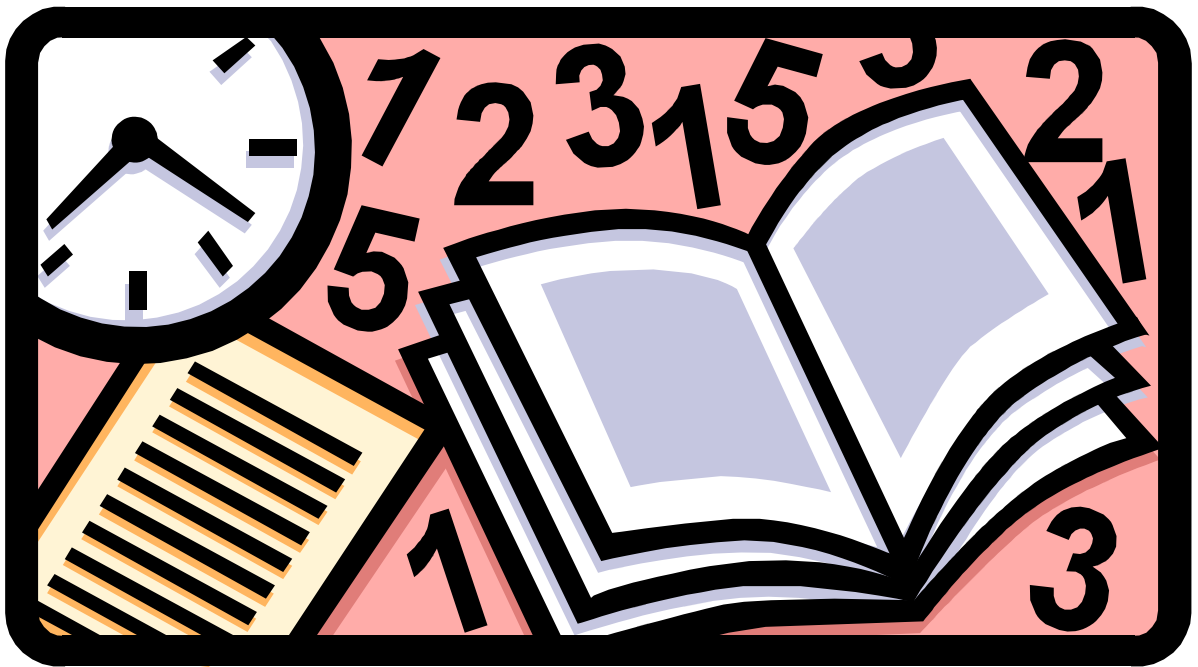


Middle School Mathematics

Program Review Report



January 23, 2007

Summary

The general perception of the middle school math program by students, parents and administrators is highly favorable. There are, however, a number of opportunities for improving the program. Some issues are already being addressed for the 2006-2007 academic year through the Academic Success class (AS) that is replacing the Independent Learning Block (ILB), the purchase of the Algebra 1 textbook for all 7th grade students to support the delivery of an integrated Algebra 1 curriculum over two years, and a revised schedule that establishes collaborative time for 6th grade teachers.

Here are some other high priority recommendations that can be implemented in a reasonably short period of time:

- Develop curriculum maps and pacing guides for each grade level.
- Supplement units with additional challenge materials for students at all levels and emphasize the use of manipulatives more extensively throughout the program.
- Modify 7th grade curriculum to integrate resources from the new McDougal Littell Algebra 1 textbook. Concurrently, modify the 6th grade curriculum to ensure a consistent transition from elementary school to the 7th grade Algebra program. (The high school is already using the same McDougal Littell series for Algebra 2).
- Place more emphasis on teaching and using common vocabulary to ensure consistency and to improve students' understanding of terminology across and between grades.
- Use common assessments, at a minimum at the end of each year if not each trimester or each unit, to ensure consistent progress for all students. Use these assessments, as well as pre-assessments, to inform instruction within a grade. Share end of year assessments with teachers at the next grade level.
- Support new teachers by providing time and supplemental training to help them to better understand and implement the curriculum.
- Enable more peer observation and sharing of student work so that best practices can be further shared among teachers. Dedicate time to support this effort.
- Provide clear, consistent guidelines to teachers for placing students in leveled classes. Communicate openly and proactively with parents, as well as students, about placement criteria.
- Examine ways to more effectively organize instruction to enable us to challenge our most talented mathematics students and to support those who struggle with the subject.

