

*A LONGITUDINAL STUDY OF THE
INSTRUCTIONAL EFFECTIVENESS*

OF

**MATHEMATICS
IN CONTEXT**

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Mathematics in Context

This report describes a multi-year study of the instructional effectiveness of Mathematics in Context (MiC), a mathematics program designed for use in Grades 6, 7, and 8.

Background Information

Holt, Rinehart and Winston, a Harcourt Education Company based in Austin, Texas, publishes secondary educational materials, including curriculum-based textbooks, CD-ROMs, videodiscs, and other support and reference materials. Holt, Rinehart and Winston's Department of Research & Curriculum conducted an instructional validation study of the effectiveness of *Mathematics in Context* (MiC).

Mathematics in Context has been adopted and is in use in a large number of school districts across the country. Holt, Rinehart, and Winston sought to determine how effective the program has been. Since nearly all states have statewide mathematics assessments, Holt's Research Department first determined which states had administered middle grade (Grades 6, 7, and 8) math tests for multiple years and whether the results for individual schools for those states had been posted on the Internet. An exhaustive review found four states that had administered middle school mathematics tests in the past several years and had made the results for individual schools or districts available on a website. There were a number of states that had administered mathematics tests to middle grade students, but they had done so for only one year; changes in performance therefore could not be determined.

The four states which had administered mathematics tests to middle grade students for several years and had posted the school results on a web site included Michigan, Delaware, Pennsylvania, and New York. The results for these four states were downloaded and analyzed and the results are described in this report.

The Instructional Program

Mathematics in Context is a comprehensive middle school mathematics curriculum. It was developed by the Wisconsin Center for Education Research, School of Education, University of Wisconsin-Madison and the Freudenthal Institute at the University of Utrecht, The Netherlands.

Mathematics in Context consists of mathematical tasks and questions designed to stimulate mathematical thinking and to promote discussion among students. Students are expected to explore mathematical relationships; develop and explain their own reasoning and strategies for solving problems; use problem-solving tools appropriately; and listen to, understand, and value each other's strategies.

The complete *Mathematics in Context*©2006 program contains 27 units, 9 at each grade level. The units are organized into four content strands: number, algebra, geometry and measurement, and data analysis and probability. The non-consumable, softcover student booklets are accompanied by teacher guides and additional supplemental material.

Holt, Rinehart and Winston is the exclusive distributor of *Mathematics in Context*, published by Encyclopaedia Britannica.

Purpose of the Study

Holt, Rinehart and Winston sought to determine the efficacy of the *Mathematics in Context* program to ensure that it fosters significant knowledge and understanding in the areas of mathematics designated by state mathematics standards as important for middle grade students. Mathematics at the middle school level lays the groundwork for students' later coursework in advanced mathematics courses, and consequently, affects their options for higher education and employment. State mathematics standards and those of organizations such as the National Council of Teachers of Mathematics emphasize deep knowledge and understanding of math skills, processes and problem solving. In addition, these standards emphasize the need for real-world connections and applications within the teaching of mathematics. The efficacy of a mathematics program at grades 6-8 hinges upon how well it meets these goals.

Research Questions

The following research questions guided the design of the data analysis:

- Is *Mathematics in Context* instructionally effective?
- Does mathematics instruction based on the teacher's guides and student texts significantly increase students' knowledge and understanding of mathematical content as measured by state math assessments?

Design and Procedures of the Study

Study Population

The demographic descriptions of the schools from the four states included in this study are summarized in Table 2. The study included a total of **17** schools with a combined student population of **13,962**.

Table 2
Summary of Math Assessment and Demographic Data
for Schools Included in the Study

State	Type of School Locale	Number Schools	Number Students	% Minority	% Free/Reduced Lunch Programs
Michigan	Urban, fringe of large city	1	665	52.9%	NA
Delaware	Urban, fringe of large city	2	1,586	21.4%	9.4%
Pennsylvania	Large central city	10	8,535	71.6%	45.2%
New York	Large central city	4	3,176	98%	NA
Total		17	13,962	61%	

The grade at which a standardized statewide middle school mathematics test is administered is listed for each state in Table 3.

