

TEST DATE: MARCH, 1996
Summary of a Matched-Sample Study Comparing
IMP and Traditionally-Taught Students on
the Stanford Achievement Test-9th Edition at
Central High School, Philadelphia Pa

Introduction: In a carefully controlled matched-sample study, the performance of 83 students in the Interactive Mathematics Program (IMP) and 83 traditionally-taught algebra students were compared using the Stanford Achievement Test (SAT-9) which was administered in March 1996. All students in the study were enrolled in their third mathematics course at Central High School as of 1995-96, their junior year.

The 83 **IMP** students represented all students enrolled in IMP Level 3 classes during the 1995-96 academic year for whom complete data was available. The 83 traditional students were chosen so that they matched the IMP students with regard to 1) gender, 2) number of students attending public and private schools in eighth grade, and 3) percentile scores on national, standardized tests taken by the students in eighth grade.

Description of Samples:

Total Sample Size	83	83
Males	41	41
Females	42	42
Public School (8th grade)	33	33
Private School (8th grade)	50	50
8th grade national percentiles		
Math	95.9	95.9
Verbal	95.8	95.8

Results: **IMP** *outperformed* traditional students in **21** out of 28 reported SAT-9 multiple choice categories. Of these, the Probability and Functions gain scores are statistically significant. There were 3 categories where **IMP** and traditional students tied. There were 4 categories where the traditional scores were higher than IMP. Of these, none are statistically significant.

The IMP students' scores on the following Stanford-9 Multiple Choice sub-scores were higher than those of their traditional counterparts:

	IMP	Traditional
Mathematics Content Cluster Total	33.9	32.2
Problem-Solving Strategies	2.3	2.1
Statistics	4.8	4.6
Probability	3.9	3.0
Functions	4.1	3.7
Geometry from an Algebra Perspective	3.5	3.1
Discrete Mathematics	2.1	2.0
Mathematics Process Cluster Total	33.9	32.2
Mathematics as Problem Solving	10.6	10.0
Mathematics as Reasoning	10.7	9.9
Mathematics as Communication	5.5	5.4
Mathematics as Connections	7.0	6.7
Thinking Skills	23.2	21.7
Reading Comprehension Content Cluster Total	45.8	44.5
Recreational Reading Comprehension	16.3	15.6
Textual Reading Comprehension	15.5	15.0
Functional Reading Comprehension	14.0	13.8
Reading Comprehension Process Total	45.8	44.5
Initial Understanding	8.7	8.4
Interpretation	21.0	20.1
Process Strategies	8.0	7.9
Thinking Skills	37.1	36.0
Science Process Cluster Total	23.7	23.2
Using Evidence Models	13.9	13.5
Patterns of Change	6.0	5.7
Thinking Skills	18.1	17.5

Both groups of students tied on the following sub-scores:

	IMP	Traditional
Conceptual Underpinnings of Calculus	1.4	1.4
Trigonometry	2.3	2.3
Reading: Critical Analysis	8.1	8.1

The traditional students outscored the IMP students on the following sub-scores:

	IMP	Traditional
Algebra	5.0	5.2
Geometry from a Synthetic Perspective	4.6	4.7
Trigonometry	2.3	2.4
Science: Comparing Form and Functions	3.8	4.0

Open-ended Assessments:

Math Score	22.3	22.0
Reading Score	22.0	21.5

Description of Stanford-9 Test: The Stanford Achievement Test - 9th Edition (SAT-9) reflects national content area standards in Reading, Mathematics and Science. It assesses higher-order thinking skills by integrating process with knowledge. The SAT-9 often requires the student to write an answer not simply recall facts.

The SAT-9 test scores are reported in three components: 1) multiple choice, 2) open-ended assessment, and 3) a composite score. Scores for each of the three components are reflected in Reading, Mathematics and Science.

