

Longitudinal/Cross-Sectional Study of the Impact of *Mathematics in Context* on Student Performance

*Classroom Achievement Gain Score Data for the Eight Grade-Level-by-Year Studies in
1997-1998, 1998-1999, and 1999-2000*
(Technical Report #45)

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Introduction

The purposes of the longitudinal/cross-sectional study of the impact of *Mathematics in Context* (MiC; National Center for Research in Mathematical Sciences Education & Freudenthal Institute, 1997–1998) on student performance are (a) to determine the mathematical knowledge, understanding, attitudes, and levels of student performance as a consequence of studying MiC for over three years; and (b) to compare student knowledge, understanding, attitudes, and levels of performance of students using MiC with those using conventional mathematics curricula. The research model for this study is an adaptation of a structural model for monitoring changes in school mathematics (Romberg, 1987). For this study, information is being gathered on 14 variables over a 3-year period for three groups of students (those in Grades 5, 6, and 7 in 1997). The variables have been organized in five categories (prior, independent, intervening, outcome, and consequent). (See Figure 1 for variables and hypothesized relationships.)

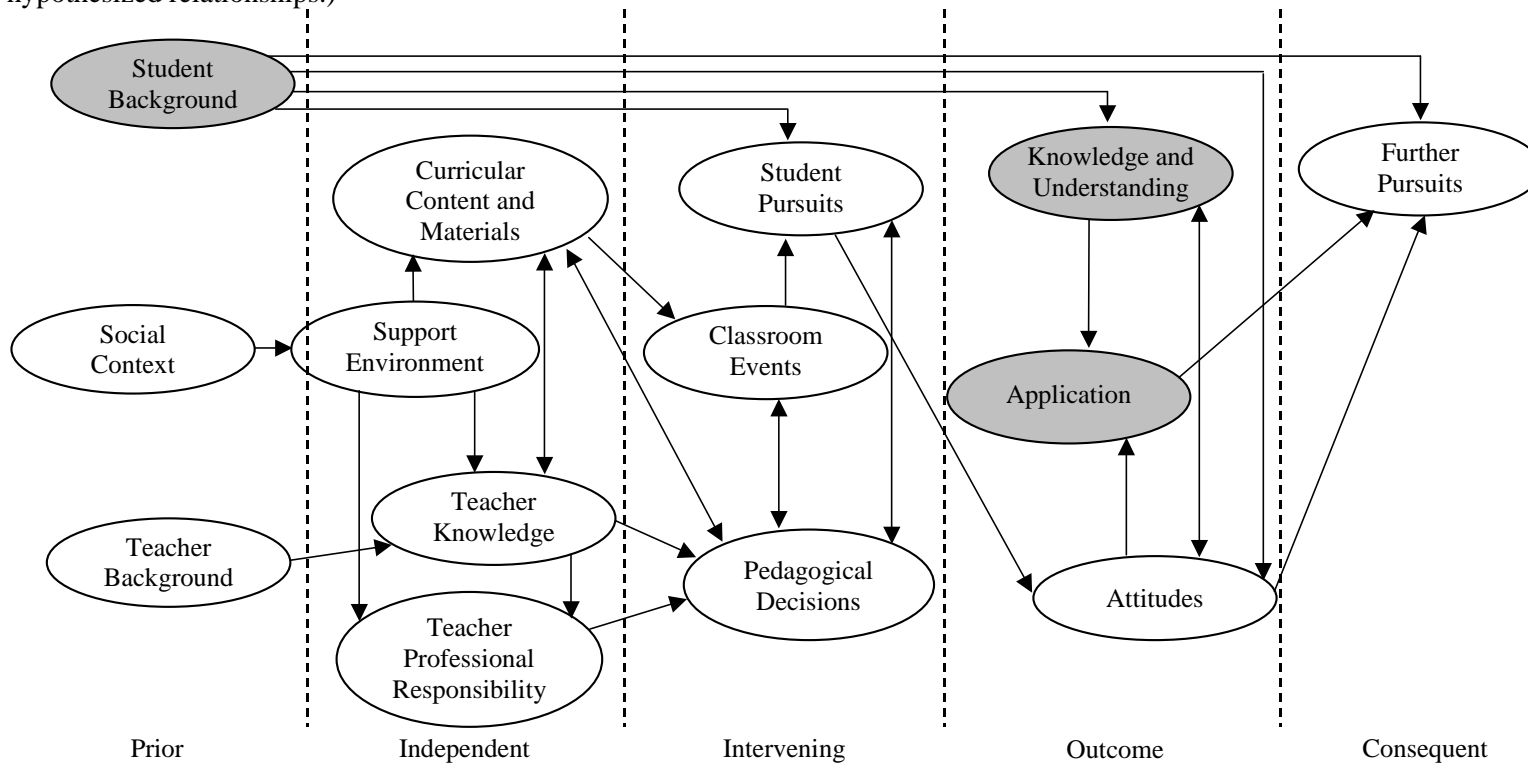


Figure 1. Revised model for the monitoring of school mathematics.

Overview

The data in this Technical Report contain the general results for the eight grade-level-by-year studies shown as white ellipses in Figure 2. The summary data has been derived from each student's weighted item scores on the Classroom Achievement Index (CA) (see Appendix A).

