

Bernards Township Schools  
Mathematics Program Evaluation  
Grades 6 – 12

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June 2012

## 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.

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. Prior to this evaluation, the goals were grounded in the National Council of Teachers of Mathematics *Curriculum and Evaluation Standards* (2000) the *NJ Core Content Standards for Mathematics* (2008).

Textbooks and materials are integral to any instructional program. The use of computers and daily use of calculators 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 with the skills needed to be competent in reading and understanding mathematics presented in newspapers, magazines, on television and at 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 important. 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.

### 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 leading 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 in sixth-grade. Specific criteria are used to identify students in seventh-grade able to enter into an accelerated Algebra 1 program. The students in eighth-grade are enrolled in Geometry, Algebra 1 or Pre-Algebra classes. An analysis of the eighth-grade population demonstrates that at least 75 % of all students have successfully completed Algebra I prior to entering ninth-grade. 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 provides 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. Due to continuing financial concerns, the teachers' access to out of district workshops, and conferences has been limited. Guidance counselors meet with students to discuss and advise them about opportunities for extra-support and appropriate placement. Additionally, letters and program description brochures have been created to advise parents about program and placement decisions.

### 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 for college or future careers. The mathematics curriculum integrates applicable mathematical content in each course with problem solving, communication, reasoning, and technology.

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 college prep, and honors. Currently a core level exists for Algebra II and beyond. Because a large percent of students who 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 the Core Algebra II class if they receive a grade of lower than C- in the previous mathematics course. Students entering Grade 9 may elect to enroll in Honors Geometry if they receive a grade of A or better in eighth grade Algebra I. Criteria for students entering tenth, eleventh, or twelfth-grade who elect to enroll in honors or AP level courses are 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. Guidelines for student placement continue to be of concern for students, parents, teachers and administrators and are continually under study.

The following chart outlines various course sequencing options:

**Ridge High School  
Mathematics Course Options**

<b>7<sup>th</sup> Grade Mathematics Class</b>	Grade 7 Mathematics		Algebra I
<b>8<sup>th</sup> Grade Mathematics Class</b>	<b><u>Pre-Algebra</u></b>	<b>Algebra 1</b>	<b>Geometry</b>
9 <sup>th</sup> Grade Mathematics Options	Algebra 1	Geometry <u>Hon Geometry</u>  Algebra 1	Hon Algebra 2 Geometry
10 <sup>th</sup> Grade Mathematics Options	Geometry <u>Hon Geometry</u>  Core Geometry	Algebra 2 Honors Algebra 2	Honors Analysis
11 <sup>th</sup> Grade Mathematics Options	Algebra 2 Honors Algebra 2 Core Algebra 2	Math Analysis 1 Honors Analysis	AP Calculus 1 AP Statistics
12 <sup>th</sup> 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 Assessment

Many support systems are in place that help all students to achieve in the area of mathematics. In addition to instruction within the classroom, mathematics teachers are available to provide extra help through an assigned tutorial period or at times 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 support class provides supplemental instruction for those students who are identified via their score on the High School Proficiency Assessment as being in need of additional reinforcement. Since the last Program Evaluation new courses entitled Algebra I Seminar and Geometry Seminar were implemented to provide assistance to students struggling in Algebra I or Geometry classes. Students take these courses in addition to their regularly scheduled mathematics class.

The administration allocates funds for the 6-12 Mathematics 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 or presenting at conferences, taking staff college classes, and by taking continuing education/graduate credits. Most recently, budgetary resources have restricted some professional development. 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.

The existing mathematics textbooks were adopted in 2003. The series is written by 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-84 calculators and in addition, the AP calculus teacher has a set of TI-89 calculators. Since the last program evaluation, all secondary teachers have access to tablet laptops and wireless LCD projectors in the classrooms. All schools have a wireless environment. Computer labs are available for instruction and the district has licenses for Math Type, Geometer's Sketchpad and Phathom.

### 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 evaluation was completed in June 2004. The 2004 recommendations that applied to the 6-12 mathematics program were to (a) research, purchase, and implement updated textbooks, materials, technology and resources, (b) update the mathematics curriculum guides to include more user friendly options, (c) 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, and (d) improve methods for articulating students' progress throughout grades 6-12.

