EVALUATION OF PWCS ELEMENTARY MATHEMATICS INITIATIVE: "INVESTIGATIONS IN NUMBER, DATA, AND SPACE" YEAR ONE REPORT: 2006-07

INTRODUCTION

In January 2006, the Prince William County School Board approved the divisionwide implementation of the mathematics initiative, "*Investigations in Number, Data, and Space"*, beginning with grades K-2 for the 2006-07 school year. At the same time, they requested that the program be evaluated. As a result, the Office of Program Evaluation (OPE) in the Office of Accountability was asked by the Associate Superintendent for Student Learning and Accountability to conduct a three-year, comprehensive evaluation of the initiative at all elementary schools and two traditional schools. The purpose of the evaluation is to inform decision-making and program improvement. OPE worked with an evaluation advisory team, composed of school-based and central office representatives, to develop evaluation questions and an evaluation design.

History of the "Investigations" Program in Prince William County Public Schools

Prince William County Public Schools has the following vision statement for mathematics:

> *Prince William County Schools' mathematics program promotes an environment in which students develop a comprehensive and enduring understanding of the concepts of mathematics. Students learn to effectively apply these concepts and use a variety of problem solving strategies. The program nurtures a productive disposition toward mathematics, challenges all learners, and supports further investigation in this field.*

In April 2005, three mathematics Textbook Adoption Advisory Committees were formed for grades K-5, 6-8, and 9-12. Each included teachers, administrators, and parents from across the School Division. The committees met from May to October 2005 to review and judge materials, using the National Council of Teachers of Mathematics (NCTM) process standards. All textbook materials were available for public review from September through December 2005, at which point the committee recommended math textbooks to the School Board. After the approval of the program by the Prince William County School Board in January 2006, a phased-in implementation was scheduled. The program started with grades K-2 in 2006-07, grade 3 in 2007-08 and grade 4 will begin in 2008-09.

RESULTS

The purpose of the report is to provide the School Board with important preliminary findings after the first year of the evaluation of the Mathematics "Investigations" program. Following is a summary of those findings, in the areas of professional development, program implementation, and program impact.

Summary of Preliminary Findings: Year One

Overall, with respect to perceptions, stakeholders demonstrated a positive outlook on the "Investigations" program with respect to the quality of instruction and students' enjoyment of mathematics. In the area of professional development, 10 professional development sessions or activities were offered for principals and 12 were offered for teachers. About one-fourth of the teachers cited the need for additional support in teaching with "Investigations".

In the area of student achievement, student performance in the initial year was a positive. Over 80% of second graders and about 70% of first graders were proficient in math skills assessed via ten subtests on the Stanford Diagnostic Mathematics Test (SDMT). In addition, PWCS students performed at the national average on the SDMT at both grades 1 and 2.

However, similar to other assessments in the School Division, the SDMT results showed performance gaps. In grades 1 and 2, there were statistically significant gaps between non-economically-disadvantaged students and economically-disadvantaged students on all 10 subtests on the SDMT. For both grades, the largest gap was in "number systems and numeration" and the smallest gap was in "geometry".

The following sections of the report contain more detailed explanations of these initial findings for each area.

Professional Development

An important key to the success of the "Investigations" program is quality training and professional development that is tailored to the needs of teachers and administrators. During school year 2006-07, 10 professional development activities were scheduled for principals and 12 were scheduled for teachers.

The following professional development activities were designated for principals:
- Community engagement sessions.
- Teacher orientation sessions.
- Administrators' institutes.
- Classroom observation sessions.

Teacher professional development opportunities included the following:
- Community engagement sessions.
- Teacher orientation sessions.
- Classroom observation sessions.
- Courses on specific topics such as Math Intervention, Building a System of Tens, and Making Meaning of Operations.

In addition to the administrator sessions, administrators were encouraged to attend sessions with their teachers. The Community Engagement sessions were geared not only at school-based staff but also at parents. In addition, the PWCS Math Office and several schools offered Parent Information Nights.

