INFORMATIONAL REPORT

MATHEMATICS
PRE KINDERGARTEN – GRADE 12

HARFORD COUNTY PUBLIC SCHOOLS
OFFICE OF MATHEMATICS

FEBRUARY 2007

BOARD OF EDUCATION OF HARFORD COUNTY

INFORMATIONAL REPORT

PRESENTATION OF MATHEMATICS PROGRAM
Pre Kindergarten – Grade 12

February 2007

Background Information:

The Harford County Public Schools Office of Mathematics provides administrative support and instructional leadership to the Harford County pre-kindergarten through grade 12 mathematics program by facilitating the development and implementation of mathematics curricula that align with Harford County Board of Education goals, the Maryland Mathematics Voluntary Curriculum, and the National Council of Teachers of Mathematics (NCTM) principles and standards for school mathematics. The six principals that guide the development and implementation of mathematics curricula in Harford County are

- Excellence in mathematics education requires equity including high expectations and strong support for all students.
- Curriculum is more than a collection of activities. Curriculum must be coherent, focused on important mathematics, and well articulated across grade levels.
- Effective teaching requires understanding of what students know and need to learn and then providing challenge and support.
- Students must learn mathematics with understanding; actively building new knowledge from experience and prior knowledge.
- Assessment must support the learning of important mathematics and provide useful information for students, teachers, and parents.
- Technology is essential to teaching and learning mathematics. Technology influences the rigor of the mathematics that is taught and enhances learning.

Mrs. Sarah Morris, Supervisor of Mathematics, and Mrs. Sharon Kachur, Coordinator of Mathematics Intervention Programs, comprise the Office of Mathematics. In February 2005, Mrs. Sarah Morris, Supervisor of Mathematics, provided an overview of the mathematics program for grades Pre-Kindergarten through grade 12 for the Harford County Board of Education. The February 2005 report included information about program goals, course selection, curricular materials, teacher experience, and student performance. The report that follows includes information about

- Development and Production of Curricula
- Identification and Implementation of Instructional Technology
- Assessment of Student Performance and Intervention/Remediation
- Professional Development
- Recruitment and Retention of Secondary Mathematics Teachers
- Participation in Systemic Initiatives, Support to Schools, and Response to Citizen Requests
- Assistance to Maryland State Department of Education
- Articulation and Partnerships with Colleges and Universities

and other Office of Mathematics initiatives occurring after February, 2005. Appendices are included to further clarify the information contained in this report.

Discussion:

Development and Production of Curricula – Elementary School

Developing, aligning, and implementing a coherent mathematics curriculum is a major function of the Office of Mathematics. Curriculum development is guided by current research on teaching and learning and student performance data from Maryland State Assessments in mathematics for grades 3 – 8, disaggregated by ethnicity, gender, poverty, special education, and sub scores in

- Algebra, Patterns, and Functions,
- Geometry and Measurement,
- Statistics and Probability,
- Number Relationships and Computation, and
- Processes of Mathematics.

In May 2004, Harford County elementary school educators were invited to participate in the textbook review process. A balanced subgroup of 35 principals, instructional facilitators, assistant principals, mentor teachers, and classroom teachers representing every elementary school region and every elementary school grade level was selected to complete the textbook screening process. The Textbook Screening Committee was charged with analyzing textbooks to determine

- alignment with state assessment indicators,
- response to student and community needs,
- reflection of current research on teaching and learning,
- application of technology,
- opportunities for student engagement and academic rigor, and
- the availability of teacher support

The committee decided that five mathematics programs warranted further study. The publishers of the five identified programs were invited to showcase their programs for the committee. The programs that warranted further study were

- *The University of Chicago School Mathematics Project - Everyday Mathematics* (McGraw-Hill Wright Group)
- *McGraw-Hill Mathematics* (Macmillan-McGraw Hill – the publisher of the text that was currently in use in all elementary schools, grades one through five.)
- *Scott Foresman/Addison Wesley Mathematics* (Scott Foresman)
- *Mathematics* (Harcourt)
- *Mathematics* (Houghton Mifflin)

Each publisher was invited to make a two-hour presentation to the committee. Following each presentation, the committee discussed program merits and deficiencies. In addition, a uniform evaluation checklist was completed for each of the five programs. The committee recommended that two programs, *The University of Chicago School Mathematics Project - Everyday Mathematics*, recognized as a promising mathematics program by the U. S. Department of Education, and a new edition of *Macmillan*

McGraw-Hill Mathematics, should receive pilot status. A press release by the U. S. Department of Education regarding Exemplary and Promising Mathematics Programs is located in the Appendix A. Recently, the federal What Works Clearinghouse published ratings on the effectiveness of mathematics programs for elementary grades. Only one mathematics program, *Everyday Mathematics*, has been cited as having "potentially positive effects" on achievement compared with more traditional mathematics programs.