Table 3
Grade Level at which State Mathematics Test is Administered

State	Grade
Delaware	8
Michigan	8
New York	8
Pennsylvania	8

Design

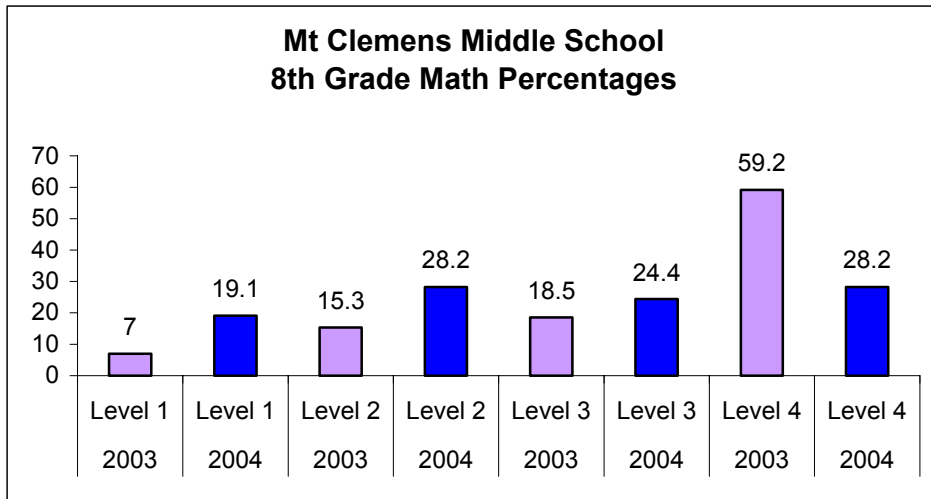
A quasi-experimental pretest/posttest design was used. Holt, Rinehart, and Winston Research Department used lists of school districts and schools from a number of states across the country where the *Mathematics in Context* program has been selected for use. Research Analysts then searched the states' assessment websites (such as those provided by state departments of education) to determine which of the states had administered middle school mathematics assessments and whether the results of those assessments were available on the Internet.

The four states included in this study used different assessments but all had administered mathematics tests at grade 8. In addition, the mathematics standards for each state were somewhat different. Because of the differences in standards and assessments for each state, the results for each state were analyzed and presented separately.

This report will highlight some schools and districts around the nation which have seen significant gains in student performance on state assessments.

Mt. Clemens Middle School, Mt. Clemens, MI

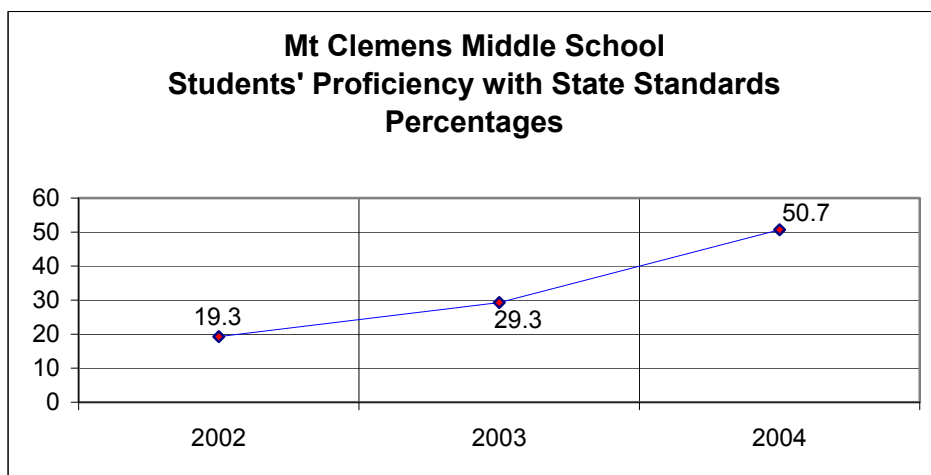
Mt. Clemens Community School District is in Macomb County on Lake Erie. The school population is 57% Caucasian and 39% African American, in eight schools, one of which is a 6-8 middle school with 374 students. Between 2000 and 2002 the school began purchasing MiC; however full implementation began in 2003 when the school purchased six units for the sixth grade, eight for grade 7 and four for grade 8. The following graph illustrates the improvement in math MEAP (Michigan Educational Assessment Program) scores from 2003 to 2004 for grade 8 students:



Level 1 = exceeded MI Standards
Level 2 = met MI standards

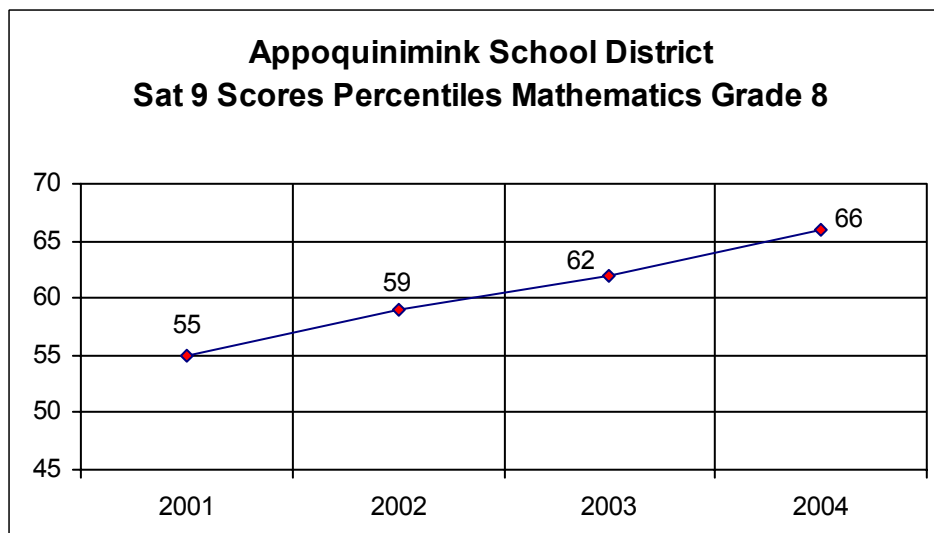
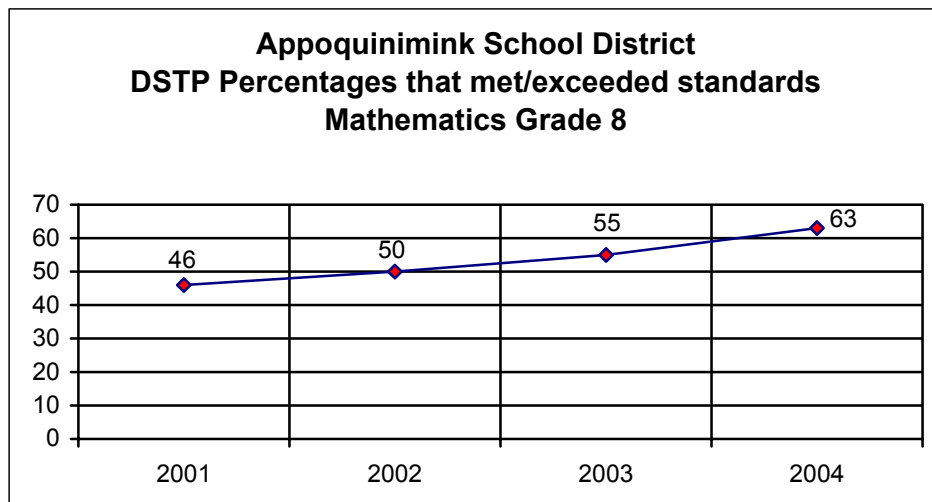
Level 3 = at basic level
Level 4 = apprentice

Students' proficiency with state standards shows a significant increase from baseline year 2002 through 2004.



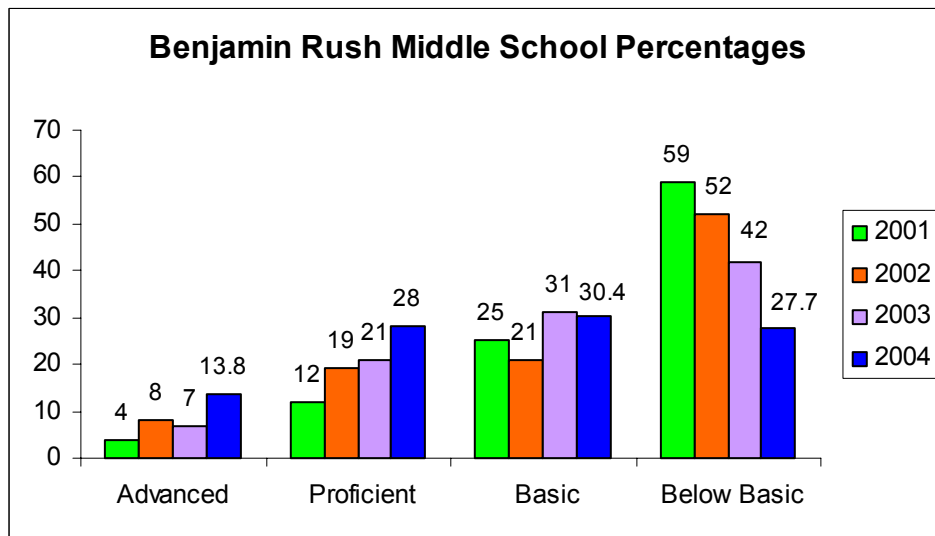
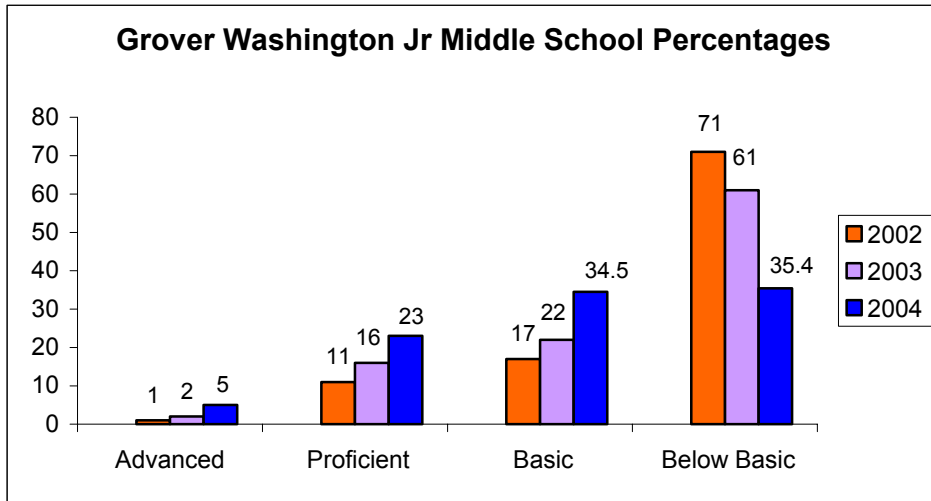
Appoquinimink School District, Odessa, DE