Stakeholder Perceptions of Areas Related to Implementation

Stakeholders' perceptions are highly regarded in evaluations and may often be related to the level of successful implementation a program attains. Surveys were conducted in April and May of 2007 to determine the opinions of principals, teachers, and parents regarding the "Investigations" program. The response rates were as follows:

- Of 55 principals surveyed, 41 responded for a return rate of 75%.
- Of 940 teachers surveyed, 722 responded for a return rate of 77%.
- Of the total population of over 18,000 K-2 parents, a random sample of 10% (1838) parents, representing all schools, were mailed surveys; 536 responded for a return rate of 29%[1].

Mathematics Instruction

- 88% of principals "agreed" (56%) or "strongly agreed" (32%) that teachers are prepared to teach using "Investigations".
- 95% of teachers agreed that they are skilled in mathematics instruction.

[1] The sample size of the parents actually responding to the survey was 536. That sample size does allow us to generalize to the larger population. For example, if the entire population of over 18,000 parents were asked the same survey questions posed to the sample, there is a 95% chance that the responses from the total population would be within plus or minus 4 percentage points of the response percent of the 536 parents in the sample.

- About 22% of the teachers indicated they needed additional support in various pedagogical areas such as differentiation, questioning and general instructional techniques, and content knowledge.
- 79% of parents indicated that they were "very satisfied" (51%) or "somewhat satisfied" (28%) with their children's mathematics instruction.

Students' Enjoyment of Mathematics

- 93% of principals "agreed" (49%) or "strongly agreed" (44%) that students enjoyed the "Investigations" program.
- 91% of teachers indicated that in their classrooms students "usually" (59%) or "always" (32%) enjoy mathematics activities.
- 83% of parents indicated that it was "somewhat true" (29%) or "very true" (54%) that their children really enjoyed mathematics in school year 2006-07.

Baseline Student Achievement Outcomes

Assessment Instrument Used

To measure student achievement outcomes, the Stanford Diagnostic Mathematics Test (SDMT) was used to assess computation skills and problem-solving strategies for all PWCS students in grades 1 and 2 in spring 2007. The SDMT is a standardized, norm-referenced assessment published by Harcourt Brace. It measures competence in basic concepts and skills, while emphasizing problem-solving and problem-solving strategies. Scores from the tests are on a developmental scale, which will allow growth to be examined for students tested in successive years (e.g., grade 1 in 2007 and grade 2 in 2008). The SDMT was chosen because there is currently no local or state assessment to evaluate the effectiveness of "Investigations" for K-2 at the Division level. In addition, the SDMT is considered reliable and credible, and other school systems have used norm-referenced tests as outcome measures in their evaluations of "Investigations".

The SDMT is comprised of a total of 52 assessment items. On the SDMT, student performance is interpreted in two different ways. First, scores are considered in terms of progress toward skill mastery. Second, scores are considered in comparison to the performance of a national sample. Appendix A contains a glossary of terms that will help explain the various scores. Appendix B contains charts and data tables with SDMT results.

Skill Mastery

A student's proficiency or grade-level performance was defined by a raw score determined by a required number items correct out of the total number of items in each of the following ten skill areas:

Concepts/Applications (total items: 32)

- Number systems and numeration
- Patterns and functions
- Problem solving
- Graphs and tables
- Measurement
- Geometry

Computation (total items: 20)

- Addition facts
- Addition operations
- Subtraction facts
- Subtraction operations

Division Performance on SDMT

Prince William County Schools' performance on the SDMT for grades 1 and 2 are as follows:

- Grade 1 Students
  - 70% or more proficient in 9 of 10 skill areas; 68% proficient in 1 of 10 skill areas
  - Over 80% proficient in 2 of 10 skill areas

Grade 2 Students
  - Over 80% proficient in all 10 skill areas
  - Over 90% proficient in 5 of 10 skill areas
- Students in both grades performed slightly better on the 'Concepts and Applications' subtest than on the 'Computation' subtest.

