Bernards Township Schools

Mathematics Program Evaluation

Grades 6 – 12

2004

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Mathematics Program Grades 6 – 12

Evaluation

Program Description

The mathematics program for Grades 6-12 is part of the comprehensive secondary curriculum provided to the students in Bernards Township. It is comprised of various components that include written curriculum, textbooks, and materials as well as the classroom instruction and teacher preparation, supported by the building administration and the district's mathematics supervisor. Student assessment is via materials provided by the textbook publishers, teacher made tests and assessments, standardized tests, and teacher observation. Students in Grades 6-8 are given final exams, while students in Grades 9-12 are given both mid-term and final exams that help to document proficiency.

The mathematics program harmoniously blends communication, creativity, application, and technical skills that lead students to become effective problem solvers and adaptive learners. The goals and objectives of the 6-12 Mathematics Program are part of the district's mathematics curriculum. These goals are ground in the National Council of Teachers of Mathematics *Curriculum and Evaluation Standards* (2000) and the *New Jersey Core Curriculum Content Standards for Mathematics* (2002).

Textbooks and materials are integral to any instructional program. The University of Chicago School Mathematics Project (UCSMP) has supported the general program. Funded by the National Science Foundation, the Amoco Foundation, GTE, and other leading foundations, UCSMP was the first full mathematics curriculum to implement the NCTM standards by teaching concepts through application, emphasizing the reading and writing of mathematics, providing a wide variety of meaningful problem-solving opportunities, and incorporating the latest technology (UCSMP, 1997). The 6 – 8

mathematics teachers incorporate this philosophy in daily instruction. The use of computers and daily use of calculators (TI-73) satisfies the goal to incorporate technology. The requirement for all students to read and take notes on each lesson prior to the instruction provides students the skills needed to be competent in reading and understanding mathematics presented in newspapers, magazines, on television and work. Writing is another tool implemented in the mathematics classroom. This strategy enables students to communicate solutions and thoughts that promote independent thinking. However, in the highly interactive world in which we live, team work is a necessity, therefore, students collaboratively work in teams to solve problems. Students learn to use mathematics effectively through problem-solving experiences that include the use of higher-order thinking skills in daily assignments, a wide variety of problem types and open-ended problems.

The Merrill Company supports the 7th Grade Algebra and the 8th Grade Geometry programs. Although this program does not emphasize the philosophy of UCSMP, the 6-8 mathematics teachers have witnessed the student benefits from this philosophy and have implemented it into the Merrill program. Therefore, the students involved in the Merrill program are exposed to the challenge of that program as well as enhanced by the philosophy of UCSMP.

Middle School

Within the middle school learning environment, students and teachers collaboratively engage in activities that allow students to focus on how to think, not just what to think. The emphasis on relationship building within the classroom enriches the learning environment and builds self-esteem, thus producing quality student performance. The classroom is a microcosm of an ideal community in which respect for each other

combined with critical thinking tools and mathematical skills lead to efficient and effective solutions to problems both in and out of the school setting. As students progress through the Bernards Township mathematics program, they acquire life-long technical and interactive skills that will provide an easy transition into the highly technical and interactive world in which they live.

The middle school mathematics teachers implement the mathematics curriculum during a forty-minute period each day. Students are heterogeneously grouped for mathematics unless they have met specifically designed criteria (Appendix B) for 7th Grade Algebra, 8th Grade Pre-Algebra, or 8th Grade Geometry. An analysis of the 8th grade population demonstrates that at least 85% of all students have successfully completed Algebra I, as compared to the national statistic of 28% of eighth-grade students based on the NAEP.

Various support systems are in place to enable all students to achieve in the mathematics program. Classroom teachers are available to provide extra help in addition to the classroom instruction; special education teachers provide assistance within the classroom and additional assistance if needed. A Math Support class provides supplemental assistance for any student who requires additional reinforcement. Extracurricular programs such as The Homework Club provide students with a setting for homework support.