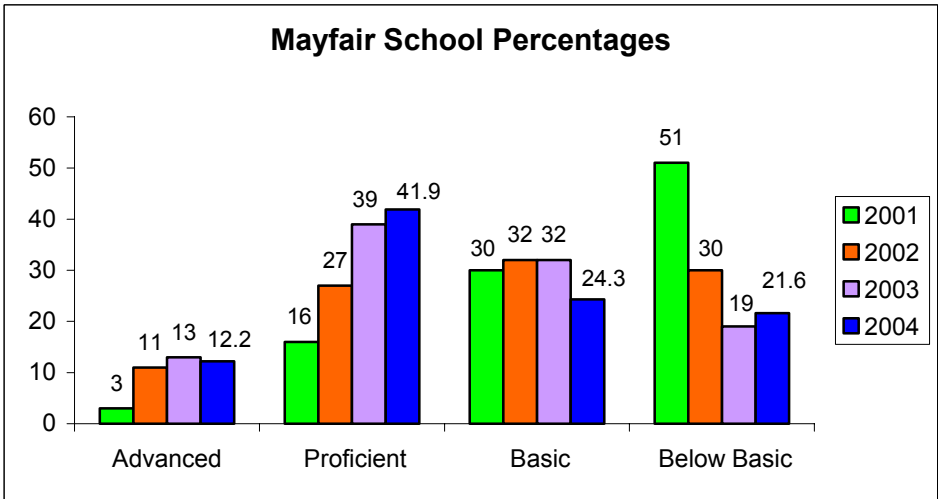
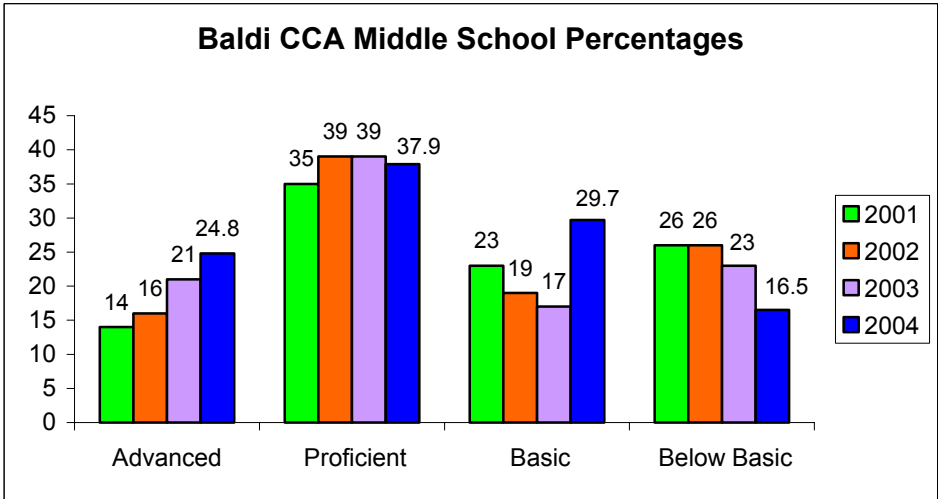
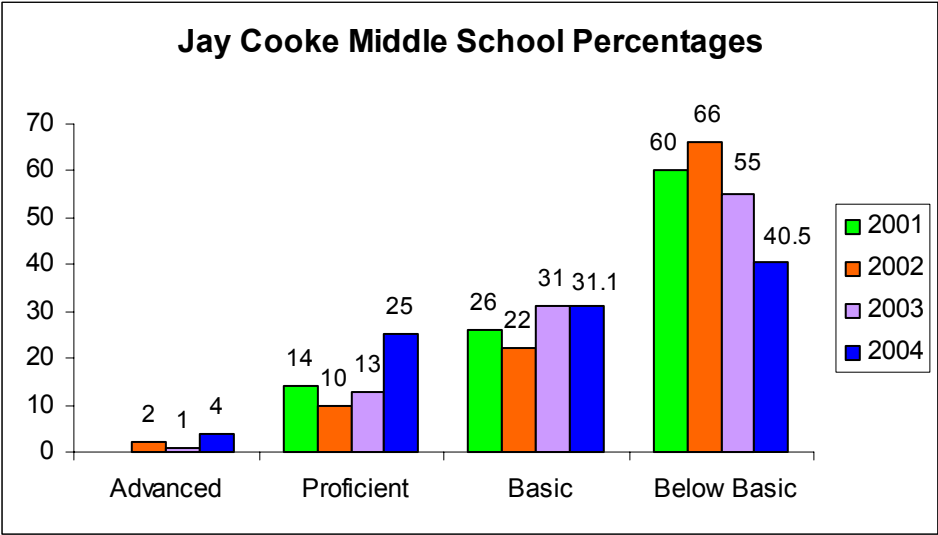
The “fastest growing school district in the state of Delaware,” the Appoquinimink district serves more than 6,300 students in grades K-12 (small to mid-size district). Most of its 10 schools have received a “superior” rating from the Delaware Department of Education NCLB statewide ratings. The district began using MiC in 2001 and purchased multiple units for each grade level, as well as for summer school, in 2003. While only Grade 8 students take the Delaware Student Testing Program (DSTP), all middle grade students have shown steady progress in math on this test as well as on the SAT 9, nationally-normed test.