For the first recommendation (a), textbooks were purchased for all levels. A list of all district textbooks is maintained on the district's website. Each secondary teacher has use of a district-provided Tablet PC and they use technology daily to demonstrate, view, and construct examples. Some uses of technology include the use of the graphing calculators and the Geometer's Sketchpad. Chances for students to interact directly with technology are limited at this time due to the availability of computer labs. Teachers report they find it difficult to find the time to truly integrate the use of technology into a packed mathematics curriculum. Currently, new policies are in place to permit students to bring their own technology to school.

For recommendation (b), mathematics guides were written and focused on a more user friendly guide. In the years that followed, an online curriculum development package known as Rubicon, was purchased by the district and used to maintain all district curricula. Due to budget cuts in previous year, the summer curriculum writing process was minimized and was later curtailed for two summers.

For recommendation (c), since the last program evaluation, a course entitled Advanced Algebra and Discrete Mathematics was added to the course offerings. This course is available to junior and senior students as an option to the other existing classes.

For recommendation (d), various software tools have made it easier for teachers to articulate between various student progress reports. The tools include Eschool and Performance Tracker. Currently teachers can access previous student records through the guidance office or the mathematics supervisor, but this process can be time consuming. Teachers have access to

Teacher Access Center (TAC) and can view a student's progress throughout the current school year.

### 2012 Evaluation Introduction

The Mathematics Program Evaluation Committee is headed by the district mathematics supervisor and consists of mathematics teachers representing the middle and high schools, one elementary teacher, and one media specialist. Each of these representatives is a stakeholder in the mathematics program and could bring biases to the evaluation process. The evaluation, 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 outlined in 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 New Jersey Ask (NJASK) 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 research and data analysis committee, the survey committee, the analysis of test data committee, and the review of the Common Core State Standards Committee. Within each subcommittee, committee members were assigned to tasks primarily by grade level divisions. All committee members were responsible for the review of textbooks, making recommendations based upon the analysis of the data based on the program evaluation questions, writing the program descriptions, and writing and editing the final report.

The following information was compiled as part of the evaluation process. First the members of the committee, along with the teachers at both schools 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 because of the current implementation of the Common Core States Standards the textbook recommendations were made prior to the completion of the mathematics program evaluation report.

Next, the steering committee members met in July 2011 to brainstorm evaluation questions and begin the program evaluation process. The research and data analysis committee members reviewed available research and NJASK for Grade 6 and 7, and 8, the HSPA, SATI and the AP Tests. Additionally committee members constructed and analyzed survey data, including collecting data from other applicable districts. The evaluation should answer the following questions.

- What affect does the 6-12 mathematics curriculum have on the district's standardized test scores?
- How does the 6-12 mathematics program prepare all students for college and career readiness tasks?
- How does the 6-12 mathematics program articulate between grades and transfer essential mathematics skills and work habits?
- In what ways does the use of technology in the mathematics classroom impact on student achievement in mathematics?
- How does the 6012 mathematics program impact on students' attitudes towards mathematics?

- What resources and professional learning opportunities are needed to support mathematics teachers both in mathematics and mathematics education?
- How does the grouping of students in the 7-12 mathematics classrooms impact on student achievement?
- How do the various recommendations for student placement in mathematics affect student success in the course?
- How does the 6-12 mathematics program transfer skills to other content areas?

### Strengths and Recommendations

Based upon a review of the program, the following items are strengths for the 6– 12 mathematics program.

- (a) There is a highly competent, professional and committed mathematics staff.