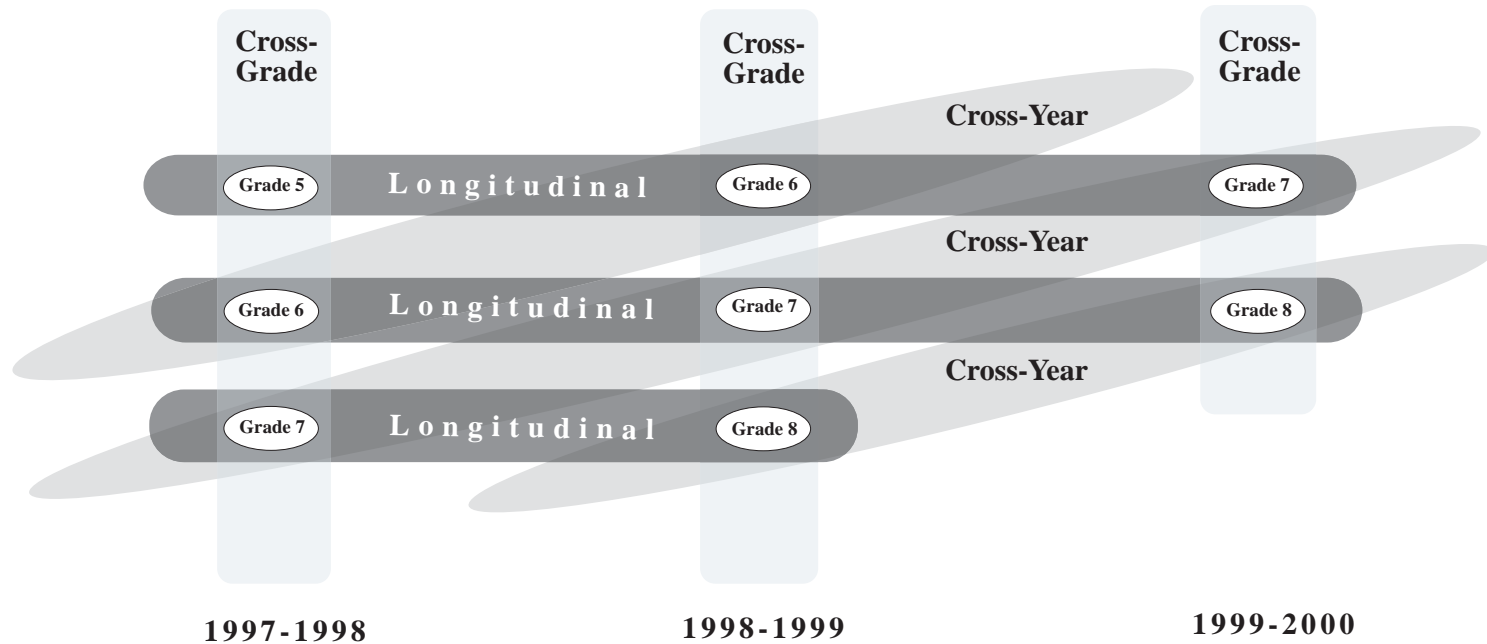


Figure 2. Sources of Data and Planned Comparisons of the MiC Longitudinal/Cross-Sectional Study

In each case the summary data has been displayed in terms of Tables that include the number of students, mean, standard deviation, both lower and upper 95% confidence intervals, and score distributions for the 95%tile, 75%tile, 25%tile, and 5%tile, then a Progress Map has been constructed to portray that data.¹

The following Tables and Maps have been organized in terms of each of the eight year-by-grade studies. Within each study the data on student performance is then organized first across all districts, second for each district separately, and then by teachers within districts.

¹ Progress Maps were not made if $N \leq 10$.

Mathematics in Context Classrooms

Table 1.1
Overall MiC Classroom Achievement Gain Scores for the Eight Grade-Level-by-Year Studies in Districts 1, 2, 3, and 4, in 1997-1998, 1998-1999 and 1999-2000

| Year | Grade | (N) | Prior Achievement Mean* | Classroom Achievement Mean | Classroom Achievement Gain Scores** |
|--------|---------|-----|-------------------------|----------------------------|-------------------------------------|
| Year 1 | Grade 5 | 384 | 53.59 | 257.57 | |
| | Grade 6 | 430 | 54.19 | 243.32 | |
| | Grade 7 | 439 | 55.18 | 254.92 | |
| Year 2 | Grade 6 | 152 | 270.30 | 279.01 | 8.71 |
| | Grade 7 | 201 | 245.88 | 260.60 | 14.73 |
| | Grade 8 | 148 | 251.27 | 263.79 | 12.51 |
| Year 3 | Grade 7 | 222 | 263.53 | 283.39 | 19.59 |
| | Grade 8 | 190 | 247.52 | 252.75 | 5.66 |

* The prior achievement score for Year 1 is the standardized test national percentile from the previous Spring (1997). The prior achievement scores for Years 2 and 3 are the classroom achievement scores from previous spring (Spring 1998 for Year 2 and Spring 1999 for Year 3).

** The classroom achievement gain score cannot be calculated for Year 1 because two different measures were used.

Table 1.2
Classroom Achievement Gain Scores for Grade Six, Seven, and Eight Students in Districts 1, 2, 3, and 4, in 1998-1999 and Grade Seven and Eight Students in 1999-2000, by District

| District | Classroom Achievement Gain Score | | | | | |
|------------------|----------------------------------|-------|---------|-------|---------|-------|
| | Grade 6 | | Grade 7 | | Grade 8 | |
| | (N) | Mean | (N) | Mean | (N) | Mean |
| 1998-1999 | | | | | | |
| District 1 | 51 | -5.57 | 39 | 44.57 | 29 | -2.94 |
| District 2 | 9 | 5.77 | 27 | 7.30 | 38 | 15.28 |
| District 3 | 92 | 16.91 | 96 | 3.63 | 50 | 25.98 |
| District 4 | 0* | 0.00 | 39 | 17.33 | 31 | 1.86 |
| 1999-2000 | | | | | | |
| District 1 | | | 57 | 30.01 | 68 | 5.68 |
| District 2 | | | 52 | 8.22 | 70 | -2.02 |
| District 3 | | | 82 | 22.32 | 3 | 1.83 |
| District 4 | | | 31 | 1.86 | 49 | 13.39 |

* Data not available.

Table 1.3

Prior Achievement and Classroom Achievement Correlations for Grade 5 MiC Students in Districts 1, 2, 3, and 4, in 1997-1998, by Teacher