Division Performance Gaps on SDMT

In addition to considering the overall group, the performance of subgroups was also analyzed. When economically-disadvantaged students were compared with non-economically-disadvantaged students on proficiency in SDMT skills, the following results were revealed.

- First and second graders had statistically significant gaps in favor of non-economically disadvantaged students for each of the 10 SDMT subtests.
- The gaps were slightly larger (ranging from 7.8 to 16.9 percentage points) for first graders than for second graders (ranging from 0.4 to 13.8 percentage points).
- For both grades, the largest gap was in "number systems and numeration" and the smallest gap was in "geometry".
- Appendix B contains data tables that illustrate these performance gaps.

Comparative Performance

The performance of PWCS students was also compared to the performance of a national sample, using percentile ranks and stanines. Definitions of the scores used are included in the glossary in Appendix A. It is important to remember that percentile ranks place a student's (or a division's) performance in the context of the performance of a larger group. For percentile ranks, 50 represents average performance (half the sample scored above that level and half scored below).

Division National Ranks

PWCS had the following ranks on the SDMT for grades 1 and 2. These percentile ranks and stanines indicate the Division performed at the "average" level.

Skill Category	Students Tested		Percentile Ranking		Stanine Ranking	
	Grade 1	Grade 2	Grade 1	Grade 2	Grade 1	Grade 2
Concepts and Applications	5661	5433	49	54	5	5
Computation	5654	5413	44	45	5	5
Total	5625	5396	45	50	5	5

Next Steps

With respect to next steps in the evaluation process, the Office of Program Evaluation (OPE) will continue to monitor the impact of "Investigations" on student achievement. For the Year Two Report (2007-08), for the first time, data will include Standards of Learning (SOL) scores for the first Grade 3 cohort to have experienced "Investigations". Also, performance growth from grade 1 to grade 2 will be studied.

Through collaboration with the evaluation advisory team, instruments are developed for collecting implementation data. These instruments will be available to individual schools to use as tools to monitor their own progress with "Investigations".

In January 2008, OPE will provide a formative report to the Mathematics Office, which will include connections between program implementation and program impact. In addition, recommendations will be provided for program improvement.

Appendix A

Glossary of Terms

National Performance

Comparative scores on the SDMT are reported in a variety of ways for each child and are expressed as national percentile ranks (PR), stanines (S), and raw scores defined as follows:

Percentile Ranks

- Show a child's performance relative to other students of the same grade level who were administered the test nationally at the same point in the school year. Percentile ranks can range from 1 to 99, with 50 representing the midpoint or median performance for the grade level. A percentile rank of 45 would mean that the student performed as well or better than 45 percent of the students in the national sample. It **does not mean** that the student answered 45 percent of the questions correctly. Percentile ranks do not equate to percent correct. National percentile ranks from 23 to 76 are considered average. Ranks below 23 are below average and ranks above 76 are above average.

Stanines

- Compare a student's performance with that of the national sample. Stanines range from 1 to 9, with a 5 designating the midpoint or average performance. For an individual child, stanines of 4, 5, and 6 represent average performance, with stanines of 7, 8, and 9 representing above-average performance, and stanines of 1, 2, and 3 representing below-average performance.

Raw Scores

- Represent the number of items a child got correct for each subtest and the total. This is in comparison to the number of items (shown as "No. of Items" on the report).

Skill Mastery

A student's proficiency or grade-level performance is defined by a raw score determined by a required number items correct out of the total number of items in each skill area.

Concepts/Applications (total items: 32)

- Subtests and required number of items correct for proficiency

	1st grade:	2nd grade:
o Number systems and numeration	9/12	8/12
o Patterns and functions	2/3	2/3
o Problem solving	5/6	4/6
o Graphs and tables	2/3	1/3
o Measurement	3/5	3/5
o Geometry	2/3	1/3