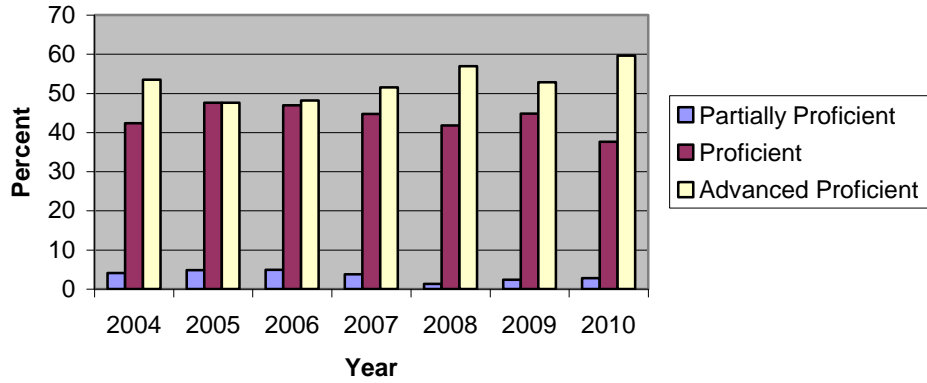
The teachers instructing the 7-8 mathematics programs are certified in secondary mathematics, consequently students receive instruction from highly qualified mathematicians. Additionally, this highly experienced mathematics staff has recognized the importance of providing students with the same level 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. According to the survey administered to eighth grade students in May 2012, over 75% believe that their mathematics teachers have created a positive learning environment. In addition, approximately 80% of students believe that their mathematics teachers are willing to help them with any questions they may have concerning mathematics.

The teachers instructing the 9-12 program are highly qualified teachers. These teachers work informally to provide students with consistent instruction and assessment within each course. Furthermore, there is an informal coordination among teachers who are teaching the same course. Although teachers design their own content quizzes, chapter tests and projects, departmentalized semester and final exams are administered and in the future departmentalized quarterly assessments will be constructed. According to a survey administered to twelfth-grade mathematics students in the Spring of 2012, approximately 70% believe that their high school mathematics teachers have created a positive learning environment, while over 75% of students believe that their mathematics teachers are willing to help them with any questions they may have concerning mathematics.

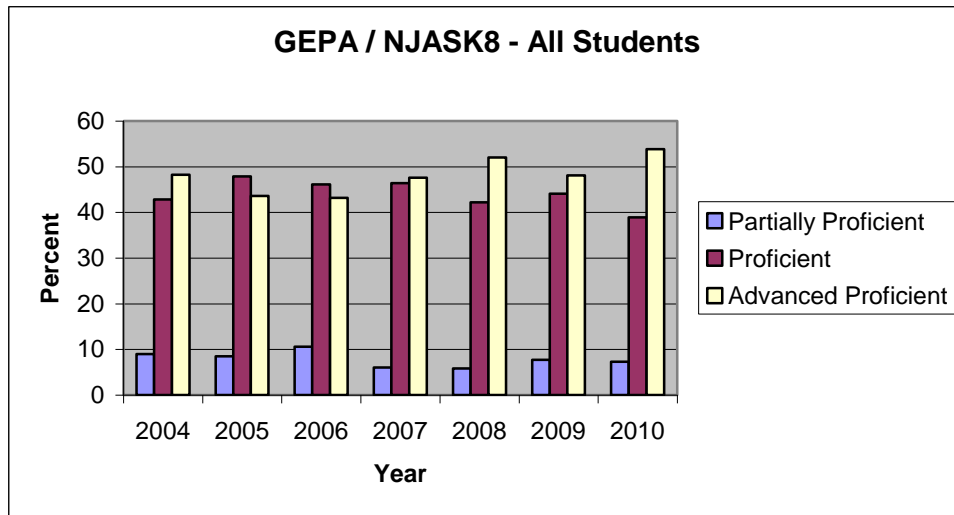
(b) Students demonstrate high levels of academic proficiencies in mathematics.

Student performance in mathematics as measured by standardized tests over the last five years has been high. Furthermore, since the last program evaluation a very high percent of students passed the HSPA with only one or two students a year required to take the Alternative High School Assessment. In the past three years, all students required to pass the HSPA have graduated with passing scores for mathematics on the assessment.