| District/ Teacher | (N) ¹ | Spring 1997 Standardized Test National Percentile | | Spring 1998 Classroom Achievement Score | | Correlation Coefficient ² | District Correlation of Mean ³ |
|----------------------------|------------------|---|--------|---|--------|--------------------------------------|---|
| | | Mean | St Dev | Mean | St Dev | | |
| District 1 | | | | | | | 0.96 |
| 4 | 14 | 47.43 | 17.07 | 252.00 | 23.80 | 0.14 | |
| 14 | 46 | 43.04 | 22.34 | 239.35 | 43.10 | 0.64 | |
| 19 | 25 | 70.76 | 14.27 | 290.38 | 26.58 | 0.48 | |
| 27 | 14 | 54.79 | 16.93 | 259.54 | 34.99 | 0.58 | |
| 31 | 30 | 92.37 | 5.88 | 318.16 | 19.88 | 0.31 | |
| 49 | 8 | 24.13 | 13.90 | 240.20 | 22.27 | 0.64 | |
| Dist. 1 Students | 137 | 59.45 | 26.79 | 269.32 | 44.97 | 0.78 | |
| District 2 | | | | | | | 0.79 |
| 2 | 25 | 68.24 | 23.32 | 240.59 | 32.33 | 0.65 | |
| 12 | 30 | 52.00 | 28.40 | 225.70 | 37.25 | 0.56 | |
| 22 | 18 | 67.22 | 22.22 | 248.50 | 35.54 | 0.70 | |
| 26 | 63 | 57.71 | 28.50 | 242.27 | 38.35 | 0.70 | |
| Dist. 2 Students | 136 | 59.65 | 27.23 | 239.13 | 37.08 | 0.66 | |
| District 3 | | | | | | | 0.54 |
| 3 | 15 | 63.13 | 23.27 | 257.73 | 50.28 | 0.29 | |
| 7 | 20 | 64.05 | 23.42 | 285.24 | 45.75 | 0.64 | |
| 23 | 20 | 45.45 | 25.35 | 256.29 | 29.03 | 0.73 | |
| 25 | 17 | 58.35 | 22.42 | 282.33 | 40.16 | 0.86 | |
| 41 | 18 | 52.44 | 24.92 | 262.71 | 44.34 | 0.86 | |
| 48 | 21 | 58.67 | 27.38 | 266.83 | 39.55 | 0.84 | |
| Dist. 3 Students | 111 | 56.80 | 24.95 | 268.73 | 42.20 | 0.69 | |
| Dist. 1, 2, & 3 Students | 384 | 58.75 | 26.39 | 258.46 | 43.82 | 0.66 | |
| Correlation of Class Means | | | | | | | 0.67 |

¹ The N in this table represents all of the students with both Spring 1997 and Spring 1998 Standardized test scores.

² These correlations are of student scores by teacher, district, and all districts.

³ These correlations are between class means within and across all districts.

Table 1.4
Prior Achievement and Classroom Achievement Correlations for Grade 6 MiC Students in Districts 1, 2, 3, and 4, in 1997-1998, by Teacher

| District/ Teacher | (N) | Spring 1997 Standardized Test National Percentile | | Spring 1998 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 30 | 6 | 58.17 | 26.44 | 237.71 | 30.82 | 0.15 |
| 33 | 41 | 47.22 | 26.08 | 218.80 | 47.81 | 0.77 |
| 38 | 35 | 46.31 | 24.35 | 203.92 | 46.27 | 0.56 |
| District 2 | | | | | | |
| 37 | 38 | 55.92 | 25.53 | 230.03 | 33.21 | 0.52 |
| 45 | 34 | 71.71 | 22.63 | 266.19 | 36.34 | 0.60 |
| 51 | 37 | 51.27 | 25.90 | 233.08 | 39.86 | 0.73 |
| 52 | 27 | 33.93 | 24.33 | 206.77 | 44.89 | 0.62 |
| District 3 | | | | | | |
| 6 | 22 | 59.68 | 24.25 | 308.55 | 30.49 | 0.79 |
| 15 | 38 | 54.58 | 20.20 | 279.35 | 28.25 | 0.74 |
| 39 | 34 | 58.00 | 23.55 | 286.17 | 29.05 | 0.78 |
| 40 | 37 | 47.08 | 25.48 | 277.92 | 27.85 | 0.66 |
| 50 | 7 | 9.43 | 6.55 | 203.79 | 23.01 | 0.41 |
| District 4 | | | | | | |
| 29 | 44 | 54.25 | 19.93 | 210.08 | 36.28 | 0.37 |
| 46 | 30 | 82.17 | 13.69 | 233.58 | 28.48 | 0.55 |

Table 1.5
Prior Achievement and Classroom Achievement Correlations for Grade 7 MiC Students in Districts 1, 2, 3, and 4, in 1997-1998, by Teacher

| Teacher/ District | (N) | Spring 1997 Standardized Test National Percentile | | Spring 1998 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 8 | 30 | 46.27 | 24.43 | 254.61 | 37.22 | 0.69 |
| 44 | 43 | 51.21 | 24.00 | 248.65 | 45.19 | 0.66 |
| District 2 | | | | | | |
| 11 | 37 | 43.97 | 22.11 | 217.69 | 29.89 | 0.32 |
| 20 | 38 | 49.79 | 23.49 | 257.74 | 35.70 | 0.66 |
| 35 | 35 | 45.54 | 27.11 | 255.28 | 53.34 | 0.75 |
| 47 | 42 | 39.05 | 22.93 | 235.03 | 29.57 | 0.70 |
| District 3 | | | | | | |
| 9 | 1 | 49.00 | -- | 231.87 | -- | -- |
| 16 | 115 | 69.82 | 21.44 | 295.45 | 48.20 | 0.68 |
| District 3 | | | | | | |
| 28 | 31 | 48.39 | 27.69 | 193.61 | 49.57 | 0.78 |
| 34 | 25 | 64.04 | 27.02 | 248.86 | 42.46 | 0.85 |
| 36 | 42 | 64.38 | 23.92 | 241.15 | 44.64 | 0.55 |

Table 1.6
Prior Achievement and Classroom Achievement Correlations for Grade 6 MiC Students in Districts 1, 2, 3, and 4, in 1998-1999, by Teacher

| District/ Teacher | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|-------------------|-----|---|--------|---|--------|-------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 33 | 17 | 268.01 | 36.96 | 262.86 | 70.02 | 0.70 |
| 38 | 12 | 290.32 | 39.58 | 290.89 | 59.72 | 0.86 |
| 67 | 15 | 270.01 | 44.37 | 269.14 | 44.68 | 0.82 |
| 73 | 4 | 291.87 | 33.37 | 222.83 | 33.55 | 0.67 |
| 78 | 3 | 302.65 | 24.66 | 331.26 | 24.10 | -0.44 |
| District 2 | | | | | | |
| 52 | 1 | 298.51 | | 278.74 | | |
| 69 | 8 | 242.67 | 24.80 | 251.64 | 40.27 | 0.63 |
| 83* | 0 | | | | | |
| 85* | 0 | | | | | |
| District 3 | | | | | | |
| 6 | 32 | 265.30 | 39.64 | 287.13 | 40.35 | 0.74 |
| 15 | 31 | 277.60 | 37.93 | 284.14 | 44.05 | 0.84 |
| 40 | 28 | 263.33 | 39.18 | 286.57 | 39.45 | 0.69 |
| 50 | 1 | 211.54 | | 215.49 | | |
| District 4 | | | | | | |
| 29* | 0 | | | | | |
| 46* | 0 | | | | | |
| 65* | 0 | | | | | |

* Data not available.