Introduction

The examination of the middle school math program is part of the Needham school district's comprehensive K-12 curriculum review process. The intent of the review is to assess the current mathematics program by learning more about the overall instructional and organizational systems and their impact on student learning. This assessment will help to establish areas of focus for continuous program improvement.

Methodology

As part of a comprehensive assessment of the middle school mathematics program, all teachers and students were surveyed, all administrators were interviewed, and 5% of the middle school parents participated in a grade level focus group. The assessment sought to understand the strengths and weaknesses of the overall middle school math program structure, the specific curriculum expectations, how the curriculum is being implemented, and the program's impact on student learning.

Using the district's curriculum assessment framework, along with the 2005 elementary math program review, surveys were developed for teachers and students aimed at assessing the effectiveness of the current math program and the continuity and consistency within and between grades. Interview and focus group questions were developed for the four middle school administrators (principal and grade level administrators) and for a cross-section of the parent population. A random selection of 1 out of every 20 parents, representing a sampling of grades and learning levels, was invited to the focus groups that were conducted by the Director of Program Development and Implementation and the Director of Student Development and Program Evaluation.

The surveys and the focus groups took place in May, 2006 and administrator interviews took place in June 2006. The results were tabulated and analyzed by Tammy Ghizzoni, middle school mathematics department Head Teacher, and David Harris, an 8th grade teacher, along with the Director of Program Development and Implementation.

Following the curriculum assessment framework, the data collected was organized into categories that focus on Instructional Systems: Curriculum, Instruction (curriculum delivery) and Assessment which lead to Student Learning, and categories that focus on Organizational Systems: Leadership, Professional Development and Teacher Culture / Community. Within each topic area we provide *background* information, quantitative and qualitative *survey findings* based on all four surveys, as well as supplemental data where available, and specific *recommendations*.

Curriculum

Background

The middle school program has undergone significant changes in the last 2 years aimed at improving all students' readiness for high school math. In particular, all 7th and 8th grade students are now enrolled in a two year Algebra 1 program.. The school also adopted a new Algebra 1 textbook (McDougal Littell *Algebra 1*) that is more accessible for students and provides more resources, including more real world connections for teachers. This text was initially introduced to 8th grade in fall of 2004 and is now being used with 7th grade students as well. Until this year, 7th grade teachers had been using a series of pre-algebra units developed by 7th grade teachers several years ago. These units were based upon an outdated Algebra 1 text (Merrill Algebra 1, copyright 1994) and Creative Publications' *Mathscape* series. Sixth grade teachers also use a variety of teacher developed materials built around the middle school math curriculum. They are using McDougal Littell *Passport #2* (copyright 1999) and Creative Publications' *Mathscape* series as references. The entire curriculum itself was reviewed and refined when the new Algebra textbook was introduced into 8th grade, both to account for all students taking Algebra 1 and to ensure that content prescribed by the Massachusetts state framework for each grade was being addressed.

Ongoing curriculum review process: On an ongoing basis, math teachers at 7th grade and math teachers at 8th grade have collaborative time built into their schedules to discuss the curriculum and their methods of implementing it. Starting with the 2006-2007 school year, collaboration time was added in for 6th grade teachers as well. One early release day each year has been focused on student transitions, both from elementary school to 6th grade and from 8th grade to the high school. Among other things, this has resulted in modifications to the high school math offerings to better reflect the range of needs of the incoming class. For example Algebra 1 honors is now offered at 9th grade to allow students in Algebra B (lower level Algebra) in 8th grade to get onto the honors level track. Algebra 2 standard is also open to incoming high school freshmen.