The team concept at the middle school provides support by providing teachers with the time to articulate, plan, and implement the mathematics program in a unified yet creative manner. Weekly department meetings by grade level and monthly meetings across grade levels support the mathematics program by providing time to discuss current issues that enhance the mathematics program, classroom instruction, and student learning.

Additionally, the mathematics supervisor provides support for teachers by offering opportunities for staff in-service and access to out of district workshops, and conferences. Guidance counselors meet with students to discuss and advise them about opportunities for extra-support and appropriate placement.

The teachers instructing the 7-8 mathematics programs are certified in secondary mathematics, consequently students receive instruction from highly qualified mathematicians. To further enhance the instruction, 85% of all 6 – 8 math teachers have earned a Master's degree or advanced education. Additionally, the highly experienced mathematics staff has recognized the importance of providing students with the same level of expectations and standards. Many hours are devoted to articulation about the program and the development of uniformed assessments and activities that ensure all students receive the same quality mathematics education.

High School

The mathematics program for grades 9 – 12 provides students with a broad foundation in mathematics and the tools necessary to build on that foundation.
The mathematics curriculum integrates applicable mathematical content in each course with problem solving, communication, reasoning, and technology.

The high school mathematics teachers implement the mathematics curriculum during a 42-minute period each day. Students in the high school receive 42 minutes of mathematics instruction daily in each course in which they are enrolled. Students are grouped for mathematics instruction into levels known as core, college prep, and honors. Because a large percent of students complete Algebra I in the middle school, most of the students enter the high school mathematics curriculum cycle in Geometry or Honors Geometry.

In order to provide students with opportunities to learn valuable high school mathematics, guidelines exist to assist with student placement. Teachers recommend students for placement into a core class if they receive a grade of C- or lower in the previous mathematics course. Students entering grade 9 may elect to enroll in Honors Geometry and/or Honors Algebra II provided they meet two of the following three criteria: a final average of B+ or better in the currently enrolled course (a final grade average of B or better for students currently enrolled in Geometry), a recommendation from the subject area teacher, a GEPA math scale score of 270 or greater, or nationally normed standardized test score or total math score of 95th percentile. Criteria for Students entering tenth, eleventh, or twelfth-grade who elect to enroll in honors or AP level courses is based upon student performance in their previous mathematics class. Additionally, students who have not performed at the required levels for enrollment in the honors or AP course may appeal to the mathematics supervisor and the principal for admission.

The following chart outlines various course sequencing options:

Ridge High School
Mathematics Course Options
2003-04

7th Grade Mathematics Class	Grade 7 Mathematics		Algebra I
8th Grade Mathematics Class	**Pre-Algebra**	**Algebra 1**	**Geometry**
9th Grade Mathematics Options	Algebra 1	Geometry Hon Geometry Algebra 1	Hon Algebra 2 Geometry
10th Grade Mathematics Options	Geometry Hon Geometry Core Geometry	Algebra 2 Honors Algebra 2	Honors Analysis
11th Grade Mathematics Options	Algebra 2 Honors Algebra 2 Core Algebra 2	Math Analysis 1 Honors Analysis	AP Calculus 1 AP Statistics
12th Grade Mathematics Options	Math Analysis 1 Senior Math Topics	Math Analysis 2 Calculus AP Calculus 1 AP Statistics Senior Math Topics	AP Calculus 2 AP Statistics

Required for High School Graduation

- **15 (high school) credits of mathematics**
- **Passing score on the NJ High School Proficiency**

To develop each student's appreciation of mathematics the following electives are offered in the mathematics department: AP Statistics, Introduction to Structured Programming, Introduction to Computer Science, and AP Computer Science.

Many support systems are in place that helps all students to achieve in the area of mathematics. In addition to the instruction within the classroom, mathematics teachers are available to provide extra help through an assigned tutorial period or during after or before school hours. Specific special education teachers provide assistance within the mathematics classroom and provide additional assistance to students if needed. A basic skills support class provides supplemental instruction for those students who are identified in need of additional reinforcement.