### GEPA / NJASK8 - General Education Students



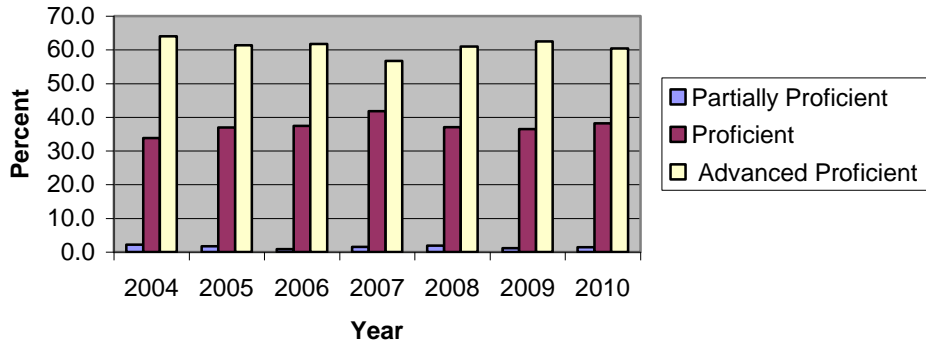
	Partially Proficient	Proficient	Advanced Proficient
2004	4.1	42.4	53.5
2005	4.8	47.6	47.6
2006	4.9	46.9	48.2
2007	3.8	44.7	51.5
2008	1.3	41.8	56.9
2009	2.4	44.8	52.8
2010	2.8	37.6	59.6



	Partially Proficient	Proficient	Advanced Proficient
2004	9.0	42.8	48.2
2005	8.5	47.9	43.6
2006	10.6	46.1	43.2
2007	6.0	46.4	47.6
2008	5.8	42.2	52.0
2009	7.7	44.1	48.1
2010	7.3	38.9	53.8

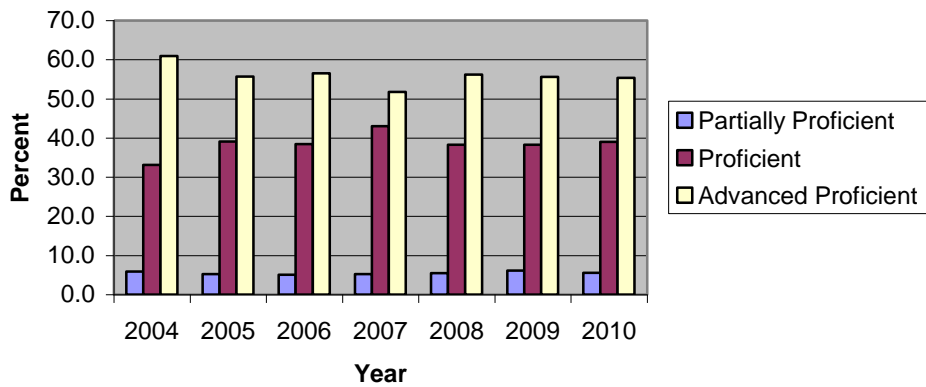
\* In 2008, NJ switched the 8<sup>th</sup> grade assessment from GEPA to NJASK8

### HSPA - General Education Students (First Time Test Takers)



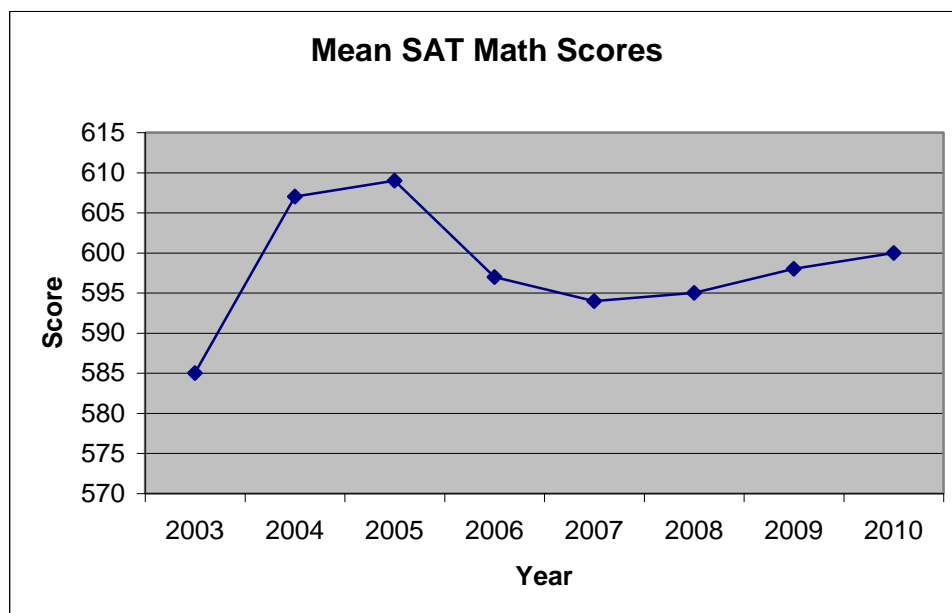
	Partially Proficient	Proficient	Advanced Proficient
2004	2.2	33.8	64.0
2005	1.7	36.9	61.4
2006	0.9	37.4	61.7
2007	1.5	41.8	56.7
2008	1.9	37.0	61.0
2009	1.1	36.5	62.5
2010	1.4	38.2	60.4