Table 1.7

Prior Achievement and Classroom Achievement Correlations for Grade 7 MiC Students in Districts 1, 2, 3, and 4, in 1998-1999, by Teacher

| District/ Teacher | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|-------------------|-----|---|--------|---|--------|-------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 8 | 13 | 214.62 | 42.04 | 243.60 | 52.02 | 0.80 |
| 74 | 9 | 184.05 | 45.99 | 254.90 | 37.67 | 0.70 |
| 88 | 17 | 212.04 | 41.35 | 254.63 | 42.46 | 0.75 |
| District 2 | | | | | | |
| 45 | 10 | 267.28 | 19.83 | 271.23 | 29.11 | 0.52 |
| 62* | 0 | | | | | |
| 70 | 17 | 196.92 | 39.12 | 206.19 | 37.40 | 0.53 |
| 80* | 0 | | | | | |
| District 3 | | | | | | |
| 9 | 7 | 193.31 | 25.55 | 182.01 | 29.27 | 0.56 |
| 16 | 89 | 284.50 | 31.63 | 289.30 | 42.49 | 0.72 |
| District 4 | | | | | | |
| 28 | 11 | 206.46 | 29.39 | 213.54 | 28.59 | 0.61 |
| 36 | 11 | 240.55 | 29.53 | 278.18 | 18.29 | 0.18 |
| 81 | 17 | 221.11 | 26.87 | 231.94 | 34.37 | 0.43 |

* Data not available.

Table 1. 8

Prior Achievement and Classroom Achievement Correlations for Grade 8 MiC Students in Districts 1, 2, 3, and 4, in 1998-1999, by Teacher

| District/ Teacher | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|-------------------|-----|---|--------|---|--------|-------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 75 | 9 | 224.59 | 29.22 | 245.80 | 40.48 | 0.63 |
| 87 | 20 | 257.57 | 35.80 | 243.76 | 42.80 | 0.83 |
| District 2 | | | | | | |
| 20 | 21 | 253.60 | 29.37 | 270.06 | 23.55 | 0.65 |
| 47 | 17 | 230.18 | 32.71 | 244.00 | 22.87 | 0.67 |
| District 3 | | | | | | |
| 71 | 50 | 276.19 | 31.66 | 302.17 | 30.61 | 0.79 |
| District 4 | | | | | | |
| 66* | 0 | | | | | |
| 68 | 18 | 215.62 | 48.67 | 223.46 | 41.57 | 0.85 |
| 89 | 13 | 237.43 | 43.35 | 231.00 | 35.27 | 0.75 |

* Data not available.

Table 1.9

Classroom Achievement Gain Score Means for Grade Six, Seven, and Eight Students in Districts 1, 2, 3, and 4 in 1998-1999 by Teacher

| District 1 | | | District 2 | | | District 3 | | | District 4 | | |
|----------------------|-----|---|----------------------|-----|---|----------------------|-----|---|----------------------|-----|---|
| Grade/ Teacher ID | (N) | Classroom Achievement Gain Scores Mean | Grade/ Teacher ID | (N) | Classroom Achievement Gain Scores Mean | Grade/ Teacher ID | (N) | Classroom Achievement Gain Scores Mean | Grade/ Teacher ID | (N) | Classroom Achievement Gain Scores Mean |
| Grade 6 | | | Grade 6 | | | Grade 6 | | | Grade 6* | | |
| 33 | 17 | -5.15 | 52 | 1 | -19.77 | 6 | 32 | 21.83 | 29 | | |
| 38 | 12 | 0.56 | 69 | 8 | 8.97 | 15 | 31 | 6.54 | 46 | | |
| 67 | 15 | -0.87 | 83 | 0 | | 40 | 28 | 23.24 | 65 | | |
| 73 | 4 | -69.04 | 85 | 0 | | 50 | 1 | 3.95 | | | |
| 78 | 3 | 28.61 | | | | | | | | | |
| Grade 7 | | | Grade 7 | | | Grade 7 | | | Grade 7 | | |
| 8 | 13 | 28.98 | 45 | 10 | 3.95 | 9 | 7 | -11.29 | 28 | 11 | 7.08 |
| 74 | 9 | 70.84 | 62 | 0 | | 16 | 89 | 4.80 | 36 | 11 | 37.63 |
| 88 | 17 | 42.59 | 70 | 17 | 9.27 | | | | 81 | 17 | 10.83 |
| | | | 80 | 0 | | | | | | | |
| Grade 8 | | | Grade 8 | | | Grade 8 | | | Grade 8 | | |
| 75 | 9 | 21.21 | 20 | 21 | 16.46 | 71 | 50 | 25.98 | 66 | 0 | |
| 87 | 20 | -13.81 | 47 | 17 | 13.82 | | | | 68 | 18 | 7.84 |
| | | | | | | | | | 89 | 13 | -6.43 |

* Data notavailable.

Table 1.10
Prior Achievement and Classroom Achievement Correlations for Grade 7 MiC Students in Districts 1, 2, 3, and 4, in 1999-2000, by Teacher

| Teacher/ District | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 13 | 7 | 245.02 | 50.79 | 263.74 | 48.28 | 0.84 |
| 74 | 29 | 255.90 | 69.88 | 296.25 | 55.64 | 0.81 |
| 90 | 21 | 274.98 | 63.63 | 294.48 | 57.78 | 0.83 |
| District 2 | | | | | | |
| 52 | 14 | 211.78 | 39.13 | 230.30 | 35.57 | 0.73 |
| 69 | 25 | 289.93 | 40.62 | 288.03 | 33.28 | 0.65 |
| 94 | 13 | 222.66 | 32.37 | 239.25 | 40.84 | 0.87 |
| District 3 | | | | | | |
| 9 | 2 | 171.44 | 62.30 | 223.40 | 24.76 | 1.00 |
| 16 | 80 | 285.70 | 38.85 | 307.98 | 42.36 | 0.79 |
| District 3 | | | | | | |
| 28 | 12 | 228.62 | 42.92 | 229.47 | 56.74 | 0.87 |
| 81 | 9 | 246.55 | 39.52 | 275.86 | 29.33 | 0.69 |
| 93 | 10 | 232.43 | 33.25 | 243.39 | 36.01 | 0.23 |