Students receive instruction from highly qualified teachers. The mathematics department consists of thirteen teachers whose average classroom experience is 17 years. More than half of the mathematics teachers hold advanced degrees, while all teachers participate in the district's staff college program. The teachers work informally to provide students within each course with consistent instruction and assessment. There is an informal coordination among teachers who are teaching the same course. Teachers conference on pacing and assessment and although they do not plan together the UCSMP strategy of read and take notes prior to instruction is employed. Although teachers design their own content quizzes, chapter tests and projects, a departmentalized midterm and final is given.

The administration allocates funds for the program and makes decisions about scheduling, while the district's mathematics supervisor and building administrators supervise classroom instruction. The district's mathematics supervisor is responsible for

ordering texts, supplies and materials associated with the mathematics program. She also provides support for the staff via staff inservice delivered at math department meetings. Additionally, the mathematics teachers keep abreast of current trends in education by attending and/or presenting at conferences, taking staff college classes, and by taking continuing education/graduate credits. The superintendent and board of education provide financial support that enables both the students and the teachers in the program to have adequate textbooks, supplies, and materials.

Textbooks and materials are integral to any instructional program. For the high school mathematics program, textbooks from the UCSMP's Secondary School Curriculum Project have been used. The UCSMP's Secondary School curriculum was developed as a research-based curriculum project funded by the National Science Foundation. This UCSMP's Secondary School Curriculum was the result of the joint efforts of researchers, mathematics educators, administrators, students, and classroom teachers. Ancillary materials included with the UCSMP program are: annotated teacher's editions, practice lesson masters, computer/calculator activities, assessment sourcebook, teaching aid masters, answer masters, solution manual, visual aids, and the *Wide World of Mathematics* videotape (for geometry).

Beginning in the fall of 2003 a new series of textbooks has been adopted. The series is written by award winning authors Larson, Boswell, and Stiff. They are the authors of a broad range of standards-based mathematics textbooks that support the best practices from research. Their textbooks pioneer the use of multimedia and the Internet to enhance the learning of mathematics. Teacher's resources for this series include: Chapter resource books (one for each chapter, organized by lesson); Basic Skill workbook: diagnosis and remediation; Practice Workbook with examples; Standardized

Test Practice Workbook; Warm-Up Transparencies and Daily Homework Quiz; and Solutions manual. Additionally, online resources provide instruction, practice, and learning support correlated to the text.

In order to prepare students to use mathematics in real life situations there is a technology component to the program. All classrooms have a complete set of TI-83 calculators and in addition the AP calculus teacher has a set of TI-89 calculators. Teachers have access to an LCD projector for classroom demonstrations and there are five computers in one of the math classrooms. There are also five computers in the math office and each classroom has a computer for the teacher's use. Two computers labs are available for instruction; one is used primarily for the three computer classes.

Background and Context

This program evaluation is part of the regular, curriculum evaluation cycle prescribed by the board of education. The last evaluation of the mathematics program was completed in June 1996 for Grades 6-8 as part of the K-8 mathematics program evaluation, and in 1996 for Grade 9 – 12, as part of the ten-year, Middle States Evaluation. The 1996 recommendations that applied to the 6-8 mathematics program was to (a) increase student reading and writing in mathematics in grade 7 and (b) increase support for the mathematics program and scheduling, and provide more opportunities for relevant professional development. The middle states recommendations that applied to the 9-12 mathematics program were (c) the core cores in Algebra I not be eliminated from the program offerings, (d) a plan be developed for continual updating of technology, (e) time be provided for team planning, intra-departmental collaboration and articulation across the curriculum, (f) the budgeting process includes a needs assessment for the

department and that budget requests be submitted in an order of priority, (g) remediation in the basic skills course continue until the students exit the course.

For the first recommendation (a), beginning in 1997, the seventh-grade teachers developed additional writing activities integrated them into the curriculum. Additionally, the curriculum was revised and teachers consistently emphasized the integration of reading and taking notes, which is a required teaching strategy for all middle school mathematics classes. For the next recommendation (b) additional articulation between the mathematics supervisor and the middle school administration with respect to the scheduling of the middle school mathematics teachers. Opportunities for staff development increased with the introduction of the district's staff college.

