



## **Report to the Legislature: Mathematics and Science Teacher Content-Based Professional Development**

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Line Item 7061-9804  
February 2010



This document was prepared by the  
Massachusetts Department of Elementary and Secondary Education  
Mitchell D. Chester, Ed.D.  
Commissioner

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Massachusetts Department of Elementary and Secondary Education  
75 Pleasant Street, Malden, MA 02148-4906  
Phone 781-338-3000 TTY: N.E.T. Relay 800-439-2370  
[www.doe.mass.edu](http://www.doe.mass.edu)





# Massachusetts Department of Elementary and Secondary Education

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75 Pleasant Street, Malden, Massachusetts 02148-4906

Telephone: (781) 338-3000  
TTY: N.E.T. Relay 1-800-439-2370

Mitchell D. Chester, Ed.D.  
Commissioner

February 2010

Dear Members of the General Court:

I am pleased to submit this report *Mathematics and Science Teacher Content-Based Professional Development* pursuant to Chapter 27 of the Acts of 2009, line-item 7061-9804.

Teacher quality is a key determinant of student achievement and strong content knowledge is crucial to effective teaching. Successfully teaching all students to reach our state's high standards of mathematics and science learning requires a depth of content knowledge, conceptual understanding, and facility with core skills that exceeds the level of many current elementary and middle school teachers.

This line item represents the only state line item dedicated to support professional development to increase the content knowledge of elementary and middle school mathematics and science teachers, particularly those teaching in high needs districts and those teaching on waivers or without appropriate certification. The Department has designated STEM fields as critical teacher shortage areas and the Board of Elementary and Secondary Education has identified STEM content-focused professional development as a priority in FY11.

In the 2008-2009 school year, 409 STEM teachers were on waivers. With so many mathematics and science teachers on waivers and schools needing to fill so many positions, there is great need for the initiatives funded through this line item.

This line item has undergone severe budget cuts since FY07, its first year of funding.

- In FY07, the legislature appropriated \$1 million to fund content-focused professional development and \$1 million to fund a pilot scholarship program for STEM teachers.
- In FY08, a total of \$895,367 was allocated for content training for STEM teachers, and the scholarship funds were allocated to a separate line item.
- In FY09, the initial allocation of \$991,367 (including an earmark) was reduced in October and then again in January. The final allocation was a drastically reduced amount of \$386,227 after accounting for a \$100,000 earmark.
- The FY10 allocation (without an earmark) effectively level-funded this line item at \$386,227.

Full funding at its original level in FY07 of \$1 million provided high quality effective content-based professional development courses, including 8 Intel Math courses (80-hour courses, serving 200 elementary and middle math teachers) and 25 STEM Professional Development

Institutes (45-hour courses serving 600 STEM teachers). In total over 800 STEM teachers were directly supported by this line item when fully funded.

At the FY10 level of funding (\$386,227) the Department is able to fund the follow-up sessions for four 2009 institutes; and 8 new institutes for the summer of 2010. The FY10 funds will also fund follow-up sessions for 3 Intel Math courses and fund 2 new additional Intel Math 80-hour courses summer 2010. Both of these programs will serve a total of 250 STEM teachers. The impact of this reduced funding has meant that we are now serving 69 percent (550) fewer STEM teachers.

The Department has been working for the past several years to develop a professional development delivery system that provides educators with tools to identify their professional growth needs and offers regionally based opportunities for teachers to enhance their content knowledge and instructional practice through the use of state, federal, and other resources. With the establishment this year of regional Readiness Centers and District and School Assistance Centers (DSACs), we have made progress in establishing a structure to support the systematic delivery of professional development.

This line item funds the following major initiatives and programs: the Professional Development Institutes, the Massachusetts Intel Mathematics Initiative, ALEKS Mathematics MTEL Preparation Pilot Study, and Professional Development Networks for Mathematics and Science leaders. These programs are detailed in the report. The Professional Development Institutes have been providing coursework during the summer for 16 years to educators throughout the Commonwealth in all subject areas. During the summer of 2009, this line item funded 4 STEM Institutes, serving fewer than 100 STEM teachers across the state. This year the Department will use the DSACs to offer high-need districts across the state a core set of regionally based teacher professional development institutes.

