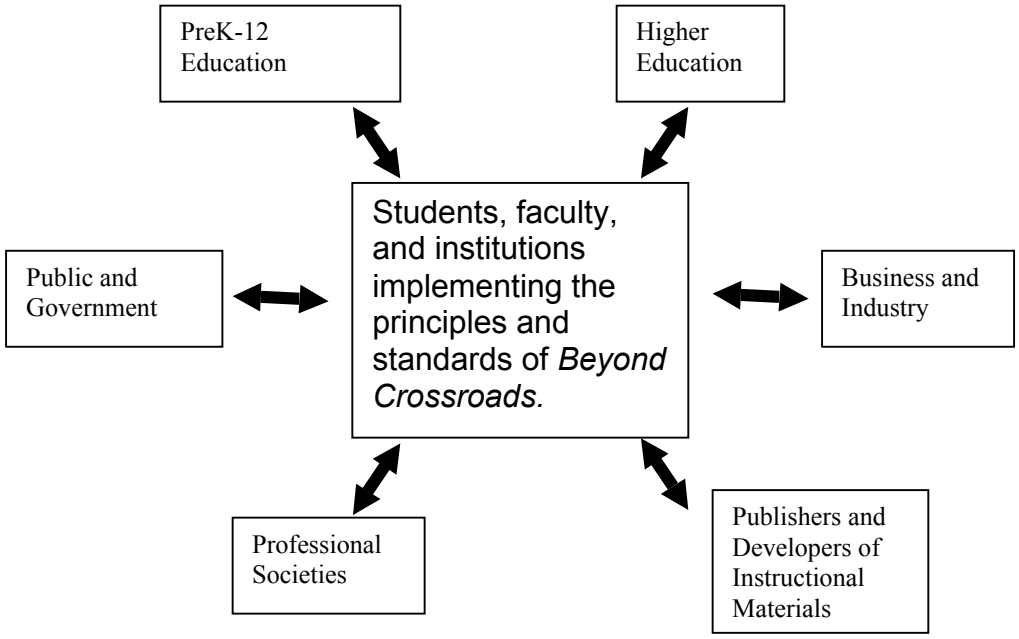
The mathematics community must recognize that the public is suspicious of changes in mathematics content and teaching methods. The mathematics community needs to help the public understand the mathematics students need to learn and the effective instructional strategies that integrate the results of research. Many adults experienced mathematics through passive learning with an emphasis on algorithmic procedures. Research about how students learn mathematics and the rewards of active student learning must be communicated broadly.

Quantitative thinking is a daily activity. Lack of quantitative skills and mathematics power is no longer an option. The public needs to understand what mathematics is important for students to learn, why this mathematics is important, and the most effective instructional strategies that teachers should employ in teaching this mathematics. Local and national newspapers, news magazines, and professional journals expect their readers to read and interpret tables, graphs, and charts. An informed citizen should understand mathematical statements such as "The margin of error was plus or minus 5%." Analyzing data and evaluating the validity of claims requires quantitative thinking and mathematical reasoning. The nature and scope of mathematics and the importance of quantitative literacy must be communicated to the public.

Action Plan

The vision of *Beyond Crossroads*, the implementation of the outlined principles and standards, will be a reality when all stakeholders acknowledge the complexities of change in mathematics education, work together to align expectations, and move toward a single goal of improving student outcomes in mathematics. Students, faculty, departments, and institutions must lead the way in implementing the principles and standards of *Beyond Crossroads*. But they cannot do it alone. Everyone must collaborate, make a commitment to, and assume responsibility for the improvement of student learning in mathematics in the first two years of college.

Figure 2. The Vision of *Beyond Crossroads*: A Collaborative Action Plan



The vision of *Beyond Crossroads*, as defined by the Collaborative Action Plan, will be best served when:

Connecting preK-12 School Districts and Two-Year Colleges

- High school teachers and higher education mathematics faculty agree on course content, instructional strategies, course expectations, and student outcomes in high school and mathematics in the first two years of college.
- High schools and two-year colleges work together to assure that students are able to transition from high school to two-year colleges as easily as possible, aligning high school exit competencies with higher education entrance requirements and mathematics placement tests.
- Mathematics faculty from preK-12 school districts and two-year colleges meet regularly to discuss, examine and explore mathematics curricula, technology, pedagogical strategies, placement tests, and dual enrollment policies.