Research Notes:

- 1) The current study reflects students who had approximately 2 1/2 years of IMP. Differences in student performance after 4 years of IMP should be investigated.
- 2) Two of the traditional students were absent on the day that the open-ended science portion of the exam was given. Therefore, this study did not analyze the open-ended science and composite science scores. For future versions of this report, we will replace those students with two similar students (based on eighth grade result, gender, and type of school attended) and will include all science process-related sub-scores.
- 3) Individuals seeking more information regarding this study should contact:

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TEST DATE: MARCH, 1996
Summary of Matched-Sample Analysis
Comparing IMP and Traditionally-Taught Students on the
Mathematics Portion of the Stanford-9 Test at the
Philadelphia Hi2b School For Girls

Introduction: In a matched-sample study conducted by Dr. Edward Wolff and Patricia Decktor, performance of 55 **IMP** students and 55 traditionally-taught students were compared on mathematics subscores of the Stanford Achievement Test, 9th edition.

The IMP students represented all students enrolled in IMP Level 3 classes during the 1995-96 academic year, excluding only a few students for whom complete data was not available. The 55 traditionally-taught students were chosen so that they matched the IMP students with regard to percentile scores on previously taken eighth grade national, standardized tests.

All students in the study were enrolled in their third mathematics course at Girls' High as of the Spring of 1996. Thus, the IMP students studied had been exposed to approximately 2 1/2 years of a standards-based curriculum (EMP) and student-centered teaching methods.

Description of Samples:

	IMP	Traditional
Total Sample Size	55	55
Males	0	0
Females	55	55
8th grade mean math normal curve equivalency (z-score)	.806	.803
corresponding national percentile	79.0	78.9
8th grade mean verbal normal curve equivalency (z-score)	.681	.697
corresponding national percentile	75.2	75.7

March 1996 Girls High Study

Results: The overall summary score reported by the Stanford-9 is the "Mathematics Proficiency Level." More EMP students achieved "Basic" proficiency and less "Below Basic" than traditionally- taught students.

The distribution of proficiency level scores is as follows:

	Number & Percent of Students	
	IMP	Traditional
Level 3 (Advanced)	0 (0.0%)	0 (0.0%)
Level 2 (Proficient)	16 (29.1%)	16 (29.1%)
Level I (Basic)	23 (41.8%)	15 (27.3%)
Level 0 (Below Basic)	16 (29.1%)	24 (43.6%)

Of the 17 math-related scores of the SAT-9, EMP students *outperformed* their traditionally taught counterparts on 12, tied on two and scored slightly lower on three. **IMP** students did better on all the cumulative scores and the open-ended assessments.

The IMP-3 students' scores on the following Stanford 9 subscores were higher than those of their traditional counterparts:

	IMP	Traditional
Mathematics Content Cluster Total	29.6	28.5
Statistics	4.5	4.3
Probability	2.9	2.3
Functions	3.7	3.3
Geometry from Synthetic Perspective	4.2	4.0
Geometry from an Algebra Perspective	2.8	2.7
Discrete Mathematics	1.8	1.6
Mathematics Process Cluster Total	29.6	28.5
Mathematics as Problem Solving	9.2	8.5
Mathematics as Reasoning	9.3	9.1
Mathematics as Communication	4.8	4.7
Thinking Skills	20.0	19.4
Mathematics Open-Ended Raw Score	21.3	19.5
Comprehensive Raw Score	50.9	46.7
Overall Mathematics Proficiency Level	1.00	.86

Both groups of students tied on the following subscores:

	IMP	Traditional
Problem Solving Strat	1.9	1.9
Making Connections	6.3	6.3

The traditional students outscored the IMP students on the following Stanford subscores:

	IMP	Traditional
Algebra	4.8	4.9
Trigonometry	2.1	2.3
Underpinnings of Calculus	1.0	1.2

Discussion: The Interactive Mathematics Program (IMP) was created in the late 1980's to implement the NCTM Standards. The Standards call for the reform of the traditional topic-based mathematics curricula to better prepare students for the intellectual demands of the 21st century.

Specifically, the NCTM Standards call for increased emphasis on problem solving, communication skills, probability, statistics, and discrete mathematics, which currently receive minimal coverage in traditional mathematics texts.

Critics of IMP and other standards-based reform curricula and teaching methods often charge that students are not trained to be as facile as traditional students in algebraic symbol manipulation. While the above results show that traditionally-taught students did slightly better than the IMP students in this area, this study also shows that the IMP curriculum is considerably more effective than the traditional in preparing students to succeed in those areas deemed most important by today's leading mathematics educators--thinking, reasoning and non-routine problem solving.

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