For recommendation c, the core course in Algebra I continued from 1997 until 2001, at which time enrollment (less than 10 students) in the class warranted its removal from the program of studies. However, at the same time, in order to better prepare all students for Algebra I, the eighth-grade pre-algebra program was revised to emphasize a concept of "pre-teaching" algebra. To address recommendation d, shortly after 1997, the district hired a director and then a supervisor of technology whose job it is to monitor and update technology. With respect to the mathematics program, both students and teachers have access to technology to use to enhance mathematics instruction. Software applications are evaluated and updated as needed. Each year 100 graphing calculators are ordered to replace both old graphing calculator technology and to meet the needs of the growing student population. Each mathematics teacher at the high school possesses a class set of graphing calculators, along with an overhead graphing calculator. Each mathematics classroom, as well as the department office has access to computers and the Internet. A mobile computer lab will be available to the mathematics department midterm

and final exams are common exams. This forces articulation to occur. Although it is difficult within the school-working day to find common time, teachers do have a common planning area and each teacher has a desk and computer access in the mathematics department office. A more formal process for articulation would (of course) be optimal. For recommendation f, a department meeting is used to discuss budgetary needs as applicable. For recommendation g, a basic skills curriculum was written and implemented. This helps to insure that instruction continues through the end of each semester, at which time students do now have an option of exiting the class.

Evaluation Introduction

The mathematics program evaluation committee is headed by the district mathematics supervisor and consists of mathematics and special education teachers representing both the middle and high schools. Each of these representatives is a stakeholder in the mathematics program and could bring biases to the evaluation process. The evaluation, upon completion, along with recommendations for program improvement will be presented to the district curriculum committee, the board of education curriculum committee, as well as the full board of education (if deemed necessary). The evaluation should help to determine whether or not the curriculum and instruction adequately align the goals and objectives outline din the curriculum, and meet the needs of the students in Grades 6-12. Additionally, the evaluation should give staff, administrators, parents, and students information about student achievement in mathematics as measured by the Iowa Test of Basic Skills (ITBS), the Iowa Test of Educational Development (ITED), the Grade Eight Proficiency Assessment (GEPA), the High School Proficiency Assessment (HSPA), the Scholastic Aptitude Test (SAT), and the Advanced Placement (AP) Tests.

Evaluation Design

The members of the mathematics program evaluation committee were divided into four subcommittees: the steering committee the textbook evaluation committee, the research and data analysis committee, the survey committee. Within each subcommittee, committee members were assigned to tasks primarily by grade level divisions The steering committee members were responsible for writing the program descriptions, and writing and editing the final report. The textbook evaluation committee members were responsible for reviewing, rating and recommending new textbooks and materials. The research and data analysis committee members were responsible for reviewing and summarizing applicable education research, and also collecting and reporting existing district, standardized test data. The survey committee members were responsible for constructing and administering necessary surveys.

The following information was compiled as part of the evaluation process. First the textbook evaluation committee members reviewed and rated various textbook series and recommended changes to the existing materials based upon both quality and availability of updated material. Due to the age and condition of the existing text materials and timelines constraints, the new textbook recommendations were made prior to the completion of the mathematics program evaluation report. The textbook evaluation committee members recommended a change from the UCSMP materials to materials published by McDougall Littell because the McDougall Littell materials mirrored the UCSMP materials, but were more current and had improved technology applications. The latest copyright of the UCSMP materials is the same edition as was adopted by the district seven years prior. The committee members felt that purchasing new textbooks that were not update was not fiscally responsible. Additionally, using the district's textbook rating scale, the McDougall Littell materials scored higher than the UCSMP materials.

Next, the steering committee members met in July 2003 to brainstorm evaluation questions and begin the program evaluation process. The research and data analysis committee members reviewed available research and collected and analyzed standardized test data to include, the ITBS for Grade 6 and 7, the GEPA, the HSPA, SATI and the AP Tests. Additionally committee members constructed and analyzed survey data. The evaluation should answer the following questions.