The Massachusetts Intel Mathematics Initiative (MIMI), has been designed and implemented to provide a high quality and scalable training approach to enhance the foundational knowledge of elementary and middle school mathematics teachers. In the fall of 2006, the Department entered into a partnership with the Intel Corporation, the UMass Medical Schools' Regional Science Resource Center, and the University of Vermont mathematician, Dr. Kenneth Gross. In 2007, the partnership offered 300 elementary and middle school teachers of mathematics an 80-hour course focused on K-8 foundational content. Participants also meet regularly during the school year to reinforce and extend their learning and improve instruction. In the summer of 2010, this line item will fund two courses, and will serve an additional 50 mathematics teachers. We are not able to meet the demand and need for the large number of elementary and middle school teachers who need to strengthen their mathematical content knowledge at the current level of funding.

A pilot study exploring the use of online technological tools for improving teacher content knowledge is continuing. The pilot explores the use of Assessment and Learning in Knowledge Spaces (ALEKS) online diagnostic and tutorial program to prepare teachers for the mathematics Massachusetts Tests for Educator Licensure (MTEL). Participants agree to use ALEKS for a minimum of 10 hours, document their experience by completing three surveys, and register and take an MTEL mathematics test in November, March, May or June. Over 300 Massachusetts educators have participated in the study during the past two years and there are more than 50 new teachers currently participating. The Department has contracted with the UMass Donahue Institute to examine the effectiveness of ALEKS as an MTEL preparation tool. Initial results of

the evaluation suggest that ALEKS participation may be responsible for substantial increases in MTEL pass rates.

Professional development networks have been used to support mathematics and science leaders. For the past five years, the superintendent of each of the 24 urban districts has appointed a liaison to statewide networks in both mathematics and science. The network collaborates around shared issues to problem-solve, build capacity, and provide feedback on initiatives and policy. The Math Support Specialists network is comprised of math leaders-practitioners, including coaches, professional development providers, and assessment specialists who meet for professional development and resource sharing.

With the continued attention placed on mathematics and science education nationally, it is crucial that we continue making investments to strengthen mathematics and science in the Commonwealth. While this line item has provided an initial platform for developing a statewide system of professional development, the amount of professional development offered by the Department has been inadequate to meet the need. Scaling up and sustaining a state-wide professional development system will require continued, and when possible, additional funds, as well as a potential adjustment in how school districts direct professional development spending.

I ask that you join me and the Board of Elementary and Secondary Education in prioritizing this line item in the FY11 budget. The Board has identified this line item as one of the programs that provide maximum statewide leverage to close proficiency gaps and promote and support student, school, and district success. I look forward to your continued support to meet the need to strengthen the content knowledge of our STEM teachers in our state. I would be happy to answer any questions you may have.

Sincerely,

Mitchell D. Chester, Ed.D.  
Commissioner of Elementary and Secondary Education

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## I. Introduction

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The Department of Elementary and Secondary Education respectfully submits this Report to the Legislature: *Mathematics and Science Teacher Content-Based Professional Development* pursuant to Chapter 27 of the Acts of 2009, line item 7061-9804:

*"... provided further, that the department shall report, not later than February 15, 2010, on the number of educators provided content training under this item, the estimated number of math and science teachers currently teaching without certification, and any legislative or regulatory recommendations necessary to make middle school and elementary math and science education more rigorous and data driven; provided further, that said report shall be provided to the secretary of administration and finance, the senate president, the speaker of the house, the chairs of the house and senate ways and means committees and the house and senate chairs of the joint committee on education..."*

The budget language for this line item states that the funds support professional development to increase the content knowledge of elementary and middle school mathematics and science teachers, particularly those in high-need districts.