IMP, (Integrated Math Program): IMP integrates Algebra, Geometry and Pre-Calculus and caters to students who learn best by hands on activities, writing and problem solving. When the program started in the high school approximately 8 years ago, as many as 1/3 of the students participated in the program. In 2004-2005 an attempt was made to offer year one of the IMP program at 8th grade. Approximately thirty 8th grade students enrolled in this program. Unfortunately, for the 2005-2006 year the interest was insufficient to continue to run the course at 8th grade. Moreover, only twelve 8th grade students were interested in taking IMP in 9th grade so the program is not being offered in 9th grade for the 2006-2007 school year.

Building on changes in the middle school curriculum, revisions have been made to the Integrated Math Program to combine the 1st and 2nd years of IMP into a single year based on the knowledge that all 8th grade students now have an Algebra 1 background. This change condenses the IMP program to 3 years and addresses some of the major criticisms of the prior 4 year program by ensuring that students are better prepared for SATs in their junior year and have flexibility to take other math classes, such as calculus or statistics, in their senior year.

Survey Findings

Of particular interest in this review was the degree to which the curriculum at each grade prepares students for the content taught at the next grade. Overall, students agree or strongly agree that they do come to each grade level prepared;

Question	6 th grade	7 th grade	8 th grade
Last year I learned the skill and information necessary to understand the material this year	83%	80%	85%

Two factors that might account for the slightly poorer 7th grade results are:

- Inconsistent 6th grade curriculum delivery due to lack of common planning time, and
- The materials that are being used in 7th grade. These materials consist of units that were developed prior to the decision to teach Algebra 1 to all 7th and 8th grade students and the teachers who developed them are no longer at Pollard.

The 8th grade curriculum was revised 2 years ago when the new McDougal Littell Algebra 1 textbook was purchased. At that time, a pacing guide was also developed. Subsequently 8th grade teachers also created grade-level mid-year and final exams. They are anticipating some common benchmark testing this year. The 6th and 7th grade curricula were adjusted and enhanced to incorporate units previously taught in the 8th grade. These adjustments were made based on the Massachusetts frameworks and the new 8th grade curriculum. However, an extensive review of this curriculum still needs to occur.

One other factor that might impact the perceived readiness in 7th grade is the fact that the 7th grade has had the greatest amount of teacher turnover. In fact 21% of the students surveyed said they were not comfortable asking for help in 7th grade compared to 11% in 6th grade and 15% in 8th grade. When the survey for this review was conducted there were no teachers who had been teaching in the 7th grade at Pollard for more than 2 years and only one teacher had professional status. Clearly, we need to improve conditions in which all students feel comfortable enough to ask questions in order to receive assistance in understanding concepts that are being taught.

Recommendations

- Review the 7th grade curriculum to ensure all standards are met and that all pre-requisites for the 8th grade curriculum are incorporated. Integrate the best elements of the current units with materials from the new Algebra 1 textbook.
- Purchase additional copies of the Algebra 1 textbook to allow for classroom sets and anticipated growth in enrollment.
- Review the 6th grade curriculum to ensure that all standards are met and that all pre-requisites for the pre-Algebra course are being covered consistently. Investigate up-to-date resources for 6th grade in order to deliver a consistent, challenging experience for all students.
- Revise the 6-8 grade pacing guides and develop easily understood curriculum maps.

Instruction

Background

Currently 6th grade math is not leveled whereas 7th and 8th grade offer 2 levels of pre-Algebra and Algebra. Student placement in these courses is based on prior year academic performance and teacher assessments:

	Grade 6 Math	Grade 7 Pre-Algebra	Grade 8 Algebra
Math 6	100%		
Pre-Algebra A		75-85% of students	
Pre-Algebra B		15-25% of students	
Algebra A			75-85% of students
Algebra B			15-25% of students

Students receive additional assistance in mathematics in a number of different ways. ILB, an Independent Learning Block, was a time set aside for students to get extra help from teachers in all subjects. It had been available at all levels until this year. ILB was primarily for students who needed more one-on-one time with their teachers. Special Education students with Individual Education Plans (IEPs) receive mathematics support in the Learning Center. There had also been a variety of, mostly voluntary, MCAS remediation programs offered over the last few years. For 2005-2006 a greater emphasis was placed on MCAS review in 8th grade classes.