Connecting Two-Year Colleges and Four-Year Colleges and Universities

- Mathematics faculty at two-year colleges meet regularly with their counterparts at the four-year institutions where their students are most likely to transfer to create a system of placement procedures and instruments that provide a seamless and coherent curriculum across sectors.
- Higher education institutions develop articulation agreements that outline required mathematics courses, credit transfer, and exit requirements.
- Higher education institutions work to align exit requirements at feeder institutions and entrance requirements at receiving institutions.
- Higher education institutions clearly communicate the use and awarding of credit in Advanced Placement (AP), International Baccalaureate (IB), and Dual Credit/Dual Enrollment Programs.

Connecting Business and Industry to Education

- Mathematics faculty establish relationships with business and industry for the interchange of information about workforce needs and include appropriate content and application in their courses.
- Mathematics faculty serve on local advisory boards and committees.
- Mathematics faculty invite industry representatives to professional organizations' conferences to present real-world mathematics applications in their fields.
- Mathematics departments establish advisory committees that include technology faculty, faculty from other disciplines, and representatives from business and industry.
- Higher education institutions collect information on the degree to which their students have acquired the necessary mathematics skills needed by their employers.
- Faculty participate in state mathematics and science coalitions and/or internships or employment in business or industry to expand their knowledge of mathematics in the workplace.

> Dependent people need others to get what they want. Independent people can get what they want through their own effort. Interdependent people combine their own effort with the efforts of others to achieve their greatest success.
>
> Stephen Covey, *The 7 Habits of Highly Effective People,* 1989, p. 49

Connecting Faculty to Publishers and Improving Instructional Materials

- Publishers include faculty conversant with the standards in prepublication focus groups.
- Publishers include faculty conversant with the standards in textbook reviews.
- Publishers develop standards alignment guides as ancillaries for all textbooks.
- Instructors class test innovative student materials aligned with the standards.
- AMATYC creates an Internet clearinghouse that gives instructors access to ideas, programs, and materials that support *Beyond Crossroads.*
- The mathematics community collaborates with publishers and other course material developers to incorporate *Beyond Crossroads* into instructional materials.

Building Public Understanding

- The mathematics community communicates the nature and scope of mathematics education and the importance of quantitative literacy to the public.
- Mathematics faculty listen to, understand, and address the public's questions and concerns about mathematics education and quantitative literacy.
- The mathematics community seeks opportunities to provide input on mathematics documents and speeches prepared for the public.
- Mathematics faculty and mathematics organizations provide opportunities for parents, faculty from other disciplines, administrators, and public officials to gain a deeper understanding of the benefits of standards-based instruction.
- Citizens and especially parents collaborate with mathematics teachers and school and college administrators to learn and understand what mathematics is important for students to learn and how those goals can be best accomplished.

Building and Implementing a National Agenda

- All stakeholders participate in and provide input for national initiatives focusing on introductory collegiate mathematics education.
- AMATYC collaborate with other boards, societies, organizations and agencies to disseminate broadly *Beyond Crossroads* as part of the larger mathematics community's agenda.
- All professional mathematics organizations partner to create a unified national agenda in mathematics and work together to improve mathematics education for all students.
- All stakeholders collaborate to promote preK-16 mathematics programs that diminish the need for remedial and developmental courses.
- Government agencies, foundations, and other funding organizations actively seek the input from the mathematics community to align their programs with the national agenda.

Conclusion

Change in mathematics in the first two years of college and improvement of student learning in mathematics is a multifaceted endeavor. The broad context of our global society, the impact of technological advances, and ever-changing mathematical expectations and requirements present ongoing challenges for mathematics education. Faculty, with support from their institutions, bear the day-to-day responsibility for addressing the learning and teaching needs of their students, preparing quantitatively literate citizens for the future, continuing to grow in their mathematical and pedagogical knowledge, and contributing to their profession. But, faculty and institutions cannot accomplish their goals alone. All stakeholders must take collaborative action to:

- make connections with preK-12 school districts and higher education institutions
- develop and use standards-based instructional resources
- create a bond with the workplace
- build public understanding and support
- speak with a unified voice in support of the improvement of mathematics education for all.

"We believe this standards-based reform effort will provide all students with a more engaging and valuable learning experience. Our students deserve no less; our nation requires no less; and we must demand no less of ourselves."[92]