In FY07, the first year of funding, the legislature appropriated \$2 million to fund content-focused professional development as well as a new Pilot Scholarship Program for mathematics and science teachers. In FY08, a total of \$895,367 was allocated to support content training for mathematics and science teachers, while the scholarship program funds were allocated to a separate line item (see 7070-0065) administered directly by the Board of Higher Education. In FY09, the initial allocation of \$991,367 was reduced by \$505,140 in October and January as part of the governor's 9c cuts, leaving \$386,227 for content-based mathematics and science professional development after accounting for a \$100,000 earmark. The FY10 allocation of \$386,227, without an earmark, has effectively level-funded this line item.

The legislature has also extended the spending period for this line item through August, 2010, which is crucial for the successful administration of these funds by allowing the support of intensive professional development activities during the summer when teachers are available.

This report describes the progress achieved in mathematics and science teacher content training that occurred since the February 2009 legislative report, and details FY10 funded program activities from July 1, 2009 through August, 2010.

### ***A Critical Need***

There continues to be a critical need for state funds to support mathematics and science education. Although there has been incremental progress at grade 10, student scores in mathematics and science have been effectively flat in grades 3-8 during the period of 2003-2009.

The positive results from the 2007 Trends in International Mathematics and Science Study (TIMSS) suggest that Massachusetts measures up well on the global stage, yet the percentage of Massachusetts students performing at the highest international benchmark category (Advanced) still lags behind leading Asian countries. In science, 22 percent of Massachusetts 4th graders met the Advanced benchmark, compared to 36 percent of students in Singapore; in math, 22 percent were Advanced, behind Singapore (41 percent), Hong Kong SAR (40 percent), Chinese Taipei (24 percent) and Japan (23 percent).

There continue to be persistent and disturbing achievement gaps between the performance of white, more affluent students, and the performance demonstrated by low income, racial and language minority students in Massachusetts public schools. In addition, a large number of students entering college need remedial coursework, indicating that they are not prepared for college-level courses.<sup>1</sup> Low mathematics and science performance is a problem that affects districts across the state, and is particularly severe in the urban districts where over 90 percent of middle schools are now identified in mathematics for improvement, corrective action or restructuring under the No Child Left Behind Act (NCLB). Low K-12 student performance contributes to shortages in the science, technology, engineering, and mathematics (STEM) pipeline (as fewer students choose STEM careers) that ultimately produces negative consequences for the knowledge-based economy of Massachusetts.<sup>2</sup>

Teacher quality is a key determinant of student achievement and strong content knowledge is crucial to effective teaching.<sup>3</sup> Successfully teaching all students to reach our state's high standards of mathematics and science learning requires a depth of content knowledge, conceptual understanding, and facility with core skills that exceeds the level of many current elementary and middle school teachers. Professional development is a key strategy for upgrading the skills of the existing workforce, particularly for teachers who are not highly qualified. To date, department-sponsored efforts to improve the content knowledge and instructional practices of mathematics and science teachers have been limited in scope but very well received. This line item provides resources to support the continuation of systemic programs to improve the professional development of mathematics and science teachers.

## ***A Strategy for Improving STEM Professional Development***

The Department has been working for the past several years to develop a professional development delivery system that provides educators with tools to identify their professional growth needs and offers regionally based opportunities for teachers to enhance their content knowledge and instructional practice. With the establishment this year of regional Readiness Centers and District and School Assistance Centers (DSACs), Massachusetts has made progress in establishing a structure to support the systematic delivery of professional development. The

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<sup>1</sup> A recent report indicated that among the 2005 cohort of high school graduates in Massachusetts who attended public colleges and universities within the state, 29 percent required developmental (i.e., remedial) course work in mathematics. See the February, 2008 "Massachusetts School-to-College Report Class of 2005" at <http://www.doe.mass.edu/research/reports/0208bhe.doc>.

<sup>2</sup> See, for example, the 2008 reports: "Gaining Momentum, Losing Ground," by Tapping America's Potential, at [http://www.tap2015.org/news/tap\\_2008\\_progress.pdf](http://www.tap2015.org/news/tap_2008_progress.pdf); and "Ready for 21st Century Success: The New Promise of Public Education," by the Patrick Administration at <http://www.mass.gov/Eeoe/docs/ma-edplan-finalrev1.pdf>.