Table 1.11

Prior Achievement and Classroom Achievement Correlations for Grade 8 MiC Students in Districts 1, 2, 3, and 4, in 1999-2000, by Teacher

| District/ Teacher | (N) ¹ | Spring 1999 Classroom Achievement Score | | Spring 2000 Classroom Achievement Score | | Correlation Coefficient ² | District Correlation of Mean ³ |
|-----------------------------|------------------|---|--------|---|--------|--------------------------------------|---|
| | | Mean | St Dev | Mean | St Dev | | |
| District 1 | | | | | | | 0.99 |
| 75 | 23 | 258.71 | 48.30 | 263.05 | 47.24 | 0.78 | |
| 91 | 9 | 247.18 | 36.71 | 242.73 | 43.92 | 0.77 | |
| 87 | 36 | 263.81 | 39.19 | 272.88 | 40.00 | 0.73 | |
| District 1 Students | 68 | 259.88 | 41.95 | 265.56 | 43.59 | 0.76 | |
| District 2 | | | | | | | 0.92 |
| 45 | 9 | 274.79 | 28.83 | 291.42 | 18.78 | 0.68 | |
| 62 | 10 | 259.15 | 43.68 | 282.98 | 36.67 | 0.64 | |
| 70 | 41 | 230.62 | 45.59 | 214.33 | 36.47 | 0.39 | |
| 95 | 10 | 233.00 | 36.29 | 246.84 | 33.13 | 0.63 | |
| District 2 Students | 70 | 240.71 | 44.63 | 238.69 | 46.26 | 0.56 | |
| District 4 | | | | | | | 0.83 |
| 29 | 9 | 225.72 | 31.85 | 233.12 | 40.15 | 0.62 | |
| 66 | 26 | 249.07 | 24.89 | 271.79 | 29.71 | 0.50 | |
| 89 | 14 | 245.91 | 37.78 | 245.83 | 26.50 | 0.72 | |
| District 4 Students | 49 | 243.88 | 30.91 | 257.27 | 34.36 | 0.60 | |
| District 1, 2, & 4 Students | 1874 | 248.51 | 41.17 | 253.33 | 43.84 | 0.65 | |
| Correlation of Class Means | | | | | | | 0.88 |

¹ The N in this table represents all of the students with both Spring 1999 and Spring 2000 Standardized test scores.

² These correlations are of student scores by teacher, district, and all districts.

³ These correlations are between class means within and across all districts.

⁴ Total students in Grade 8 MiC classes in 1999-2000 is 190 students. Three district 3 spec/ ed. Students are not included in this table.

Table 1.12

Classroom Achievement Gain Score Means for Grade Seven and Eight Students in Districts 1, 2, 3, and 4 in 1999-2000 by Teacher

| District 1 | | | District 2 | | | District 3 | | | District 4 | | |
|----------------------|-----|---|----------------------|-----|---|----------------------|-----|---|----------------------|-----|---|
| Grade/ Teacher ID | (N) | Classroom Achievement Gain Score Mean | Grade/ Teacher ID | (N) | Classroom Achievement Gain Score Mean | Grade/ Teacher ID | (N) | Classroom Achievement Gain Score Mean | Grade/ Teacher ID | (N) | Classroom Achievement Gain Score Mean |
| Grade 7 | | | | | | | | | | | |
| 13 | 7 | 18.72 | 52 | 14 | 18.52 | 9 | 1 | 25.41 | 28 | 12 | 0.85 |
| 74 | 29 | 40.35 | 69 | 25 | -1.90 | 16 | 80 | 22.28 | 81 | 9 | 29.30 |
| 90 | 21 | 19.50 | 94 | 13 | 16.59 | | | | 93 | 10 | 10.96 |
| Grade 8 | | | | | | | | | | | |
| 75 | 23 | 4.35 | 45 | 10 | 16.63 | na* | | | 29 | 9 | 7.40 |
| 91 | 9 | -4.46 | 62 | 41 | 23.83 | | | | 66 | 26 | 22.72 |
| 87 | 36 | 9.07 | 70 | 41 | -16.28 | | | | 89 | 14 | -0.08 |
| | | | 95 | 10 | 13.84 | | | | | | |

8 Three District 3 spec. ed. students are not included in this table.

Table 1.13
*Classroom Assessment Gain Scores in All Districts, Grade 6, in Districts 1, 2, 3, and 4, in 1998-1999, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|-----|--------|-------|
| Overall | 152 | 8.71 | 35.31 |
| Male | 73 | 8.24 | 35.13 |
| Female | 79 | 9.14 | 35.68 |
| White | 113 | 15.24 | 32.29 |
| Afr-American | 9 | -33.70 | 40.98 |
| Hispanic | 8 | 2.33 | 25.86 |
| Other | 22 | -5.19 | 36.34 |
| Number | 152 | 1.84 | 38.79 |
| Algebra | 152 | 8.72 | 60.65 |
| Geometry | 152 | 12.06 | 54.55 |
| Statistics | 152 | 12.33 | 46.34 |

* The N in this table represents all of the Grade 6 students in 1998-1999 with both 1998 and 1999 Classroom Assessment test scores.

Table 1.14
*Classroom Assessment Gain Scores in All Districts, Grade 7, in
 Districts 1, 2, 3, and 4, in 1998-1999, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|-----|-------|-------|
| Overall | 201 | 14.73 | 34.95 |
| Male | 91 | 10.56 | 36.40 |
| Female | 110 | 18.17 | 33.48 |
| White | 122 | 13.28 | 35.00 |
| Afr-American | 32 | 21.46 | 36.81 |
| Hispanic | 22 | 14.27 | 35.84 |
| Other | 25 | 13.58 | 32.52 |
| Number | 201 | 14.17 | 42.00 |
| Algebra | 201 | 8.92 | 51.23 |
| Geometry | 201 | 8.96 | 48.14 |
| Statistics | 201 | 13.56 | 46.26 |

* The N in this table represents all of the Grade 7 students in 1998-1999 with both 1998 and 1999 Classroom Assessment test scores.