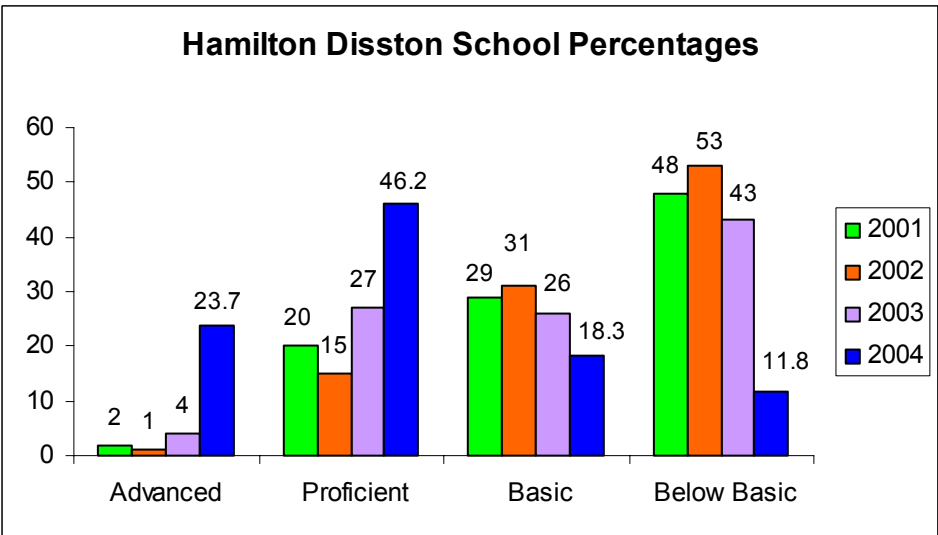
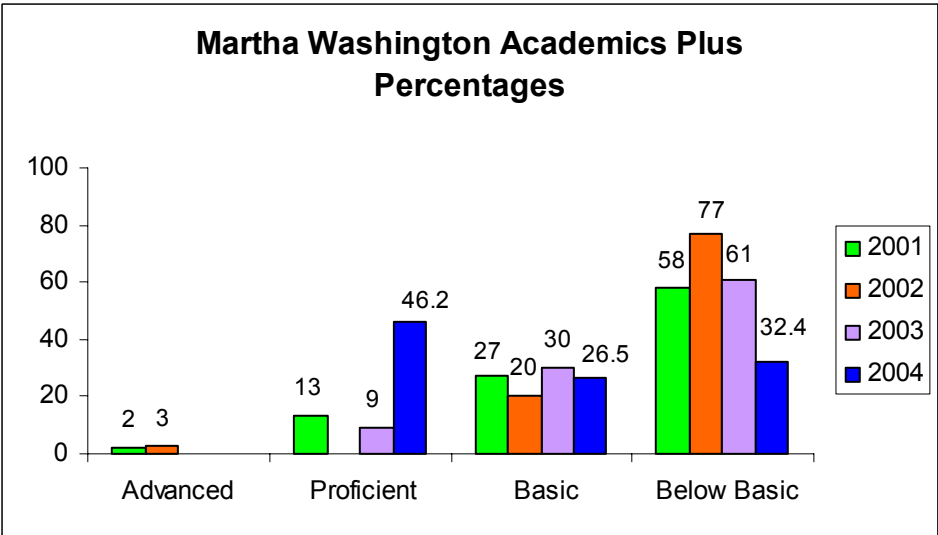
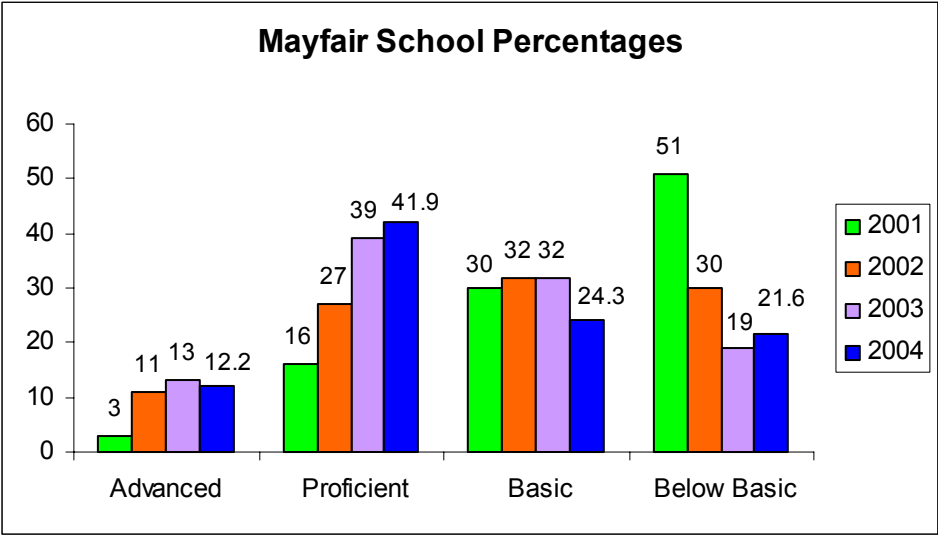