For 2006-2007 Pollard has replaced ILB with an Academic Success block (AS). Students who are not on IEPs but who need to improve their proficiency in math or English Language Arts (based on MCAS scores and teacher assessments) are assigned to AS for a trimester in place of an elective. The goal is to increase each student's proficiency in specific areas that have been identified.

Teacher profile: Over the course of three years there have been significant changes in the middle school math faculty. Two 8th grade math teachers were hired for the 2003-2004 school year. Five math teachers (one 8th, three 7th, and one 6th grade) were hired for the 2005-2006 school year. For the 2006-2007 school year, one 8th grade, one 6th grade, and two 7th grade positions were filled. Of the returning teachers for school year 2006-2007, 7 out of 9 have professional status. The two remaining teachers have one and two years experience at Needham Public Schools. Overall, 7 of the 12 math teachers at Pollard for school year 2006-2007 will have professional status.

2005-2006 Math Teacher Profile

	1 st year	1-3 years	4-6 years	7-10 years	11-15 years	15+ years
Years teaching	0	2	4	2	2	2
Years in Needham	2	5	2	1		2

2006-2007 Math Teacher Profile (Note that 3 of the teachers surveyed in 2005-2006 are no longer in the Needham school system.)

	1 st year	1-3 years	4-6 years	7-10 years	11-15 years	15+ years
Years teaching	2	2	1	2	3	2
Years in Needham	3	2	3	1	1	2

With about 40% of the Middle School Math teachers relatively new to teaching and to Needham, it will be important to insure that we have a well-articulated program and sufficient teachers support in place to enable them to successfully implement the math curriculum at their respective grade levels.

Survey Findings

Pacing: A number of parents felt that the pace of the classes was too slow for their children while others felt that the class was moving too quickly and their children were unprepared. Similarly, administrators see the need to provide additional challenge for some students but also recognized that others require additional support. Most teachers feel that smaller, more homogeneous classes provide a pace that better addresses student needs and are more effective for student learning.

Although 58% of students think the pace of their course is about right, the rest are equally divided between it being too fast and too slow. This supports the idea that we need to examine how we might better organize for instruction in a way that will meet all students' needs. One administrator felt that perhaps leveling should be eliminated and we should think about different ways to provide Algebra instruction.

6th grade appears to be meeting a wide range of student needs, with 64% of students being satisfied with the pace (despite not having leveled classes). However, 22% of students still would like more opportunity to be challenged. This number increases to 29% in 8th grade. Indeed 60% of students agreed that they like to challenge themselves in math, regardless of the level of their class.

"The curriculum could have included more if the class had moved at a quicker pace. Maybe there should be a class for faster learners much like the one for slower learners" said an 8th grade student.

"This year I feel like math class moves very slowly and that I am not challenged at all." according to a 7th grade student.

Clearly, we need to find ways to better challenge our most talented mathematics students and to insure supports are in place for those who struggle with the subject.

Technology use: 92% of teachers say they use technology and the Internet. However, less than 10% of students perceive that software is used and less than 20% say the Internet or websites are used to help students learn. This disparity is partly the result of teachers having limited access to technology in the classroom. So, although teachers do use technology occasionally for lessons, students do not readily recall its use since technology is not an integral part of the instruction process. Indeed, 83% of teachers would like to integrate more technology into homework but many are fearful that lack of access will present problems for both teachers and students.

"More study websites and more real life examples" would make the program more interesting according to a 6th grade student.

43% of 6th grade students say they use a calculator to help them learn whereas that number jumps to 93% and 90% in the 7th and 8th grades respectively. In 8th grade, students are introduced to the graphing calculators that they are required to use in 9th grade. The use of these calculators in the Middle School program is limited by the lack of complete classroom sets.