Three elementary schools were selected to participate in the pilot of *Everyday Mathematics*, and three elementary schools were selected to participate in the pilot of the new edition of *Macmillan McGraw-Hill Mathematics* program. Criteria used to select the six pilot schools and insure a fair evaluation process included

- student enrollment,
- student population demographics,
- Maryland School Assessment results, and
- availability of mathematics specialist support.

During the 2004-2005 school year, teachers in the pilot schools gathered frequently to receive program-specific professional training and compare the two programs. Exhaustive discussions and surveys were completed to determine

- grade level effectiveness,
- student satisfaction,
- teacher satisfaction, and
- assessment results.

Textbook selection process summary data shows that *Everyday Mathematics* scored higher than *Macmillan McGraw-Hill Mathematics* in each of the following areas:

- program philosophy,
- overall satisfaction with the program and ease of use,
- teacher satisfaction with materials and publisher support,
- teacher assessment of program use for highly able students and average students,
- teacher assessment of program use for at risk students and special education students,
- presentation of HCPS learning outcomes and number of aligned HCPS learning outcomes,
- presentation of number sense concepts.
- presentation of measurement and geometry concepts.
- presentation of computation concepts.
- presentation of fractions and decimals concepts.
- presentation of time and money concepts, and
- presentation of probability concepts.

Macmillan McGraw Hill Mathematics scored higher than *Everyday Mathematics* in only one category – presentation of charts and graphs.

Mrs. Morris presented findings from the program pilot to the Harford County General Curriculum Committee and made a recommendation that *Everyday Mathematics* be implemented in all Harford

County elementary schools. The General Curriculum Committee agreed with Mrs. Morris' recommendation.

Several implementation models were examined. Based on the information gathered during the pilot study, Mrs. Morris decided that all Harford County elementary schools would implement Everyday Mathematics across all grade levels during the same school year. Factors that greatly influenced this decision included

- the manner in which pilot schools implemented the program,
- pilot school student achievement results as measured by the Maryland Assessment Program,
- the richness of the Everyday Mathematics materials,
- teachers in pilot schools reported that students were actively engaged in meaningful discussion about important mathematics, and
- additional feedback provided by administrators and teachers involved in the pilot program.

Committees were formed and charged with the task of developing Harford County elementary mathematics pacing charts and unit assessments that include all Voluntary State Curriculum indicators. Collaboration between the Office of Mathematics, the Office of Special Education, and the Office of Accelerated Learning provide guidance and resources that allow teachers can tailor instruction to meet the needs of individual learners. A sample pacing calendar is located in the Appendix B.

Dr. Gerald Scarborough, Assistant Superintendent of Curriculum and Instruction, Mrs. Patricia Skebeck, Executive Director of Elementary Education, and Mrs. Morris worked together to schedule professional development sessions that would support classroom teachers as they implemented the *Everyday Mathematics* program. Informational sessions for elementary school principals, instructional facilitators, and mentors were also scheduled. Beginning in Fall, 2005 and continuing through the current school year, elementary school teachers and those who provide support to elementary teachers have had multiple opportunities to meet with national consultants, talk with teachers who conducted the *Everyday Mathematics* pilot study, and plan with their peers.

<u>Development and Production of Curricula – Middle School</u>

Middle school students enroll in a variety of mathematics courses. About 20% of middle school students complete pre-algebra in sixth grade, algebra in seventh grade, and geometry in eighth grade. About 60% of middle school students complete a combination of general mathematics and algebra courses. Another 20% of middle school students complete only general mathematics courses.