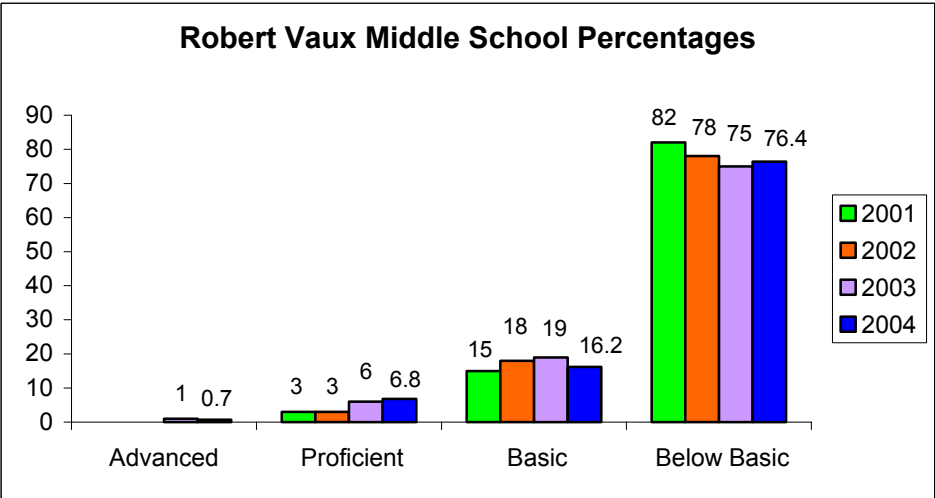
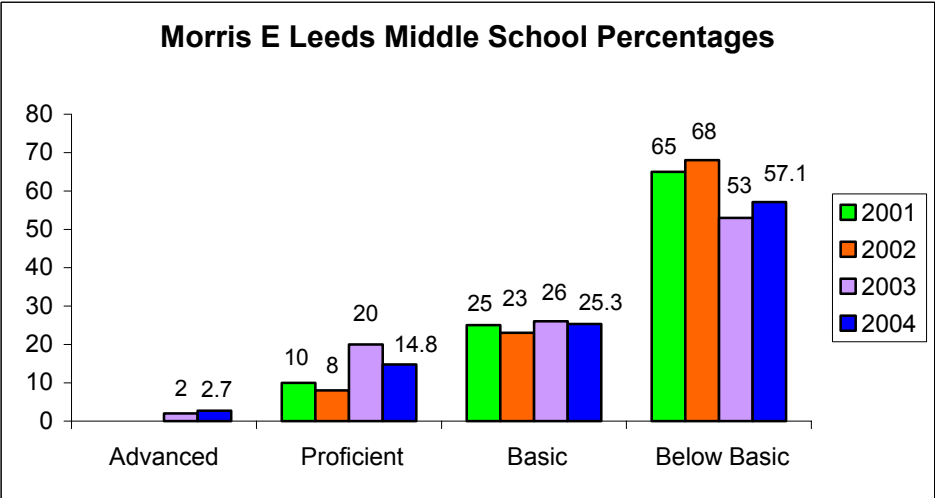
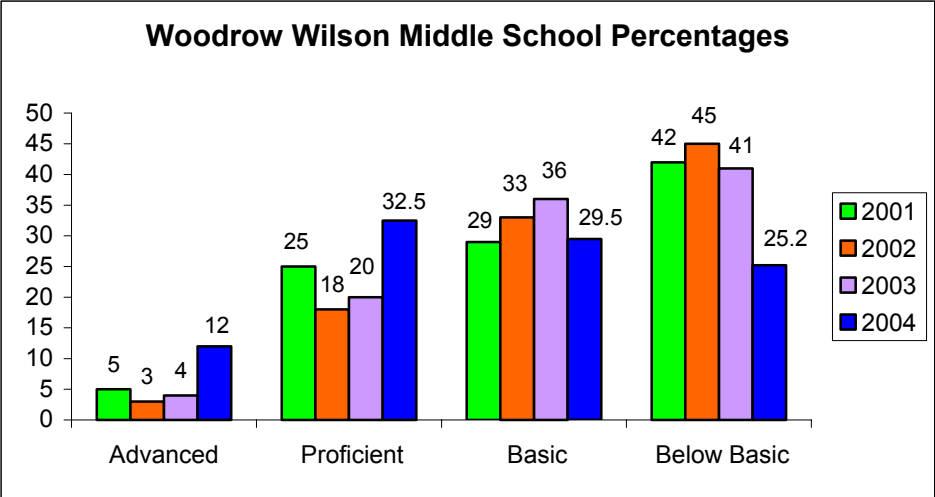
The School District of Philadelphia Middle Schools