Table 1.15
*Classroom Assessment Gain Scores in All Districts, Grade 8, in
 Districts 1, 2, 3, and 4, in 1998-1999, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|-----|-------|-------|
| Overall | 148 | 12.51 | 27.13 |
| Male | 70 | 10.61 | 25.28 |
| Female | 78 | 14.22 | 28.74 |
| White | 74 | 17.10 | 25.62 |
| Afr-American | 14 | 8.59 | 20.94 |
| Hispanic | 23 | 2.28 | 33.79 |
| Other | 37 | 11.19 | 26.46 |
| Number | 148 | 13.76 | 43.65 |
| Algebra | 148 | 4.02 | 40.12 |
| Geometry | 148 | 7.99 | 39.97 |
| Statistics | 148 | 21.50 | 47.40 |

* The N in this table represents all of the Grade 8 students in 1998-1999 with both 1998 and 1999 Classroom Assessment test scores.

Table 1.16
*Classroom Assessment Gain Scores in All Districts, Grade 7, in
 Districts 1, 2, 3, and 4, in 1999-2000, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|-----|-------|-------|
| Overall | 222 | 19.86 | 32.79 |
| Male | 97 | 22.74 | 32.37 |
| Female | 125 | 17.62 | 33.07 |
| White | 110 | 23.28 | 28.81 |
| Afr-American | 33 | 19.49 | 37.64 |
| Hispanic | 23 | 1.67 | 33.27 |
| Other | 56 | 20.81 | 35.29 |
| Number | 222 | 22.74 | 40.18 |
| Algebra | 222 | 5.64 | 46.20 |
| Geometry | 222 | 17.51 | 47.62 |
| Statistics | 222 | 15.75 | 51.82 |

* The N in this table represents all of the Grade 7 students in 1999-2000 with both 1999 and 2000 Classroom Assessment test scores.

Table 1.17
*Classroom Assessment Gain Scores in All Districts, Grade 8, in
 Districts 1, 2, 3, and 4, in 1999-2000, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|-----|-------|-------|
| Overall | 190 | 5.22 | 35.54 |
| Male | 83 | 0.76 | 39.79 |
| Female | 107 | 8.68 | 31.61 |
| White | 58 | 2.00 | 39.87 |
| Afr-American | 52 | 9.49 | 36.44 |
| Hispanic | 37 | -1.01 | 33.17 |
| Other | 43 | 9.77 | 29.63 |
| Number | 190 | 10.35 | 46.14 |
| Algebra | 190 | -4.62 | 55.55 |
| Geometry | 190 | 2.82 | 48.73 |
| Statistics | 190 | 11.18 | 43.06 |

* The N in this table represents all of the Grade 8 students in 1999-2000 with both 1999 and 2000 Classroom Assessment test scores.

Conventional Classrooms

Table 2.1
Overall Classroom Achievement Gain Scores in Conventional Classrooms for the Eight Grade-Level-by-Year Studies in Districts 1 and 2, in 1997-1998, 1998-1999 and 1999-2000

| Year | Grade | (N) | Prior Achievement* | Classroom Achievement | Classroom Achievement Gain Scores** |
|--------|---------|-----|--------------------|-----------------------|-------------------------------------|
| Year 1 | | | | | |
| | Grade 5 | 84 | 78.06 | 277.08 | |
| | Grade 6 | 86 | 44.81 | 230.80 | |
| | Grade 7 | 87 | 46.48 | 236.06 | |
| Year 2 | | | | | |
| | Grade 6 | 17 | 273.46 | 283.69 | 10.23 |
| | Grade 7 | 21 | 229.85 | 232.73 | 2.88 |
| | Grade 8 | 35 | 238.74 | 227.84 | -10.91 |
| Year 3 | | | | | |
| | Grade 7 | 16 | 283.08 | 275.11 | -7.98 |
| | Grade 8 | 28 | 265.90 | 248.85 | -17.04 |

* The prior achievement score for Year 1 is the standardized test national percentile from the previous Spring (1997). The prior achievement scores for Years 2 and 3 are the classroom achievement scores from previous spring (Spring 1998 for Year 2 and Spring 1999 for Year 3).

** The classroom achievement gain score cannot be calculated for Year 1 because two different measures were used.

Table 2.2
*Classroom Achievement Gain Scores for Grade Six, Seven, and Eight Students in 1998-1999
 and Grade Seven and Eight Students in 1999-2000, by District*

| District | Classroom Achievement Gain Scores | | | | | |
|------------------|-----------------------------------|--------|---------|--------|---------|--------|
| | Grade 6 | | Grade 7 | | Grade 8 | |
| | (N) | Mean | (N) | Mean | (N) | Mean |
| 1998-1999 | | | | | | |
| District 1 | 1 | -27.67 | 20 | 2.85 | 29 | -12.70 |
| District 2 | 16 | 12.60 | 1 | 3.39 | 6 | -2.26 |
| 1999-2000 | | | | | | |
| District 1 | | | 3 | 39.16 | 28 | -17.04 |
| District 2 | | | 13 | -18.85 | (none) | |

Table 2.3
Prior Achievement and Classroom Achievement Correlations for Grade 5 Conventional Students in 1997-1998, by Teacher

| Teacher/ District | (N) | Spring 1997 Standardized Test National Percentile | | Spring 1998 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 17 | 20 | 74.10 | 20.17 | 275.27 | 29.47 | 0.71 |
| 42 | 28 | 82.43 | 13.81 | 285.84 | 28.14 | 0.61 |
| District 2 | | | | | | |
| 43 | 36 | 76.86 | 21.31 | 271.26 | 42.01 | 0.59 |

Table 2.4
Prior Achievement and Classroom Achievement Correlations for Grade 6 Conventional Students in 1997-1998, by Teacher

| Teacher/ District | (N) | Spring 1997 Standardized Test National Percentile | | Spring 1998 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 18 | 10 | 43.00 | 30.87 | 220.12 | 42.63 | 0.59 |
| 32 | 37 | 37.95 | 17.15 | 257.02 | 28.83 | 0.66 |
| District 2 | | | | | | |
| 10 | 21 | 37.14 | 26.80 | 193.14 | 41.55 | 0.73 |
| 21 | 18 | 68.89 | 17.48 | 226.76 | 36.99 | 0.54 |