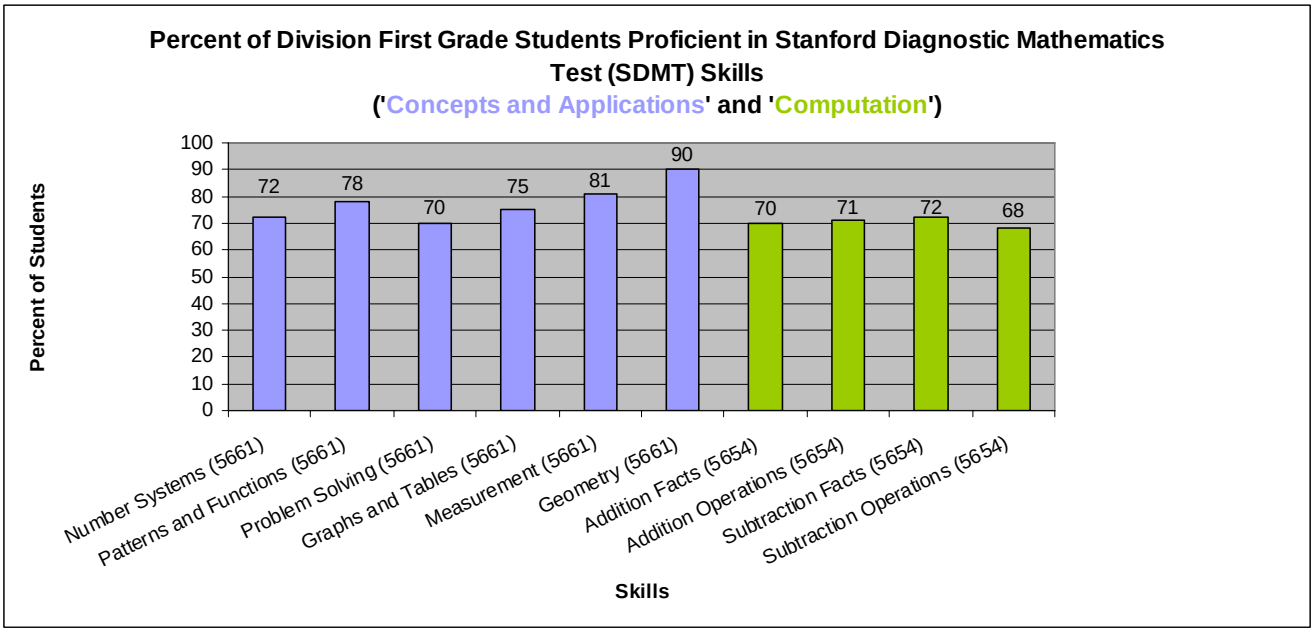
Computation (total items: 20)

- Subtests and required number of items correct for proficiency

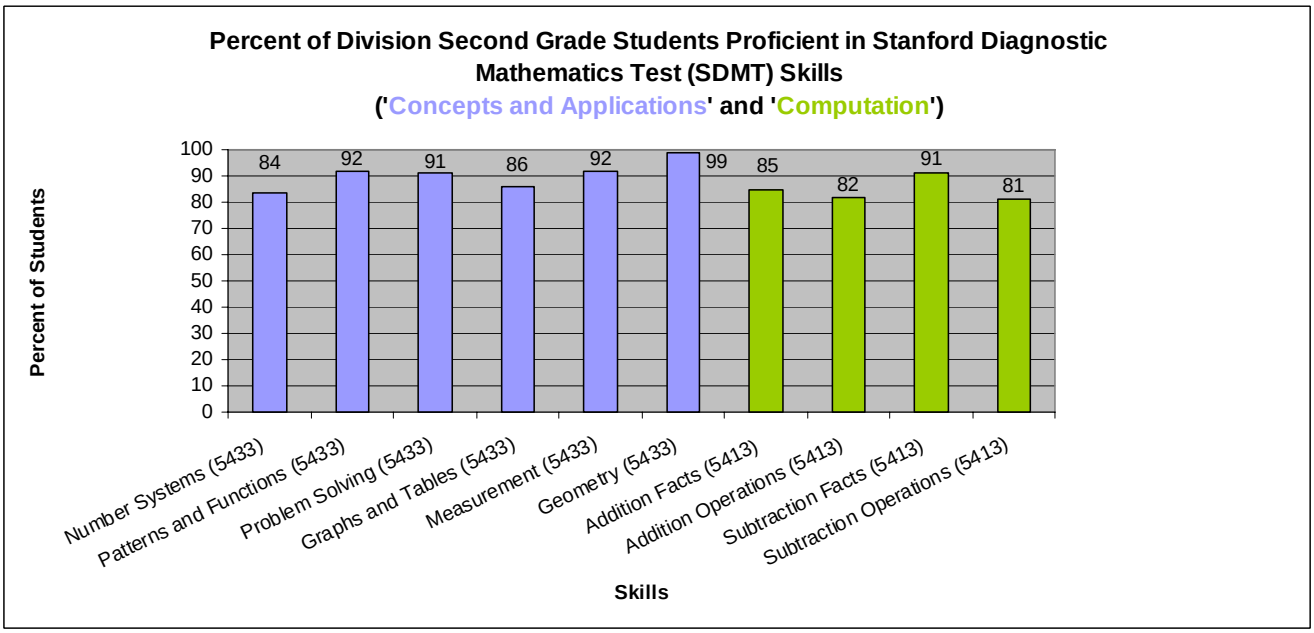
	1st grade:	2nd grade:
o Addition facts	5/6	4/5
o Addition operations	3/6	3/4
o Subtraction facts	3/5	3/5
o Subtraction operations	1/3	3/6