<sup>3</sup> See, for example, Chapter 6 of the 2008 National Mathematics Advisory Panel report, "Foundations for Success," at <http://www.ed.gov/MathPanel>.



programs detailed in Section II of this report represent initial steps in the development of this professional development system.

For the past 16 years, the Professional Development Institutes have been offered during the summer in locations across the state. Starting this year, the Department will use the DSACs to offer high-need districts across the state a core set of regionally based teacher professional development institutes, covering key mathematics and science content knowledge and related standards-based instructional strategies throughout the year. At its current funding level, this line item will support a small portion (8 STEM institutes) of the Department-sponsored professional development in the summer of 2010.

The Massachusetts Intel Mathematics Initiative (MIMI) has been designed and implemented to provide a high quality and scalable training approach to enhance the foundational knowledge of elementary and middle school mathematics teachers. The current funding level allows the delivery of two courses, down from eight courses in 2008. We will need continued and increased state funding for mathematics and science professional development over the next two years in order to meet the original goal of scaling-up this initiative to strengthen the teaching capacity of over 1,000 elementary and middle school mathematics teachers.

A pilot study exploring the use of online technological tools for improving teacher content knowledge is continuing in the current year. Building on the teacher content knowledge assessment study funded through the line item in its first year, the current pilot study investigates the use of the Assessment and Learning in Knowledge Spaces (ALEKS) online diagnostic and tutorial program to prepare teachers for the mathematics Massachusetts Tests for Educator Licensure (MTEL). Initial results of the external evaluation suggest that ALEKS helps prepare teachers to pass the MTEL. The pilot study has been expanded to include teachers who are taking the General Curriculum MTEL, to support educators seeking licensure at the elementary level under the recently increased mathematics requirements.

Finally, funds have been used to support professional development networks for mathematics and science leaders. The Department meets monthly with several groups of district leaders to build leadership capacity for improving mathematics and science teaching.

The remaining sections of this report describe these programs in more detail, provide the mathematics and science educator data that are currently available, present the FY10 budget, and articulate recommendations for strengthening mathematics and science education in future years.

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## II. Major Initiatives and Programs

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### ***Teacher Professional Development Institutes***

#### Background and Program Design

The Professional Development Institutes are sponsored by the Department in partnership with non-profit organizations, professional development organizations, educational collaboratives, cultural institutions, school districts, charter schools, colleges, and universities. The purpose of the institutes is to increase the content and pedagogical knowledge of Massachusetts educators necessary to provide effective, standards-based classroom instruction. Starting last year, the institutes have been selected and revised specifically to address achievement gaps, particularly for students with disabilities and English language learners. A set of foundational professional development courses will be offered through the regional DSACs to serve a targeted number of high-need districts across the state. In addition, the Department will continue to sponsor the Professional Development Institutes Program statewide.

Teachers from across the state participated in the summer 2009 Professional Development Institute program; this line item funded 4 of the science and mathematics courses targeted to serve the urban districts. These courses engaged 100 teachers, coaches, paraprofessionals, and administrators in subject-specific math and science courses, including foundational courses as well as courses designed to continue to improve teachers' classroom practice through advanced study (see Appendix 2 for course titles). Although all institutes were required to administer pre- and post-tests of content knowledge, these results are not yet available. The participants completed the institute participant survey, providing detailed information about their teaching positions and credentials. A preliminary summary of the survey data follows:

- *Of those respondents teaching science, 87 percent were certified in the science subject they teach, while 5 percent were teaching on a waiver. In mathematics, 91 percent were certified in mathematics and 3 percent were teaching on a waiver. Those not certified or on a waiver were teaching these subjects out-of-field.*
- *Teacher participants worked with key student populations - 63 percent of participants teach with students with disabilities and 38 percent teach English language learners.*
- *Almost all participants reported that the Institute contributed to their content knowledge in the subject (98 percent in science and 97 percent in mathematics).*

#### Fund Use

FY10 funds from this line item funded the fall follow-up components of four institutes from summer 2009 and will support eight institutes during summer 2010.