Table 2.5
*Prior Achievement and Classroom Achievement Correlations for Grade 7 Conventional Students
in 1997-1998, by Teacher*

| Teacher/ District | (N) | Spring 1997 Standardized Test National Percentile | | Spring 1998 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 13 | 33 | 63.42 | 22.19 | 264.98 | 41.36 | 0.68 |
| 53 | 35 | 40.83 | 20.51 | 230.39 | 33.17 | 0.62 |
| District 2 | | | | | | |
| 5 | 19 | 27.47 | 20.13 | 196.29 | 36.62 | 0.12 |
| 24 | 0 | | | | | |

Table 2.6
Prior Achievement and Classroom Achievement Correlations for Grade 6 Conventional Students in 1998-1999, by Teacher

| Teacher/ District | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 79 | 1 | 243.16 | | 215.49 | | |
| District 2 | | | | | | |
| 21 | 0 | | | | | |
| 82 | 16 | 275.36 | 43.84 | 287.96 | 36.20 | 0.57 |

Table 2.7
Prior Achievement and Classroom Achievement Correlations for Grade 7 Conventional Students in 1998-1999, by Teacher

| Teacher/ District | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 13 | 3 | 257.28 | 13.35 | 272.72 | 21.54 | 0.99 |
| 76 | 12 | 244.81 | 30.70 | 222.69 | 32.08 | 0.62 |
| 77 | 5 | 180.93 | 61.63 | 236.16 | 40.59 | 0.93 |
| District 2 | | | | | | |
| 5 | 1 | 212.67 | | 180.93 | | |

Table 2.8
Prior Achievement and Classroom Achievement Correlations for Grade 8 Conventional Students in 1998-1999, by Teacher

| Teacher/ District | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 | | | | | | |
| 60 | 9 | 205.58 | 36.62 | 190.77 | 35.54 | 0.19 |
| 86 | 20 | 268.35 | 46.28 | 256.61 | 35.41 | 0.40 |
| District 2 | | | | | | |
| 5 | 6 | 189.80 | 43.45 | 187.54 | 7.14 | 0.48 |
| 24 | 0 | | | | | |

Table 2.9
Classroom Achievement Gain Score Means for 1999-2000 Grade 7 Conventional Students in Districts 1 and 2, by Teacher

| Teacher/ District | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 77 | 3 | 200.81 | 13.16 | 239.96 | 51.52 | 0.71 |
| District 2 82 | 13 | 302.07 | 43.37 | 283.22 | 51.87 | |

Table 2.10
Classroom Achievement Gain Score Means for 1999-2000 Grade 8 Conventional Students in Districts 1 and 2, by Teacher

| Teacher/ District | (N) | Spring 1998 Classroom Achievement Score | | Spring 1999 Classroom Achievement Score | | Correlation Coefficient |
|----------------------|-----|--|--------|--|--------|----------------------------|
| | | Mean | St Dev | Mean | St Dev | |
| District 1 86 | 27 | 267.16 | 33.16 | 248.69 | 29.29 | 0.58 |
| 92 | 1 | 231.87 | | 253.33 | | |
| District 2 (none) | | | | | | |

Table 2.11
*Classroom Assessment Gain Scores in Conventional Classrooms in All Districts, Grade 6, in Districts 1 and 2, in 1998-1999, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|----|--------|-------|
| Overall | 17 | 10.23 | 37.68 |
| Male | 6 | 12.33 | 53.40 |
| Female | 11 | 9.09 | 29.02 |
| White | 6 | 3.01 | 23.65 |
| Afr-American | 1 | 106.17 | - |
| Hispanic | 5 | 6.78 | 44.31 |
| Other | 5 | 3.16 | 23.67 |
| Number | 17 | -9.71 | 35.85 |
| Algebra | 17 | 3.53 | 42.66 |
| Geometry | 17 | 23.33 | 63.63 |
| Statistics | 17 | 28.03 | 50.73 |

* The N in this table represents all of the Grade 6 students in 1998-1999 with both 1998 and 1999 Classroom Assessment test scores.

Table 2.12
*Classroom Assessment Gain Scores in Conventional Classrooms in All Districts, Grade 7, in Districts 1 and 2, in 1998-1999, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|----|--------|-------|
| Overall | 21 | 2.88 | 40.77 |
| Male | 12 | -3.72 | 42.60 |
| Female | 9 | 11.67 | 38.83 |
| White | 10 | 9.49 | 35.05 |
| Afr-American | 7 | -9.28 | 52.31 |
| Hispanic | 2 | 20.33 | 20.77 |
| Other | 2 | -5.08 | 55.91 |
| Number | 21 | 24.52 | 56.78 |
| Algebra | 21 | -15.68 | 67.11 |
| Geometry | 21 | -5.22 | 64.17 |
| Statistics | 21 | -2.27 | 36.16 |

* The N in this table represents all of the Grade 7 students in 1998-1999 with both 1998 and 1999 Classroom Assessment test scores.

Table 2.13
*Classroom Assessment Gain Scores in Conventional Classrooms in All Districts, Grade 8, in Districts 1 and 2, in 1998-1999, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|----|--------|-------|
| Overall | 35 | -10.91 | 44.16 |
| Male | 13 | -1.13 | 50.82 |
| Female | 22 | -16.69 | 39.85 |
| White | 18 | -13.46 | 48.11 |
| Afr-American | 10 | -3.61 | 44.03 |
| Hispanic | 5 | -14.12 | 44.78 |
| Other | 2 | -16.38 | 27.15 |
| Number | 35 | -0.25 | 71.02 |
| Algebra | 35 | -20.02 | 50.93 |
| Geometry | 35 | 0.93 | 56.11 |
| Statistics | 35 | -16.18 | 43.32 |

* The N in this table represents all of the Grade 8 students in 1998-1999 with both 1998 and 1999 Classroom Assessment test scores.

Table 2.14
*Classroom Assessment Gain Scores in Conventional Classrooms in All Districts, Grade 7, in Districts 1 and 2, in 1999-2000, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|----|--------|-------|
| Overall | 16 | -7.98 | 43.45 |
| Male | 4 | 5.65 | 50.39 |
| Female | 12 | -12.52 | 42.34 |
| White | 8 | 13.48 | 40.95 |
| Afr-American | 0 | | |
| Hispanic | 4 | -24.57 | 36.41 |
| Other | 4 | -34.31 | 41.03 |
| Number | 16 | -1.79 | 47.18 |
| Algebra | 16 | -16.05 | 34.37 |
| Geometry | 16 | 10.63 | 47.90 |
| Statistics | 16 | -16.88 | 64.97 |

* The N in this table represents all of the Grade 7 students in 1999-2000 with both 1999 and 2000 Classroom Assessment test scores.