Processes similar to those used to select and adopt *Everyday Mathematics* for elementary school students were used to select and adopt texts for middle school students. The texts selected for use in middle school mathematics courses are

- *Middle School Mathematics Course 1* (McDougal Littel)
- *Middle School Mathematics Course 2* (McDougal Littel)
- *Middle School Mathematics Course 3* (McDougal Littel)
- *The University of Chicago School Mathematics Project – Transition Mathematics* (Prentice Hall)
- *The University of Chicago School Mathematics Project – Algebra* (Prentice Hall)
- *The University of Chicago School Mathematics Project – Geometry* (Prentice Hall)

The University of Chicago School Mathematics Project is recognized as a promising mathematics programs by the U. S. Department of Education. Texts associated with this program have been used in Harford County middle schools since 1993 and the McDougal Littel texts have been used since 2004.

All middle school courses are aligned with the Maryland Mathematics Voluntary Curriculum. Pacing calendars and model lesson plans are available on the Harford County infoweb. Uniform unit assessments and mid-year cumulative tests are available for all middle school mathematics courses. A sample middle school mathematics pacing calendar is located in Appendix C.

The Office of Mathematics is currently re-evaluating the middle school program to insure that middle school students engage in rich and challenging mathematics learning experiences, and that the elementary school, middle school, and high school mathematics programs are in accord.

Development and Production of Curricula – High School

Harford County Public Schools students who entered ninth grade prior to August 2006 must successfully complete three courses in mathematics to earn a high school diploma. Students who entered ninth grade in August 2006 or later, must successfully complete four courses in mathematics to earn a high school diploma. Ninth grade students enroll in Cognitive Tutor IA, Integrated Algebra IB, Integrated Geometry, or Integrated Algebra II based on the student's program of study in middle school. High school students move along the continuum of courses until they meet or exceed graduation requirements. A flow chart illustrating the scope and sequence of mathematics courses available to high school students is located in Appendix D.

Processes similar to those used to select and adopt elementary and middle school mathematics texts were used to select and adopt high school texts. Harford County high school students who did not complete a formal algebra course in middle school begin their algebra coursework using *Cognitive Tutor Algebra I* published by Carnegie Learning. *Cognitive Tutor Algebra I* has been recognized by the U. S. Department of Education as an exemplary mathematics program. Students use University of Chicago School Mathematics Project texts in Integrated Algebra IB, Integrated Geometry, Integrated Algebra II, Trigonometry, and Pre-Calculus courses. The University of Chicago School Mathematics Project is recognized by the U. S. Department of Education as a promising mathematics program. Students enrolled in Applied Geometry use *Geometry Concepts and Skills* published by McDougal Little, students enrolled in Consumer Mathematics use *Thinking Mathematically* by Pearson Prentice Hall, and students enrolled in Foundations of College Mathematics use *Mastering the Math SAT 1/PSAT* published by Great Source and *For All Practical Purposes: Mathematical Literacy in Today's World* published by W.H. Freeman & Company. Calculus, Statistics, and Computer Science students use a variety of texts.

Curriculum for all Algebra I and geometry courses have been aligned with the Maryland State Department of Education Core Learning Goals and uniform unit assessments and mid-year and final examinations have been implemented. Uniform unit assessments have also been implemented in Integrated Algebra II, Trigonometry, and Pre-Calculus.

The curriculum guides for Foundations of College Mathematics, Applied Geometry, Integrated Geometry, Integrated Algebra II, and Trigonometry were revised in the past two years and presented to the General Curriculum Committee.

The August, 2006 county-wide implementation of a uniform block schedule for high schools provides students with an opportunity to complete additional mathematics courses. The Office of Mathematics is currently working with a committee comprised of high school mathematics teachers and department chairs to identify additional mathematics courses that could be offered in Harford County high schools.

Identification and Implementation of Instructional Technology

The Office of Mathematics works with Dr. Scarborough and Mr. Andrew Moore, Director of Technology, to provide computer and calculator hardware and software that help make important mathematics accessible to students. The following computer-based programs are available in Harford County public schools.

Program	Grade Level
Everyday Mathematics Games	K – 5
Gizmos	6 – 12
Geometer's Sketchpad	6- 12
Cognitive Tutor Algebra	9 – 12

Both *Gizmos* and *Cognitive Tutor Algebra* are internet-based programs. Four function calculators are available in elementary schools and scientific and graphing calculators are available in middle and high schools.