## ***Massachusetts Intel Mathematics Initiative***

### Background and Program Design

In the fall of 2006, the Department of Education entered into a partnership with the Intel Corporation, the UMass Medical School's Regional Science Resource Center, and University of Vermont mathematician, Dr. Kenneth Gross. In 2007, the partnership launched the Massachusetts Intel Mathematics Initiative (MIMI) and offered 300 elementary and middle school teachers of mathematics an 80-hour mathematics course focused on K-8 foundational content (e.g., arithmetical operations, proportional reasoning, linear equations). Participant teachers from four high-need districts (Boston, Springfield, New Bedford, and Worcester) completed most of the coursework during the summer and finished during the school year.

Participants also meet regularly during the school year in mathematical learning communities to reinforce and extend their learning and improve instructional practice. UMass Medical School has managed the training of facilitators and support for the learning communities, as well as developed high-quality materials to structure 30 hours of collaborative work by mathematics teachers. These materials are available for free on the Department website and have been downloaded by educational leaders from across the country.

An external evaluation, conducted by WestEd and funded primarily by Intel, has provided early indications of success. The evaluation indicates that participant teachers had gains in both conceptual knowledge and computational skills, with a nationally validated assessment exhibiting significant gains in content knowledge across the program. MIMI is representative of best practices in content-focused professional development and has been recognized nationally as a model program.<sup>4</sup>

Starting in the summer of 2010, this line item will fund an additional 2 courses enabling 50 teachers to take the intensive 80-hour mathematics course. Four of the 15 trained master instructors will be deployed for this purpose.

### Fund Use

FY10 funds have primarily been used to complete three courses of the third cohort of MIMI during the fall of 2009. Due to decreased funding for this line item, the MIMI initiative has been scaled down by 75 percent for the summer 2010 cohort of teachers, compared to summer 2008 levels.

FY10 funds will be allocated to contract with UMass Medical School to coordinate the initiative. The contract will include the following activities to support two courses in summer 2010: compensation for instructors (course planning and delivery); participant teacher stipends; and support for the mathematical learning communities in participating districts.

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<sup>4</sup> For example, Intel Math is a centerpiece of one of the public-private partnerships highlighted by the recently announced federal "Educate to Innovate" STEM campaign. See the White House press announcement at <http://www.whitehouse.gov/the-press-office/president-obama-expands-educate-innovate-campaign-excellence-science-technology-eng>

## ***ALEKS Mathematics MTEL Preparation Pilot Study***

### Background and Program Design

The Department is continuing a pilot study that began during the second half of 2008 to examine the potential benefits to teachers and teacher candidates of using a web-based tutorial program to prepare for the MTEL Elementary Mathematics (#53) and Middle School Mathematics (#47) tests. The Department has opened the program during the 2009-2010 school year to also support and study the use of ALEKS for teacher preparation for the new MTEL General Curriculum Mathematics subtest (#03).

Study participants receive a free three-month subscription to Assessment and Learning in Knowledge Spaces (ALEKS) software, a web-based assessment and learning system. After an initial adaptive diagnostic assessment, ALEKS provides each participant with a summary report that can guide the participant's use of the learning mode tutorial where the program provides detailed explanations, opportunities for practice, and tracks the mastery of concepts and skills. Participants in the study agree to use ALEKS for a minimum of 10 hours, document their experience by completing three surveys, and register and take an MTEL mathematics test in November, March, May or July. Over 300 Massachusetts educators have participated in the study during the past two years and there are more than 50 new teachers currently participating.

Although ALEKS is not specifically designed to prepare teachers for the MTEL tests, teachers who participated in the Department's teacher content assessment study three years ago identified ALEKS as potentially helpful for mathematics MTEL preparation. At the Department's request, the initial ALEKS Pilot Study findings were used to refine the course offerings to better align with the MTEL test objectives and provide recommendations on optimization of study time.