### HSPA - All Students (First Time Test Takers)



	Partially Proficient	Proficient	Advanced Proficient
2004	5.9	33.1	60.9
2005	5.2	39.1	55.7
2006	5.1	38.4	56.5
2007	5.2	43.0	51.8
2008	5.5	38.3	56.2
2009	6.1	38.3	55.6
2010	5.6	39.0	55.4





School Year	Mean Score
2003	585
2004	607
2005	609
2006	597
2007	594
2008	595
2009	598
2010	600

A student survey was administered to the eighth and twelfth-grade students. When responding to the item, “I have usually done well in mathematics,” 43% of the eighth-grade students, in Pre-algebra agreed, 77% of the eighth-grade students enrolled in Algebra I agreed, and 93% of the students enrolled in eighth-grade Geometry agreed. Similarly, 70% of all twelfth-grade students agreed with the statement. When responding to the item, “I often feel like I am missing something important in math class,” 61% of the eighth-grade students enrolled in Pre-algebra disagreed, 58% of the eighth-grade students enrolled in Algebra I disagreed, and 41% of the eighth-grade students enrolled in geometry disagreed. Likewise, 73% of the twelfth-grade

students disagreed with the statement. With regards to the standardized testing, 71% of eighth-graders felt prepared for the NJASK7 testing. Also, over 78% of twelfth-graders felt prepared for the HSPA testing.

(c) 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 and 7, class sets of TI-34 calculators, (which are designed for middle school students), are available. In eighth-grade, 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 graphing calculators into the mathematics instruction. In Grades 9 – 12, class sets of TI-84 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 recommended for use by the College Board. According to the survey of eighth grade students, 75% believe that using a calculator in the math classroom has helped their understanding of mathematics. Also, over 76% of twelfth grade students believe that using a graphing calculator in the math classroom helped their understanding of mathematics.

Based upon a review of the program, the following items are recommended for the 6– 12 mathematics program.

- (a) Further study and analyze the seventh-grade mathematics program in order to understand the significance of the NJASK scores and the impact of the CCSS implementation in that grade.

The members of the evaluation committee observed a possible issue with the NJASK scores for Grade 7. Past analysis confirmed that although the percent of students falling at the partially proficient level is higher in Grade 7 than in other grades, the students in the district continue to

perform above the state averages and at or above the district factor group averages. Although the middle school mathematics teachers under the supervision of the mathematics supervisor, continue to study this trend, it is noted that this phenomenon occurs state-wide and is an issue with the assessment itself rather than the program. However, with the increasing number of students meeting the criteria for the seventh-grade Algebra I class, combined with the increase of rigor required by the CCSS implementation, the members of the committee recommend that, while in the process of implementing new standards, additional care be given to the seventh-grade program, including Algebra 1 at that grade.

- (b) Study and analyze the impact Grade 7 Algebra 1 has on the high school program and make recommendations for changes if needed.

A growth in the student population at the secondary level has logically brought about a growth in the number of students enrolled in Algebra 1 in seventh-grade. Additionally, more students are requesting courses beyond the AP Calculus II level. Members of the committee recommend that with the implementation of the CCSS at the high school level, the high school teachers under the supervision of the mathematics supervisor should study the feasibility of higher level elective courses.

- (c) Research, analyze, and implement necessary changes aligned to the NJ Department of Education Implementation Guidelines for the Common Core State Standards for Mathematics (CCSS) in grades 6-12.