Assessment of Student Performance and Intervention/Remediation – Elementary and Middle School

Instructional decisions made in the Office of Mathematics are predicated on the understanding that high quality classroom instruction within the core mathematics program is the best intervention for students and mitigates the need for remedial programs. Ongoing assessment of student progress that occurs during instruction and summative assessment that measures student mastery of a body of knowledge provides school personnel with a clear picture of student strengths and weaknesses.

Harford County elementary and secondary mathematics teachers assess student understanding multiple times during a single mathematics lesson. These ongoing, formative assessments are used to inform the planning of future lessons so that the needs of individual students are met. Ongoing, formative assessment may take many forms including

- every pupil response,
- class discussion,
- observation of game play and student conversations,
- examination of student work, and
- lesson closure

Diagnostic programs, unit tests, cumulative tests, and the Maryland School Assessment also provide information about student mastery of mathematics skills and processes. Taken together, formative and summative assessments help school personnel make decisions about intervention and remedial programs that support student learning.

Traditionally, the Kindergarten Readiness Assessment (KPA) has been used to measure the reading and mathematics readiness and subsequent growth of children during their kindergarten year. The KPA was administered two times during the year; once in the fall and once in the spring. In concert with the Mrs. Ginny Smith, Coordinator of Early Childhood Education, the Office of Mathematics recommended that the mathematics portion of the KPA, a locally developed assessment tool, be replaced by the Students Numeracy Assessment Progression (SNAP), a researched–based and commercially developed assessment tool. Information regarding this assessment program was presented to the General Curriculum Committee and approved for implementation in elementary schools in Fall, 2006. In December 2006 and January 2007, every kindergarten teacher received training in administration of SNAP and interpretation of SNAP results. All kindergarten students have recently completed SNAP, and will be re-assessed in spring 2007. Beginning in fall 2007, SNAP will be used three times per school year to assess the readiness and progress of each kindergarten student. (The KPA will continue to be used to assess student readiness in reading.) Kindergarten teachers provide remedial instruction within the kindergarten core mathematics program.

Advantage MR, a commercially produced assessment program also measures student understanding of numeracy and is used to assess mathematics knowledge of selected elementary school students. Designed to provide information about students who are struggling to meet grade level expectations in mathematics, *Advantage MR* identifies gaps in numeracy understanding. Teacher recommendation and other testing data are factors in deciding which students will complete the *Advantage MR* assessment.

New Harford County mathematics unit assessments for grades one through five were developed in Summer, 2006. Each unit assessment measures student mastery of *Everyday Mathematics* outcomes as well as Voluntary State Curriculum outcomes. These assessments are designed to be completed independently by students and include

- calculator and non-calculator sections,
- portfolio items, and
- interview items.

The cover sheets that accompany the elementary mathematics unit assessments are designed to provide students, parents, and teachers with information regarding student strengths and weaknesses. Computer scannable unit assessment cover sheets have been developed in a collaborative effort with Mr. Thomas Hayes, Assistant Supervisor in the Office of Evaluation and Accountability, and Mrs. Allyn Watson, Title I Supervisor. The scannable cover sheets, which are currently being used in all Title I schools, generate class reports that allow teachers to monitor student progress. At the conclusion of the 2007 school year, the use of scannable cover sheets will be analyzed to determine if the use of scannable cover sheets should be extended.

The Maryland School Assessment Program measures student progress in attaining state determined minimum grade level mathematics expectations as delineated in the Voluntary State Curriculum (VSC) for grades 3 through 8. A copy of the Harford County Public schools Mathematics Content Standards Pre-K to 5 that are aligned with the Voluntary State Curriculum is located in Appendix E. A copy of the Maryland Mathematics Voluntary State Curriculum Grades 6 to 8 is located in Appendix F. Information regarding the performance of Harford County students on the Maryland School Assessment is available at mdreportcard.org. Summary data that shows trends in elementary and middle school student performance on the Maryland School Assessment is located in Appendix G.

Because the Maryland School Assessments measure student mastery of skills and processes that are extensions and refinements of work learned in previous grade levels as well as skills and processes that have been recently introduced, remediation program for elementary and middle school students must supplement rather than replace the core mathematics program. Consequently, the greatest impediments to providing supplementary intervention and remediation programs to elementary and middle school students with fidelity are the structure of the school day and the availability of personnel to deliver intervention/remediation instruction. Two research-based, elementary/middle school mathematics intervention/remediation programs, *Math Recovery* and *Knowing Mathematics*, are supported by the Office of Mathematics.