"I enjoyed doing the parabolas because we used the graphing calculators," said an 8th grade student.

Manipulatives: Students and administrators do not perceive enough use of manipulatives to address various learning styles. This may be due to the fact that some teachers may not know that they are available or know how to incorporate them into lessons. More use of manipulatives could help students with hands-on, visual learning

styles. We could be more effective with this strategy if we provide teachers with focused opportunities to share strategies for using the various instructional tools available.

Homework: Most students say they are spending the right amount of time on homework (0-60 minutes) and feel that the homework reflects what was learned in class that day. Parents, however, report that there is not enough math homework in 6th grade and they see inconsistencies in how homework is assigned across clusters (an issue that one of the Pollard teacher task-forces has been looking into for all subjects). Both parents and administrators are concerned that either homework is not reviewed in class or that some classes are spent almost entirely reviewing homework. They feel that it is important that homework is used if it is assigned. Through a PTC grant, www.hotmath.com, a homework help site, has been made available to 8th grade students and will be extended to 7th grade students when using the new textbook this year. This should reduce homework time for the 8% of 7th graders who said that homework takes longer than 60 minutes.

Parent communication: Parents expressed concern about the limited communication from teachers, about what they could do to support their child's learning in math, about how their child was progressing, and about the placement process and the role they should play in it.

The availability of PowerSchool online, the grading software that allows parents and students to access up to date grades as soon as teachers enter them, will address some of these issues, especially if teachers indicate upcoming topics and assignments through the system. More emphasis must be put on setting objective methods for placing students, informing both students and parents of the parameters and their progress towards them, and involving parents and students in the final placement decisions.

Tutors: The survey found that 6% of 6th grade students hired outside tutors and that number rose to 9% of 7th grade students and 12% of 8th grade students. The trend, especially in 8th grade, could be due to the complexity of the material, to the desire for a safety net, to the fact that we are not challenging our most talented students, or perhaps to parental concerns about their child's placement and performance in high school and on the SATs.

Recommendations

- Examine the possibility of 6th grade creating two levels within each cluster after trimester 1
- Examine ways to more effectively organize instruction to enable us to challenge our most talented mathematics students and to insure supports are in place for those who struggle with the subject.
- Improve communications with parents and students to insure that they have information that will help them to better understand the placement criteria and process.
- Monitor the Academic Success program to see how well it is contributing to students' learning.
- Augment the curriculum to insure teachers have problems/activities to address the learning needs of all learners.
- Provide professional development to increase effective use of manipulatives in the classroom.
- Provide training for new teachers on the specific curriculum content and available materials.
- Insure that teachers have access to resources that enable them to implement effective instructional strategies. (e.g. classroom computer projectors, full sets of graphing calculators for each classroom.)

Assessment

Background

For the most part, responsibility for unit assessment and for determining a student's overall progress rests with each individual teacher. Teachers use a variety of tests, quizzes, projects and other means to determine students' progress and to assign grades. Common assessments that exist provide a vehicle for conversation about student progress. Since the 8th grade curriculum was revised two years ago, a grade-level mid-year assessment and a grade-level final were developed and implemented. Additionally, the 7th grade teachers have developed grade-level, end-of-semester exams.

Survey Findings

Although 70% of 6th and 8th grade students say that teachers review prior units and relate new material to them at the start of each new unit (that number is 60% for 7th grade), formal pre-assessments are not used as much as they could be to inform instruction (only half the teachers use them). MCAS tests are analyzed on a grade-wide basis, but there is little use of the data to inform instruction. The new Academic Success class is now beginning to use this data to identify areas in which students need additional support. Administrators suggested greater use of data to inform student-specific instruction in the classroom. Further, the surveys found that there is little collaborative review of student work. This is a missed opportunity for shared understanding of student progress. In general, a wide mix of assessment strategies and materials are used, but we could be doing better in using that data to inform instruction and to clarify the placement process.