The Department contracted with the UMass Donahue Institute to examine the effectiveness of ALEKS as an MTEL preparation tool. Initial findings suggest that ALEKS participation may be responsible for substantial increases in MTEL pass rates. The study continues to seek solid evidence of effectiveness and profile the types of teachers for whom ALEKS is most effective in supporting MTEL preparation. If the study results continue to be promising then the Department will consider supporting the use of ALEKS or similar tools for prospective mathematics teachers as a means of addressing the workforce shortage in this area.

### Fund Use

Funds from this line item support the Department's contract with the UMass Donahue Institute to conduct the ALEKS mathematics teacher training pilot study.

## ***Professional Development Networks for Mathematics and Science Leaders***

### Background and Program Design

For the past five years, the Superintendent of each of the 24 urban districts in the Commonwealth has annually appointed a liaison to the statewide networks in both mathematics and science. Liaisons act as the bridge between statewide programs and local math initiatives and are responsible for both integrating statewide opportunities and professional development into district activities as well as scaling up local efforts to improve student achievement in

mathematics and close achievement gaps. The Department network collaborates around shared issues to problem-solve, build capacity, and provide feedback on mathematics initiatives, assessing the need and focus for content-focused professional development programs, and Department policy.

The Math Support Specialists (MSS) network is comprised of urban district math leader-practitioners (e.g., coaches, professional development providers, assessment specialists) who meet for a full day four times per year for professional development and resource sharing. The network is focused this year on addressing math learning issues for students with disabilities, and districts send Special Education specialists in addition to mathematics specialists. The network will produce resources and recommendations to inform future Department initiatives and professional development programs that address achievement gaps in mathematics between regular education and special education students.

#### Fund Use

The line item has supported meeting expenses for these professional development networks.

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### III. Teacher Data

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The teacher data available provides the basis for an estimate of the number of mathematics and science teachers who are teaching without proper certification. However, the data are not without limitations and the figures provided are a conservative reflection of the challenges facing the state. Explanations for why this is so are included below.

#### ***Teachers on Waivers***

The Department has designated STEM fields as critical teacher shortage areas. Schools can take advantage of a Critical Shortage Waiver to hire retired teachers into these fields. Schools can also fill positions under the general waiver program, in which school districts can hire unlicensed teachers on a short-term basis (typically limited to one year).

The table below shows the number of Massachusetts teachers who were teaching in STEM fields under waivers for the 2008-2009 school year.

*Table 1: Number of STEM Educators Teaching on Waiver, 2008-2009*

<b>Subject</b>	<b># of Waivers</b>
General Elementary	58
Middle School Mathematics/Science	30
Elementary Mathematics (Gr. 1-6)	5
Middle School Mathematics (Gr. 5-8)	43
Mathematics (Gr. 8-12)	94
Mathematics TOTAL	142
General Science	28
Biology	64
Chemistry	34
Earth Science	13
Physics	28
Technology/Engineering	12
Science/Technology TOTAL	179
<b>TOTAL:</b>	<b>409</b>

Source: ESE Data Analysis and Reporting

While 409 STEM teachers on waivers in 2008-2009 is high, this number is under-representative of the actual demand. Since waivers for a particular position are only granted for one year, schools request more waivers each year than are granted. For example, at this point in the 2009-2010 school year, the Department has granted 202 of the 227 waivers requested in mathematics and science. With so many mathematics and science teachers on waivers and schools needing to fill so many positions, there is great need for the initiatives funded through this line item. These numbers also do not account for the approximately 1,200 waivers in 2008-2009 for special

education teachers of students with severe and moderate disabilities, many of whom may be teaching mathematics and science as part of their responsibilities.

### ***Teachers “Not Highly Qualified”***

The table below reports the number of mathematics and science teachers not highly qualified for the field they are teaching by virtue of not having an acceptable subject area license or by lacking subject matter competency. The figures displayed show full-time equivalents (FTEs) to avoid inflating head count figures for teachers that teach multiple subjects. The last three columns provide the corresponding percentage of teachers not highly qualified in the subject they teach.