- How does the 7-12 mathematics program differentiate between mastery and non-mastery skills?
- How does the 7-12 mathematics program establish guidelines for algorithms and procedures?
- How does the curriculum and instruction align with the program's goals and objectives?
- How does the 7-12 mathematics program meet the varying needs of our students?
- What affect does the curriculum and instruction have on the district's standardized test scores?
- How does the 7-12 mathematics program provide students with access to technology?
- How does the 7-12 mathematics program affect students' attitudes towards mathematics?
- How does the 7-12 mathematics program prepare students for college placement?

- How does the textbook and ancillary materials address the needs of the students?
- How does the 7-12 mathematics program provide students with meaningful and comprehensive activities?
- How does the 7-12 mathematics program articulate between grades transfer skills to other content areas?

Strengths and Recommendations

Based upon a review of the program, the following items are strengths for the 7–12 mathematics program.

The mathematics curriculum and instruction is standardized at each grade level and each subject area

At the middle school level teachers plan all lessons, quizzes, tests, and exams collaboratively. The teachers utilize at least one period per week for department planning.

Exams, unit tests, quizzes, as well as weekly agendas and pacing are discussed and planned at these meetings. The collaborative planning helps to insure that the middle school teachers are delivering the mathematics curriculum in a similar manner.

At the high school level, teachers of similar subjects meet informally to insure standardization of pacing and curricular activities. The mathematics department office serves as a hub for such planning. The area provides the mathematics teachers with a location to discuss curriculum issues. Additionally the standardization of the mid-term and final exams increases the need for standardization of pacing.

At both the middle and high school levels an informal review of marking period grades notes no discrepancies between teachers teaching the same grade or subject.

Students are encouraged to read and take notes on material presented in the mathematics textbooks

Beginning in Grade 7 the students are required to read and take notes as a part of the nightly homework assignment. This process develops a foundation for students to learn to use the mathematics textbook as a resource. Mathematics teachers report that this process helps students to identify misunderstandings and also better prepares them to ask questions in class.

Technology is effectively integrated into various aspects of the program.

Graphing calculators are extensively used in all mathematics classes beginning in Grade 6. In Grades 6 – 8, class sets of TI-73 calculators, (designed for a middle school student) are available. The middle school teachers work collaboratively to design lessons that integrate the graphing calculators into the mathematics instruction. In Grades 9 – 12, class sets of the TI-83 Plus calculators are available for student use. In Addition, class sets of TI-89 calculators are available for use by the Advanced

Placement Calculus students. These calculators are the ones recommended for use by the College Board.

Dynamic software for geometry and statistics is used appropriately in selected courses. Activities applying such software are written into the middle and high school curriculum guides. As the area of technology is itself dynamic, the need for more efficient and effective tools to help our students learn mathematic is always there. Because of this, the members of the evaluation committee recommend that the Supervisor of Mathematics stay abreast of applicable technologies, recommend upgrades for such, provide training for mathematics teachers, and make provisions to insure that such activities are written into the mathematics curriculum guides in order to provide consistency of instruction.

There is a highly competent, professional and committed mathematics staff

The teachers instructing the 7-8 mathematics programs are certified in secondary mathematics, consequently students receive instruction from highly qualified mathematicians. To further enhance the instruction, 85% of all 6 – 8 math teachers have earned a Master's degree or advanced education. Additionally, the highly experienced mathematics staff has recognized the importance of providing students with the same level of expectations and standards. Many hours are devoted to articulation about the program and the development of uniformed assessments and activities that ensure all students receive the same quality mathematics education.

The teachers instructing the 9-12 program are highly qualified teachers. The mathematics department consists of thirteen teachers whose average classroom experience is 17 years. More than half of the mathematics teachers hold advanced degrees, while all teachers participate in the district's staff college program. The teachers

work informally to provide students within each course with consistent instruction and assessment. There is an informal coordination among teachers who are teaching the same course. Teachers conference on pacing and assessment and although they do not plan together the UCSMP strategy of read and take notes prior to instruction is employed. Although teachers design their own content quizzes, chapter tests and projects, a departmentalized midterm and final is given.