Projects: Although students say that class expectations and grading policies are clear, parents and administrators believe that there is significant grade inflation. Differences in grading practices and, at times, less content laden, but heavily weighted, projects provide students a false perception that they have mastered various concepts.

More objective measures as to how well students are meeting the standards need to be developed, communicated, and used regularly to insure consistency in grading practices.

Recommendations

- Implement common pre-assessments, benchmark, and year-end assessments at all grades.
- Use common assessments to provide an objective basis for placement of students going into 7th, 8th and 9th grade classes.
- Share results of year end assessments with teachers at the next grade level to insure they have a better understanding of incoming students' individual strengths and weaknesses.
- Review and revise current grading practices to allow for more consistency and clarity in reporting.

Student Learning

Background

Needham has continued to score well on 6th and 8th grade MCAS tests. The current department goal is for continued improvement as well as to increase the number of students scoring in the Advanced and Proficient categories. 6th and 8th grade teachers use a variety of resources, to support their ongoing review for the MCAS math test. Over the past three years the middle school has shown continuous improvement in the areas of Patterns and Algebra, Statistics and Probability, and Geometry, yet still needs to focus attention on the areas of Number Sense, Measurement and Open Response questions. 7th grade MCAS tests were administered for the first time during the 2005-2006 academic year so there is no comparison data available.

Survey Findings

Students were asked for their perceptions of their own understanding of various aspects of math. This table presents the percent of students agreeing or strongly agreeing with each statement:

	6 th grade	7 th grade	8 th grade
I know the basic addition facts	98	96	98
I know the basic multiplication facts	97	94	97
I know the basic subtraction facts	98	96	99
I know the basic division facts	95	91	96
I am confident with percents	89	82	90
I am confident with decimals	91	82	92
I am confident with fractions	85	77	80
I am confident drawing a graph	89	81	86
I am confident reading a graph	96	88	91
I have approaches to learn math vocabulary	89	75	80
I have learned problem solving strategies	97	94	96
I have learned strategies to solve open response questions	85	67	79
I am confident answering open response questions	81	65	75
I have learned strategies to help me succeed on tests	88	80	75
My teacher brings real world math into the lesson	93	75	86
I feel prepared to take the math MCAS	90	79	90
I am able to express math ideas in words	81	68	80

Over 95% of students report they have a grasp on their math facts and believe that they have learned problem-solving strategies. However, it is not clear how consistently problem-solving strategies are being taught since all teachers expressed an interest in increasing their knowledge of how to approach this topic. Some 7th and 8th grade students perceive that teachers need to do more to both connect math to real world applications and to connect to other disciplines, especially in 7th grade (24%). A 6th grade student commented, *"I like the fact that the projects in math relate to real life."*

An area of concern for all groups surveyed was the need to put more emphasis on teaching vocabulary. Doing so may help students with the language laden MCAS tests, problem solving, and may enable easier transitions for them between grade levels.

Parents and administrators expressed some concern about students' readiness to handle the rigors of the 8th grade program. Some parents were concerned about whether students were adequately prepared for high school.

It should be noted that an analysis of the student scores from the grade-level mid-year and final exams in 8th grade showed relative consistency and algebraic competency from cluster to cluster. To date the results of the 7th grade semester exams have not been analyzed.

Recommendations

- Integrate more real world applications at all grade levels.
- Focus on teaching vocabulary and use a consistent vocabulary across grades.
- Dedicate professional development time to sharing problem solving strategies.
- Determine if Academic Success addresses the need for an MCAS prep course as well as the needs of the 10%-15% of students who reported weaknesses in fractions, decimals, percents or graphing.

Leadership

Background

Unlike the high school and elementary schools, the middle school math department Head Teacher is also a full time teacher with a full cluster and class load. Responsibility for evaluating teachers lies with the grade level administrators although the head teacher periodically sits in on math classes and provides feedback. The head teacher is responsible for coordinating supply orders and leading monthly department meetings where teachers address current departmental needs and concerns and curricular changes. She is also responsible for planning two early release days dedicated to department-based activities. Last year, the principal initiated "Head Teacher Days" whereby the head teachers of each department take a day out of the classroom to observe colleagues within his/her department, then meet with the other head teachers, house administrators and the principal in the afternoon to discuss departmental and school-wide issues. Further, the head teacher participates in a monthly curriculum cabinet meeting comprised of all department heads and curriculum leaders from the district, along with the Director of Program Development and Implementation. Finally, the head teacher writes and submits to the principal, a yearly formal MCAS analysis for teachers and administrators in her school.