Appendix B

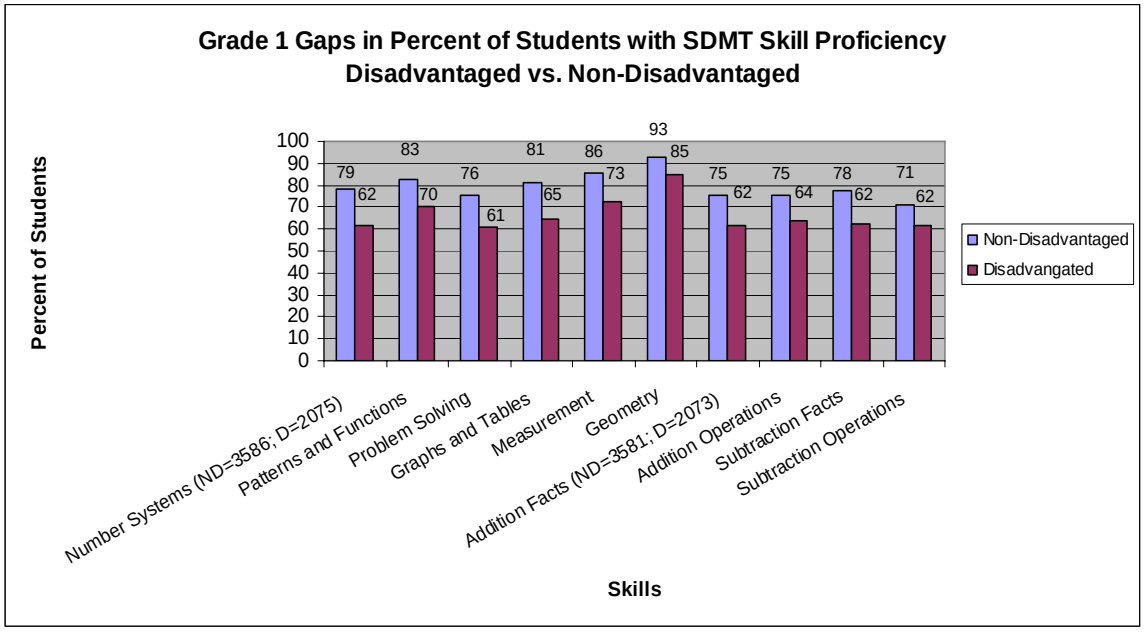
Grade 1 Skill Proficiency on SDMT



Grade 2 Skill Proficiency on SDMT



Grade 1 Performance Gaps



Grade 2 Performance Gaps