Table 2.15
*Classroom Assessment Gain Scores in Conventional Classrooms in All Districts, Grade 8, in Districts 1 and 2, in 1999-2000, by Gender and by Ethnic Group**

| | N | Mean | SD |
|--------------|----|--------|-------|
| Overall | 28 | -17.04 | 29.34 |
| Male | 11 | -20.13 | 29.54 |
| Female | 17 | -15.05 | 29.94 |
| White | 25 | -19.43 | 30.16 |
| Afr-American | 0 | | |
| Hispanic | 0 | | |
| Other | 3 | 2.82 | 6.87 |
| Number | 28 | -4.05 | 39.17 |
| Algebra | 28 | -55.90 | 48.32 |
| Geometry | 28 | -12.78 | 44.79 |
| Statistics | 28 | 1.28 | 33.12 |

* The N in this table represents all of the Grade 8 students in 1999-2000 with both 1999 and 2000 Classroom Assessment test scores.

Appendix A

The purposes of the longitudinal/cross-sectional study of the impact of *Mathematics in Context* (MiC) on student performance were (a) to determine the mathematical knowledge, understanding, attitudes, and levels of student performance as a consequence of studying MiC for over three years; and (b) to compare student knowledge, understanding, attitudes, and levels of performance of students using MiC with those using conventional mathematics curricula. The research model for this study was an adaptation of a structural model for monitoring changes in school mathematics (Romberg, 1987, described in Chapter 2). The outcome variables for this model are - knowledge and understanding, and application. For analytic purposes we assumed that variation in classroom achievement based on the measures developed for these variables can be captured in progress maps for classroom achievement.

There were three questions that the study was designed to answer:

1. What is the impact of the MiC instructional approach on student performance?
2. How is this impact different from that of traditional instruction on students performance?
3. What variables associated with classroom instruction account for variation in student performance?

To answer these questions an analysis plan involving seven steps has been planned.

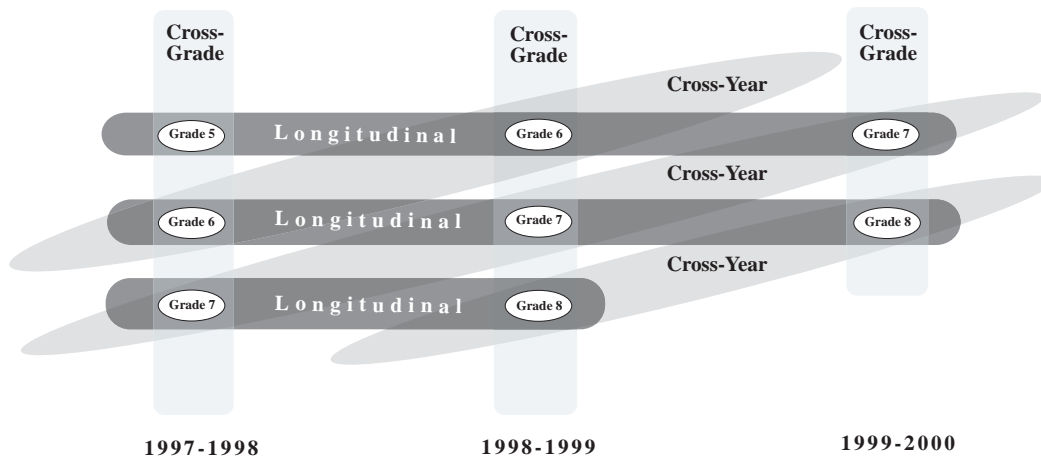
Step One: Creating an Overall Progress Map

The dependent variable used to answer each of the questions is an index of “Classroom Achievement (CA)” derived from data from student responses to eight tests {four External Assessments (EA) based on NAEP and TIMSS items, and four Problem Solving Assessments (PSA) developed by the staff of the Freudenthal Institute.

One form of each test was given to students at each of the grades 5, 6, 7 and 8. From the raw scores on these tests the CA index was derived by the research team at the Australian Council for Educational Research (ACER) using “Rasch measurement models” that allow one to combine information from different tests administered at different times onto a single scale. The product of this step is a single CA scale.

Step Two: Answering Question #1 – Grade-Level-by-Year

As shown in Figure 1, the overall study involves seventeen studies: eight grade-level-by year studies that can be related for cross-sectional comparisons, three cross-grade studies, three cross-year studies, and three longitudinal comparisons.



To answer “Question 1” the CA index was used to examine the performance of all MiC students in the four sites at each grade level (the eight grade-level-by-year descriptions of performance of all MiC students). Comparisons of performance on CA then was derived for the different sites, classes, teachers, gender of students, ethnicity of students, etc.

Step Three: Answering Question #1 – Cross-Grade, Cross-Year

From the analyses done in Step Two we made the three cross-grade comparisons, and the three cross-year cross-sectional studies indicated in Figure 1. These comparisons yield pictures of general student progress in performance as a consequence of instruction using MiC.

Step Four: Answering Question #1 – Longitudinally

Next we examined the three longitudinal descriptions also shown in Figure 1. However, since the student data-base must be restricted to those MiC students that participated in two or three years of the study (study transiency was high), several cohorts of students examined over the two (or three) years with respect to the overall index (CA).

Step Five: Answering Question #2

To answer Question 2 only the MiC data from the two sites where similar data from students in classes using conventional instructional materials was gathered. The comparisons were with respect to the eight grade-level-by-year studies, followed by the cross-grade, cross-year, and longitudinal comparisons.

Step Six: Answering Question #3 – Creating Composite Indices

Data for both MiC and conventional students at the two sites were used to examine the relationship between variation in classroom achievement (CA), aggregated by strand, test, or total performance can be attributed to variations in opportunity to learn with understanding (OTL_u), preceding achievement (PA), method of instruction (I), and school context (SC).

Step Seven: Answering Question #3 – Analyses

Since indices for each of these composite variables was constructed three different analyses were planned. First, for the grade-level-by-year studies we compared similar groups of students on CA. Second, linear regression was used to examine this relationship for the eight grade-level-by-year studies. Third, since the composite variables were constructed from several sources that reflect the original 14 variables structural model, we calculated path coefficients relating most of the variables in the model using structural equations.