Survey Findings

Teachers overwhelmingly feel that the leadership in the middle school encourages and supports current mathematics content and teaching practices. Yet, one fourth of teachers do not feel that they receive helpful feedback on their instructional practices from their supervisors. This could be due to the fact that grade level administrators, who are the primary evaluators, have less of a math background than the teachers themselves, or teachers may find it difficult to accept constructive feedback from a particular supervisor whose expertise lies in a different curriculum area.

Recommendations

- The head teacher's responsibilities need to be reassessed so that there is time to monitor student achievement, instructional effectiveness, assessments, teacher reflection on practice, and the overall implementation of the curriculum.
- Examine ways for the head teacher to participate in department meetings at all grade levels so as to insure vertical and horizontal programmatic consistency.
- Examine ways that the head teacher could be available to offer feedback and support and to promote best practices for department teachers.
- Encourage primary evaluators to become more knowledgeable of the current curriculum and instructional practices in mathematics.

Professional Development

Background

Although the district has offered a number of math-related courses, many had to be cancelled due to low enrollment. In June, 2005 the middle school teachers had the opportunity to take an MCAS mathematics workshop; 75% of the teachers took the course. During the winter months between 2004 and 2005, 75% of the teachers took an online course on teaching mathematics to students with learning disabilities. The majority of the SPED department also took this course. This experience opened the opportunity for deeper dialog and collaboration between the two departments.

Survey Findings

100% of teachers participated in some type of math-related professional development in the last three years. The middle school math teachers are very active learners with 92% of teachers taking at least 16 hours of courses and workshops designed to develop their knowledge of mathematical content and pedagogy; 67% have taken at least 35 hours. Although all teachers feel comfortable teaching students with special needs, and most differentiate instruction within their classrooms (83%), middle school math teachers are committed to improving their practices in the classroom. 92% want to increase their ability to differentiate instruction and want to increase their repertoire of how to best teach students with special needs. The need to reach all students along the spectra of learning styles and math abilities is a consistent theme for teachers, parents and administrators.

Recommendations

- Provide a math specific differentiated instruction course for the department.
- Assess how the techniques teachers learned in the course that addressed the needs of students with disabilities are being implemented and share strategies.

Teacher Culture / Community

Background

While the math teachers are very collegial and many of them share ideas and materials, significant turnover in recent years has tended to promote more individualism in teaching practice.

Survey Findings

The teacher survey found that there is not enough sharing of teaching strategies and there is little time to prepare materials. This is becoming more imperative now that there is a need to prepare for the newly configured Academic Success class. Parents' and administrators' expression of concerns about the inconsistencies in academic and social expectations from cluster to cluster in some grades, reflect the consequences of the lack of planning time and teacher turnover.

Recommendations

- Reorganize the schedule to allow more collaboration time for departments at all levels, perhaps with the addition of a dedicated time for collaboration on the Academic Success class [this has already been implemented in 8th grade].
- Provide teachers with the opportunity to visit each other's classrooms more often to observe instructional strategies and practices.
- Provide teachers with protocols and time to enable them to look at student work to inform practice.

The Middle School mathematics program has many strong points. The combined efforts of talented teachers, supportive administrators, and engaged parents, maximize the resources that are in place to support instruction and student learning. Teachers have a number of opportunities for professional development. Our students' enjoy learning math and their MCAS scores are competitive with comparable communities. There is much in place for which we can be justifiably proud. However, there are a number of areas in need of improvement. We look forward to beginning our work to address the report's recommendations with an eye towards strengthening the effectiveness of the Middle School math program for all students.