Teachers engage in a high degree of professional development

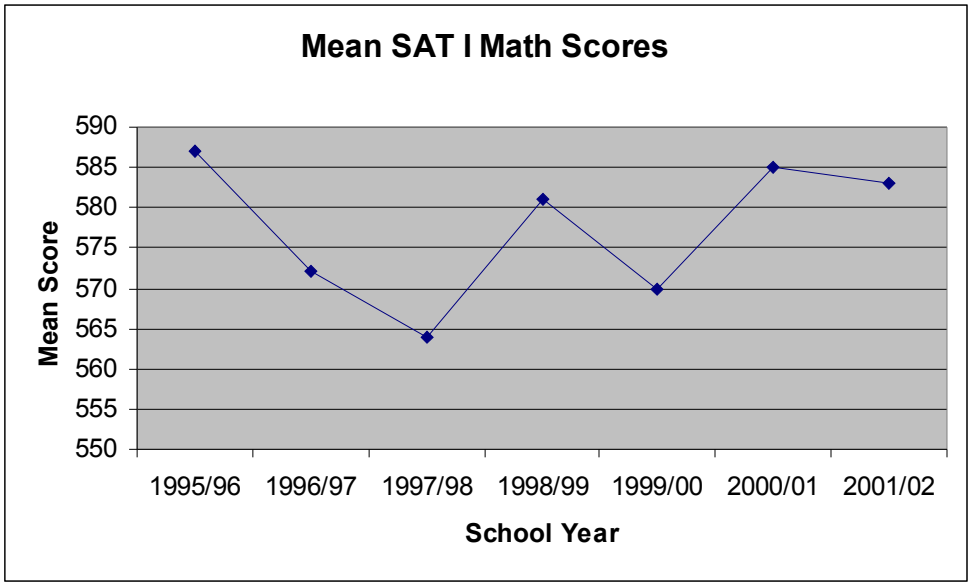
The Mathematics Supervisor provides support for the staff via staff inservice delivered at math department meetings and Staff College courses. She encourages teachers to join professional organizations and attend conferences and workshops. The Mathematics Supervisor is responsible for providing training for new initiatives. All teachers of Advanced Placement courses attend applicable workshops prior to teaching the course and communicate with colleagues in other districts via the available AP list serves. Additionally, the mathematics teachers keep abreast of current trends in education by attending and/or presenting at conferences, taking staff college classes, and by taking continuing education/graduate credits. The superintendent and board of education provide financial support that enables both the students and the teachers in the program to have adequate textbooks, supplies, and materials.

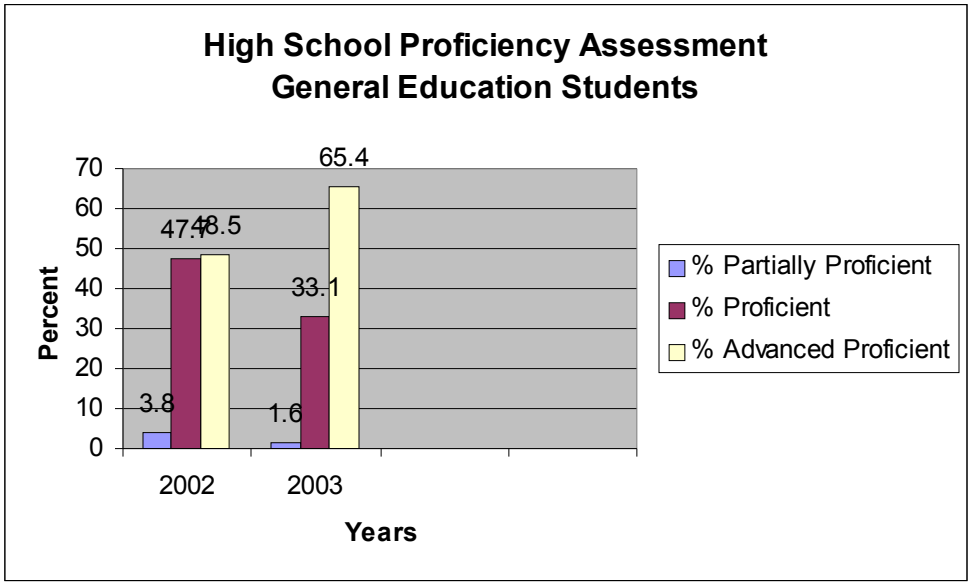
A large percent of students enroll in four years of mathematics during the high school years