The School District of Philadelphia began partial implementation of Mathematics in Context during the 2002-2003 school-year and full implementation during school year 2003-2004. The following graphs show the 8th grade math scores comparing the year before implementation 2001-2002 school year to the first two years (school years 2002-2003 and 2003-2004) following implementation. The following graphs represent a sampling of ten Philadelphia schools showing growth and improvement on the Pennsylvania State Student Assessment (PSSA).







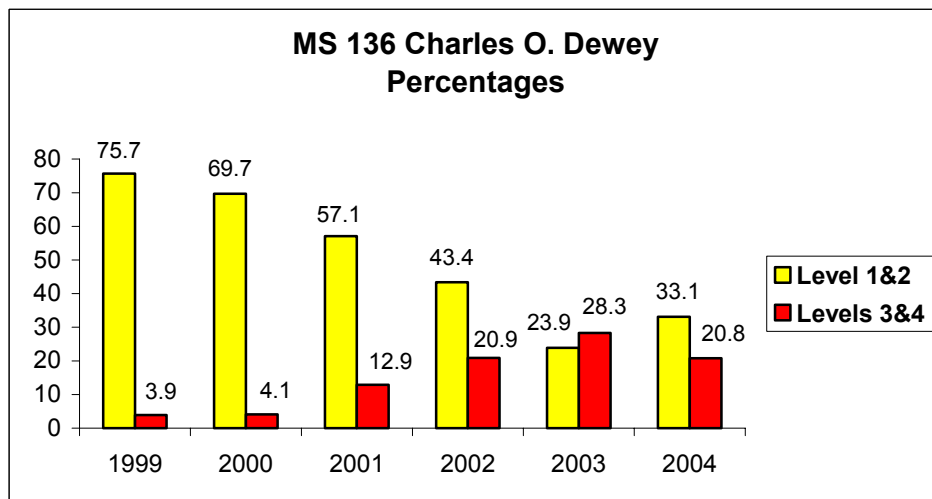
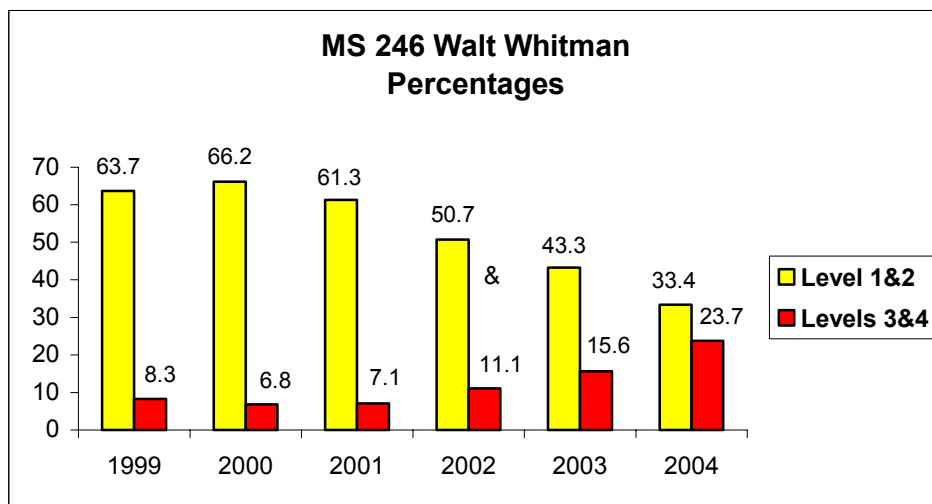