Limitations to the data presented here should be noted:

- (1) These numbers do not reflect generalist elementary teachers responsible for teaching all subject areas (including math and science) who are licensed as elementary teachers. The General Curriculum elementary license currently does not ensure that teachers have the requisite content expertise in mathematics and/or science.<sup>5</sup>
- (2) The highly qualified status of teachers is based on district reporting. Future plans for the integration of teacher data systems with teacher requirement rules will allow for statewide verification of highly qualified reporting.
- (3) Technology and Engineering is not currently considered a core academic subject area, therefore highly qualified information on teacher work assignments are not required. The figures below only represent Technology and Engineering teachers without a license.
- (4) The data do not capture those teachers teaching math courses in work assignments that school districts have designated as non-core.

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<sup>5</sup> For details on the efforts to strengthen the preparation and licensure requirements for elementary and special education teachers who teach mathematics, see <http://www.doe.mass.edu/news/news.asp?id=3801>.

*Table 2: Mathematics, Science & Technology/Engineering Teachers by School Levels and Percent Not Highly Qualified-FTE\**

Subject	# FTE			# FTE Not Highly Qualified			% Not Highly Qualified		
	Elem	Middle	HS	Elem	Middle	HS	Elem	Middle	HS
General Science	389	1,439	252	15	65	20	3.9	4.5	7.9
Biology	2	85	1,186	0	3	68	0.0	3.5	5.7
Chemistry	0	14	626	NA**	0	37	NA	0.0	5.9
Earth Science	24	256	348	0	9	24	0.0	3.5	6.9
Physics	0	45	624	NA	0	72	NA	0.0	11.5
Tech/Engineering	22	186	145	1	8	8	4.5	4.3	5.5
<b>Sciences (Total)</b>	437	2,025	3,181	16	85	229	3.7	4.2	7.2
<b>Mathematics</b>	660	2,437	3,508	31	116	190	4.7	4.8	5.4

Source: ESE Data Analysis & Reporting, January 2010

\* FTEs rounded to whole numbers unless it is less than 1 but greater than 0

\*\* NA= Not applicable

### ***Teacher Data System in Place for Analysis***

The Department completed the first statewide implementation of the Education Personnel Information Management System (EPIMS) in 2008. EPIMS collects demographic and professional data along with work assignment information on all individual public school educators, paraprofessionals and administrative staff (approximately 130,000 individuals). Educator information is collected at the classroom level. The data has been linked to the Department's licensure database (ELAR), and beginning in October 2010 EPIMS collections will increase statewide to three times a year in conjunction with the introduction of a Student Course Schedule (SCS) collection. For the first time, this will allow the Department to link teacher and student data and improve analyses noting trends, identifying high need areas, and assisting districts with their recruiting efforts in mathematics and science.



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## **IV. FY10 Budget**

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<b>Program or Initiative</b>	<b>Estimated Amount</b>
<b>Teacher Professional Development Institutes</b>	<b>\$230,745</b>
Complete the Summer 2009 45-hour Math and Science Institutes (4)	\$29,306
Summer 2010 45-hour Math and Science Institutes (8)	\$201,439
<b>Massachusetts Intel Mathematics Initiative</b>	<b>\$136,282</b>
Complete the Cohort III 80-hour Intel Math Courses (grants)	\$26,282
Cohort IV 80-hour Intel Math Courses (2)	\$110,000
<b>ALEKS Mathematics MTEL Preparation Pilot Study</b>	<b>\$8,000</b>
External evaluation contract	\$8,000
<b>Professional Development Networks for Mathematics and Science Leaders</b>	<b>\$11,200</b>
<b>TOTAL</b>	<b>\$386,227</b>

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## V. Recommendations for Mathematics and Science Education Funding and the FY11 Budget Line Item

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### *Strengthening Mathematics and Science Education by Restoring Previous Levels of Professional Development*

With the recent attention placed on mathematics and science education through the expectations of NCLB and our state's competency determination policy, it is crucial that we continue making the investments needed to strengthen mathematics and science education in the Commonwealth. While this line item has provided an initial platform for developing a statewide system of professional development, the amount of professional development offered by the Department has been inadequate to meet the need in the past. Scaling up and sustaining a state-wide professional development system will require additional state funds, and a potential adjustment in how school districts direct professional development spending. It has been suggested that an investment of \$50 million per year in content training for teachers would be required to sufficiently retool the mathematics and science teaching force.<sup>6</sup> Survey responses from urban district Superintendents and mathematics curriculum coordinators identified content-based professional development in mathematics as a top priority for district support, highlighting the importance of these programs to education improvement efforts.