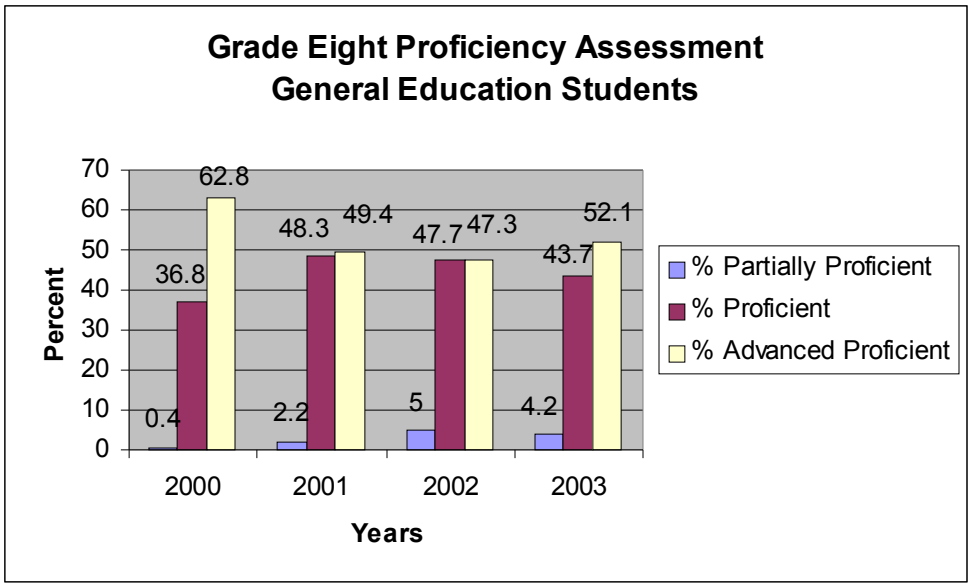
For the 2003-04 school year over 85% of the senior class was enrolled in a mathematics course. Most of the seniors enrolled in a mathematics course are enrolled in a Calculus course. Some seniors choose to enroll in AP Statistics in addition to a Calculus class.

Students demonstrate high levels of academic proficiencies in mathematics.

Student performance in mathematics as measured by standardized tests over the last five years has been high.







Additionally, a student survey was administered to the eighth and twelfth-grade students. When responding to the item, "I have usually done well in mathematics, for the eighth-grade students, 56% of the students enrolled in Pre-algebra agreed, 88% of the students enrolled in Algebra I agreed, and 95% of the students enrolled in Geometry agreed, while for the twelfth-grade students, 79% of the students agreed with the statement. When responding to the item, "I often feel like I am missing something important in math class," for the eighth-grade students, 67 % of the students enrolled in Pre-algebra disagreed, 75% of the students enrolled in Algebra I disagreed, and 67% of the students enrolled in geometry disagreed, while 63% of the twelfth-grade students disagreed. When responding to the item, "Mathematics is more difficult than other subjects for me," for the eighth-grade students, 57% of the students enrolled in Pre-algebra disagreed, 75% of the students enrolled in Algebra I disagreed, and 70% of the students enrolled in Geometry disagreed, while for the twelfth-grade students, 62% of the students disagreed with this statement.

Based upon a review of the program, the following items are recommendations for the 7 – 12 mathematics program.

- Research, purchase, and implement updated textbook, materials, technology, and resources
- Update mathematics curriculum guides to include more user-friendly options
- Examine the sequencing of courses at the eleventh and twelfth-grade levels and explore the need and feasibility for elective courses at the high school level
- Improve methods for articulating students' progress throughout grades 6 – 12.

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