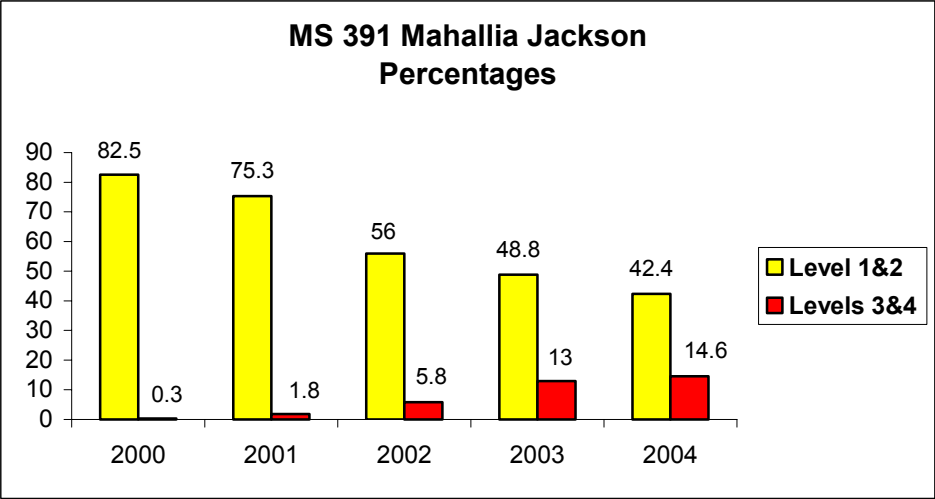
Brooklyn Middle Schools

Four Brooklyn middle schools, users of MiC for several years, showed dramatic improvement in their 8th grade scores. Walt Whitman MS 246 has used MiC since 1999, Charles O. Dewey MS 136 since 1997, Mahalia Jackson MS 391 since 1999, and Meyer Levin IS 285 since 1998. Graphs show 8th grade percentages in growth to the proficient and advanced levels since 1999:

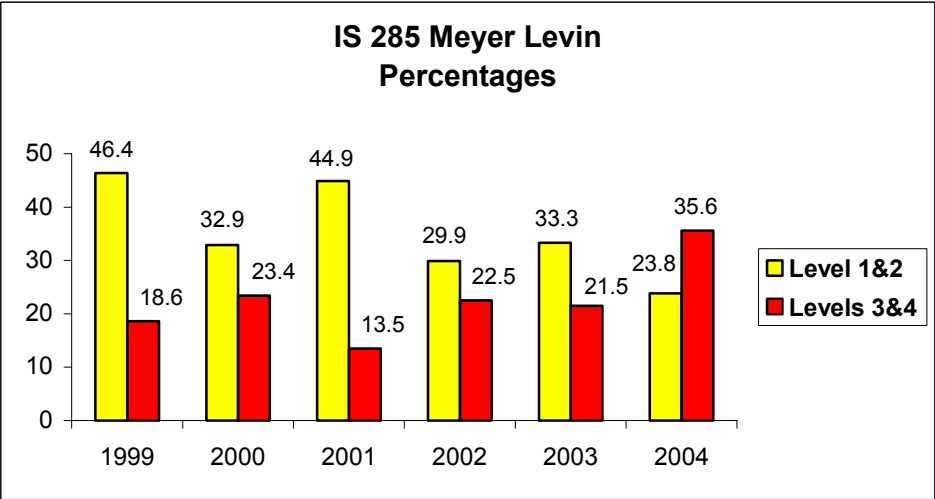
Level 1 = not proficient
 Level 2 = basic
 Level 3 = proficient
 Level 4 = advanced
 At levels 3&4, student has mastered standards.

Chancellor's District 85





Brooklyn School District 18



Summary of Results

- Following the adoption of *Mathematics in Context*, across these schools in these four states, the percentage of students scoring at the lowest levels of achievement on statewide mathematics tests declined significantly.
- Following the adoption of *Mathematics in Context*, across these schools in these four states, the percentage of students scoring at the proficient and higher levels of achievement on statewide mathematics tests increased significantly.
- The first year gain scores on the state mathematics tests continued into the second and subsequent years for those schools that used the *Mathematics in Context* for two or more years.
- The gains observed for students in urban and large central city schools with a high percentage of minority students were in a positive direction.