In part based upon research from studies of high performing countries and a continuing demand for high school graduates to demonstrate college and career readiness, the Council of Chief State School Officers and the National Governors Association led the common core standards initiative for English Language Arts and mathematics. The initiative called for a set of common expectations that define and describe what students should know and be able to do at each grade level. Currently 45 states and the District of Columbia have adopted the CCSS. NJ

adopted them in August of 2010. The standards for mathematics define what students should understand and be able to do in their study of mathematics. The CCSS for mathematics consists of two parts: mathematical practices and content domains. The mathematics practices are consistent for all students Grades K-12 and describe practices that all mathematic educators should strive to develop in their students. The content domains then have certain grade level progressions. Both the practices and content domains are based on current research and internationally benchmarked.

In the 2012-2013 school year, students in Bernards Township in grades 9-12 will be implementing the Common Core State Standards, and grades 6-8 will be implementing these standards the following year. Members of the committee believe that as part of this implementation, it is crucial to provide significant professional development for the mathematics teachers. There are many areas that will require a deep understanding of new skills and concepts, specifically statistics and probability, as well as constructions for geometry. In conjunction with professional development, the district will need to adopt new textbooks to support the CCSS. The Algebra I, Geometry, and Algebra II courses at the high school will all be using the Holt McDougal program. Members of the mathematics committee are in the process of choosing new textbooks for the middle school courses. The teachers will all be trained appropriately for using the resources with the textbooks and understanding how the content is aligned to the Common Core State Standards.

- (d) Create common expectations for study skills in mathematics for Grades 6 - 12 so the students will be able to use the textbook to better read and understand the content.

Currently, most mathematics courses ask students to employ the strategy “Read and Take Notes” (RTN) to work with and understand the topics covered. However, Members of the

committee recommend that students receive more support and instruction on how to use the strategy to learn mathematics.

In the student survey, students were asked to agree or disagree with the statement, “When asked to RTN, I typically skip the ‘READ’ part and only ‘TAKE NOTES.’” Almost 72% of the twelfth-graders agreed, while, among eighth graders, 65% of the Algebra students, 49% of the Pre-Algebra students, and 56% Geometry students agreed. These statistics point out, that although students have been taught to RTN, by the time they get to high school, they often do not read and understand the text. Many students merely write highlighted words or copy definitions without working to understand the examples present in the text. With a coordinated definition and agreed-upon consistent method for RTN, students will be able to employ the strategy more effectively to actively learn the content.

- (e) Study and analyze ways to use emerging technologies that will better facilitate the learning of mathematics.

Technology is utilized daily in secondary mathematics classes. Many of the technologies are used to complete mathematical tasks quickly and efficiently, which have many other benefits the district can use to its advantage. For example, a graphing calculator can be used to understand how a graph is connected to its equation rather than simply inputting data. Teachers should have the opportunity to develop classroom activities using available technology that allow students to experience deep, meaningful mathematics rather than instantaneous results. Also, students in Geometry classes should have the opportunity to utilize dynamic software through new technologies that can help them develop significant connections between traditional constructions and computerized representations. Additionally, communication between students and their peers as well as teachers can be improved by using social networking.

## References

New Jersey State Department of Education. (2004). New Jersey Core Curriculum Content Standards in Mathematics, Trenton, NJ.

Riordan, J. and Noyce, P. (2001). The impact of Two Standards-Based Mathematics Curricula on Student Achievement in Mathematics. *Journal for Research in Mathematics Education*. 32-4.

Schoen, Harold, et al. (2003). Teacher Variables that Relate to Student Achievement when Using a Standards-Based Curriculum. *Journal for Research in Mathematics Education*. 34-3.

The Mathematics Kindergarten to Grade 9 Program of Studies has been derived from The Common Curriculum Framework for K&#x2013;9 Mathematics: Western and Northern Canadian Protocol, May 2006 (the Common Curriculum Framework). The program of studies incorporates the conceptual framework for Kindergarten to Grade 9 Mathematics and the general outcomes and specific outcomes that were established in the Common Curriculum Framework. BACKGROUND. The Common Curriculum Framework was developed by the seven ministries of education (Alberta, British Columbia, Manitoba, Northwest Territories, Nunavut, Saskatchewan The Bernards Township School District is a comprehensive community public school district, serving students in pre-kindergarten through twelfth grade from Bernards Township in Somerset County, New Jersey, United States. As of the 2014-15 school year, the district and its six schools had an enrollment of 5,691 students and 463.9 classroom teachers (on an FTE basis), for a student&#x2013;teacher ratio of 12.3:1.