The level of FY10 funding is significantly lower than the amount required to maintain historical levels of mathematics and science professional development. In the summer of 2008, the 16 Professional Development Institutes engaged 407 participants. At an average cost of \$28,168 per institute (\$1,661 per participant) for 40 hours of instruction and 20 hours of follow-up, the total cost was approximately \$676,000. The MIMI initiative costs approximately \$45,000-\$50,000 per course (less than \$2000 per participant) for 80 hours of instruction, mathematical learning, community support, and teacher stipends, totaling approximately \$360,000 to support eight courses in that year. The total spending to implement these two programs at the level of 2008 is over \$1 million, representing a shortfall of more than \$600,000 in FY10.

Although it is not adequate to meet the need in the state, for FY11 we recommend steps to restoring this line item to the original level that approached the \$1 million mark. The Board of Elementary and Secondary Education has prioritized this line item as one that provides maximum statewide leverage to close proficiency gaps and promote and support student, school, and district success. Returning these programs to their previous scope will provide a basis for preparing to scale-up and systematize mathematics and science professional development over the long-term.

In past legislative reports we have also highlighted other areas of need, such as mathematics and science coaching, formative assessment, science and technology/engineering laboratory

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<sup>6</sup> See the 2005 report by Mass Insight Education and Research Institute, "World Class: The Massachusetts Agenda to Meet the International Challenge for Math- and Science-Educated Students," at <http://www.massinsight.org/>.

facilities, the promotion of technology/engineering, and support for student interventions. Although these areas continue to require attention, the need for high quality systematic professional development in mathematics and science is at a critical level that demands the highest priority and a renewed commitment.

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## VI. Appendix

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### Appendix 1: FY10 Budget Line Item Language

7061-9804

For teacher content training in math and science; provided, that said training shall include math specialist and Massachusetts test for educator licensure preparation; provided further, that funds from this item shall be expended on content based professional development in math and science, with a focus on increasing the content knowledge of elementary and middle school math and science teachers in districts with a high percentage of students scoring in level 1 or 2 on the math or science Massachusetts comprehensive assessment system exams, or in districts which are at risk of or determined to be underperforming in accordance with sections 1J and 1K of chapter 69 of the General Laws; provided further, that such professional development courses shall demonstrate proven, replicable results in improving teacher and student performance, and shall demonstrate the use of best practices, as determined by the department, including data comparing pre-training and post-training content knowledge; provided further, that the department shall report, not later than February 15, 2010, on the number of educators provided content training under this item, the estimated number of math and science teachers currently teaching without certification, and any legislative or regulatory recommendations necessary to make middle school and elementary math and science education more rigorous and data driven; provided further, that said report shall be provided to the secretary of administration and finance, the senate president, the speaker of the house, the chairs of the house and senate ways and means committees and the house and senate chairs of the joint committee on education; provided further, that no funds shall be expended for personnel costs; and provided further, that for the purpose of this item, appropriated funds may be expended through August 31, 2010

**Appendix 2: 2009 Professional Development Institutes funded by this Line Item**

	<b>Institute Title</b>	<b>Region</b>
<b>Mathematics</b>		
1	Developing Algebraic Thinking	Central
2	Assessment & Conceptual Mathematics Problems	Greater Boston
3	The Coaching Cycle: An Interactive Online Course for K-8 Mathematics Coaches	Online
<b>Science</b>		
1	Improving Middle Grades Science through Effective Formative Assessments	Northeast