Math Recovery is a research-based program of instruction for children who encounter difficulty in early numeracy. This research-based program, closely aligned with *SNAP* and *Advantage MR*, is used in grades 1 and 2. Mrs. Amy Ernst, teacher at Homestead Wakefield Elementary School, and Mrs. Pam Tabor, mathematics specialist at Havre de Grace Elementary School, are certificated *Math Recovery* teachers and trainers. These women are also contributing authors for two recent *Math Recovery* books and have willingly provided *Math Recovery* training to Harford County professionals. *Math Recovery* is personnel intensive as it is delivered to one to five students at a time by highly trained personnel. Information about *Math Recovery* is available in Appendix H. Please note that Harford County students were a part of the longitudinal study that demonstrates the effectiveness of *Math Recovery*.

Knowing Mathematics is a research-based program designed to address the needs of students in grades 4 – 6 whose progress in mathematics is one or two years behind their peers. *Knowing Mathematics* is a unique program that combines the best practices of Asian and Western instruction. The program focuses on building conceptual understanding and each lesson includes role play, mathematical conversation, guided practice, independent practice. Instructional units include addition/subtraction, multiplication/division, geometry, statistics, and fractions. *Knowing Mathematics* classes are limited to 12 students at a time. *Knowing Mathematics* can be implemented using pull-out, extended day, or summer school models. Minimal training is required. Knowing Mathematics program information is available in Appendix I.

Assessment of Student Performance and Intervention/Remediation – High School

The Maryland School Assessment Program includes the High School Assessment Program. This program measures student progress in attaining state determined minimum expectations for algebra and data analysis as delineated in the Core Learning Goals for algebra, data analysis, and geometry. Students who entered ninth grade prior to August 2005 are required to take the High School Assessment in Algebra and Data Analysis. Students who entered ninth grade in August 2005 or later, must pass the Maryland High School in algebra and data analysis to earn a high school diploma. Harford County algebra and geometry curricula incorporate the Core Learning Goals indicators. Information regarding the performance of Harford County students on the High School Assessment in Algebra and Data Analysis is available at mdreportcard.org. A Core Learning Goal chart is located in Appendix J. Summary data that shows trends in Harford County student performance on the Maryland High School Assessment in Algebra and Data Analysis is located in Appendix K.

Many students complete high school level mathematics course work during their middle school years. Students who have not started their formal study of algebra in the middle school are at risk. These students are enrolled in *Cognitive Tutor Algebra I* as 9th graders. In the Cognitive Tutor program, students spend 60% of their course time in classrooms applying algebra concepts to real world problems and 40% of their course time completing interactive computer modules.

Harford County High School students also participate in PSAT, SAT, and AP testing programs.
PSAT testing occurs each October. An opportunity to participate in PSAT is offered to all tenth and eleventh grade students. Occasionally, a ninth grade student chooses to participate. Test results provide students, parents, schools, and the school system with specific information about student mastery of identified skills. The PSAT serves as the National Merit Scholarship Qualifying Test for eleventh grade students.

Harford County students usually score higher than their state and national counterparts on the mathematics section of the SAT. In the two years since the mathematics section of the SAT was reformatted to include Algebra II content, state and national scores on the mathematics section of the SAT decreased. Conversely, Harford County students have earned higher scores on the mathematics section of the SAT in the past two years. Information regarding the SAT performance of Harford County Public School students is available in Appendix L.

In the spring of each school year, the Office of Mathematics works with Drs. Bernard Schroeder and Janet White, professors at Millersville University, to conduct Advanced Placement Test simulations in calculus and statistics. Students from nine Harford County high schools travel with their Advanced Placement teachers to a central location to participate in the simulation that measures their understanding of college level mathematics. Teachers score the tests to make informed decisions about the instruction that will occur in their Advanced Placement courses in the time between the simulation and the administration of Advanced Placement tests by the College Board. Teachers have found that students who participate in the Advanced Placement simulation test increase their simulation test score by 20 percent when they take the actual Advanced Placement test. (Possible scores on Advanced Placement Tests are 1, 2, 3, 4, and 5 with 5 being the highest score.)

<u>Professional Development</u>

Throughout the year, the Office of Mathematics sponsors a variety of workshops and training sessions. The foci of these professional development sessions are

- program implementation
- strategies and techniques that enhance mathematics instruction,
- current research on teaching and learning mathematics,
- analysis of local assessment results, and
- updates on local, state, and national assessments

A list of professional developments sessions conducted by the Office of Mathematics for elementary and secondary mathematics teachers and special educators is located in Appendix M.

Hiring and Retention of Secondary Mathematics Teachers

Mrs. Morris and Mrs. Kachur perform screening interviews on all secondary mathematics teacher candidates. During these interviews candidate knowledge of mathematics content and mathematics pedagogy are assessed. As funding permits, Mrs. Morris and Mrs. Kachur provide evening workshops to support newly hired secondary mathematics teachers and special educators who work in secondary cooperative-collaborative mathematics classes. In addition, Mrs. Kachur and Mrs. Morris work with Drs. Michael Krach and Reza Sarhaghei, professors at Towson University, to develop and implement a master's degree program tailored to meet the needs of Harford County Public Schools and elementary certificated teachers who would like to teach mathematics in middle school. In spring 2006, Mrs. Morris and Mrs. Kachur were the instructors for the Secondary Mathematics Methods course associated with this master's degree program.

Mrs. Morris and Mrs. Kachur formed partnerships with the College of Notre Dame in Maryland to provide advanced mathematics content and pedagogy to secondary mathematics teachers. Mrs. Kachur continues to teach the Secondary Mathematics Methods course for the College of Notre Dame in Maryland. Several students from this program are currently secondary mathematics teachers in Harford County.

Aberdeen High School and Aberdeen Middle School have been identified as professional development schools for the College of Notre Dame in Maryland. Mrs. Morris works with Sr. Sharon Slear, Dean of Education and Outreach for the College of Notre Dame in Maryland, to identify master teachers and place preservice teachers in the Aberdeen schools. Several of these preservice teachers are now Harford County secondary mathematics teachers.

The Office of Mathematics also maintains a strong relationship with McDaniel College through work with Dr. Francis Fennell, president of the National Council of Teachers of Mathematics and professor at McDaniel College. Mrs. Virginia Hinckley, recently retired Havre de Grace Elementary School mathematics specialist, served as the instructor in McDaniel/Harford County mathematics content courses tailored to the needs of elementary teachers.

Drs. Krach, Saranghi, Schroeder, White, and Fennell have often recommended outstanding teacher candidates to Mrs. Morris and Mrs. Kachur for employment.

Participation in Systemic Initiatives, Support to Schools, and Response to Citizen Requests

Mrs. Morris and Mrs. Kachur respond to questions about the mathematics program posed by Harford County Schools personnel and individual citizens. It is the goal of the Office of Mathematics to provide accurate responses in a thorough and timely manner.

Mrs. Morris and Mrs. Kachur strive to support initiatives that originate in other Harford County Public Schools departments whenever the initiative might include a mathematics instruction component, increase the effectiveness of mathematics teachers, or improve learning for students.
Within the past year, Mrs. Morris and Mrs. Kachur were actively engaged in the following activities that did not originate in the Office of Mathematics

- Ad Hoc Grade Reporting Committee

- Intervention Committee
- CollegeBoard Advanced Placement Course Audit
- Walkthroughs
- Special Education Testing and Liaison
- Individual Education Plan Evaluation
- Family Night PTA Meetings
- School-Based Parent Conferences
- Plans of Assistance
- INFORM Committee
- Articulation Planning with Harford Community College

Information regarding the hiring, retention, and experience of Harford County Public Schools secondary mathematics teachers is located in Appendix N.

Assistance to the Maryland State Department of Education

Mrs. Morris and Mrs. Kachur have been actively engaged in the development and implementation of the Maryland School Assessments and the High School Assessments. The Maryland State Department of Education asked for and received Office of Mathematics assistance in

- Development of the Voluntary State Curriculum
- Range Finding for the Maryland School Assessment
- Standards Setting for the Maryland School Assessment
- Development of the Core Learning Goals
- Development of the Scoring Rubric for High School Assessment Constructed Responses
- Range Finding for the High School Assessment
- Standard Setting for the High School Assessment