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

Standardized Test Data for
Mathematics in Context Longitudinal Cohorts in 1997-2000
(Technical Report #51)

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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.)

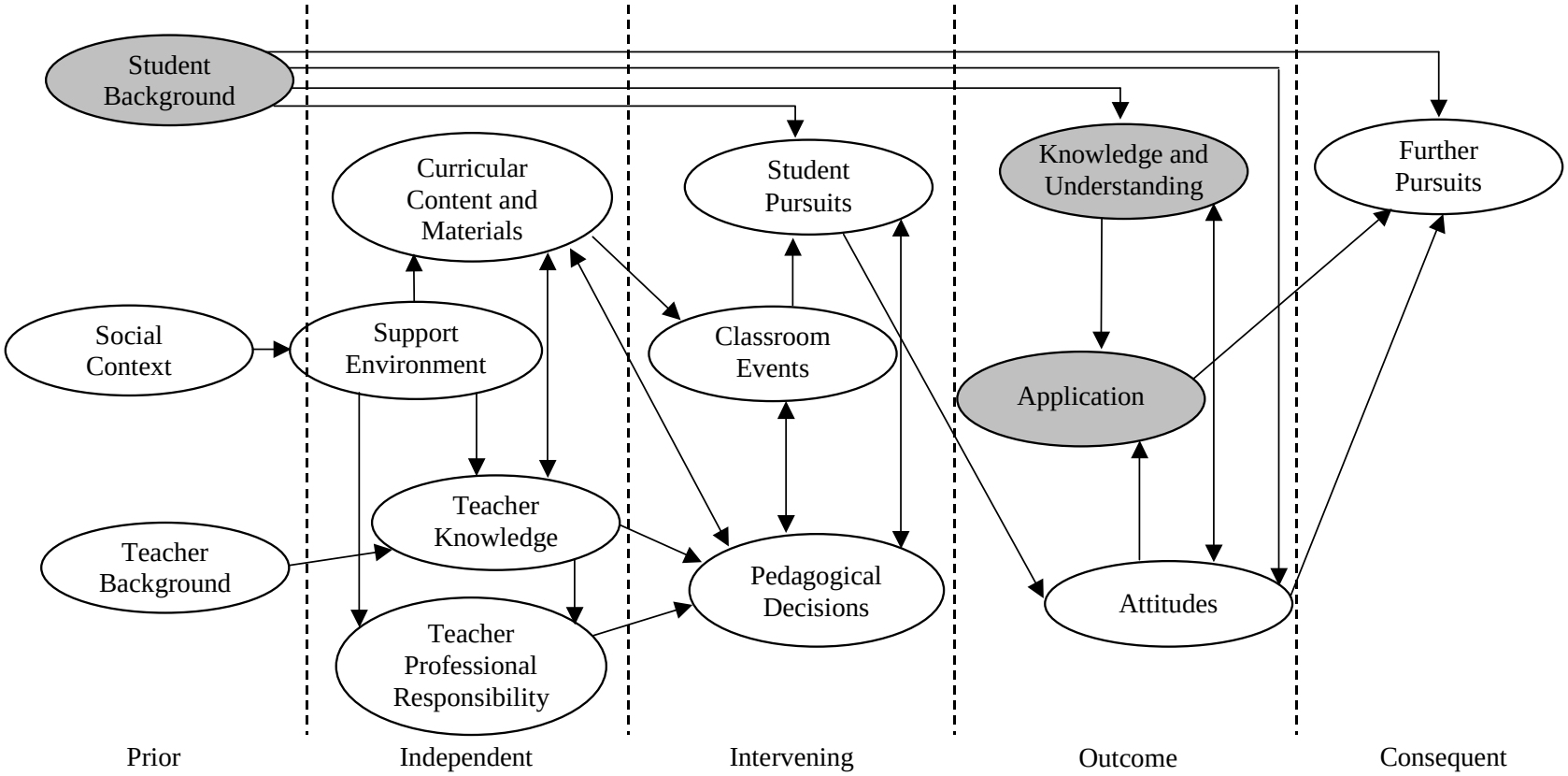


Figure 1. Revised model for the monitoring of school mathematics.

Overview

The *Collis–Romberg Mathematical Problem Solving Profiles* is a set of mathematical superitems designed to provide information about students' qualitatively different levels of reasoning ability. A "superitem" is a set of test questions based on a common situation or stem (Cureton, 1965). The test used in this study contains five mathematical problem solving situations and four questions for each situation which were based on Collis and Biggs' (1979) SOLO taxonomy used to classify the structure of observed learning outcomes.

Collis and Biggs outlined the theory based on the reasoning and judgment a student displays in using existing knowledge. Most psychologists agree that, when an individual learns something, he or she interprets it in terms of his or her existing thought structures. These structures are modified and extended according to the demands placed upon the learner. By so modifying his or her thought structure, the individual constructs an increasingly complex system of rules of thinking: some rules are general, applying to a variety of situations, while others are specific to the subject matter learned. While this process is continuous from infancy to adulthood, certain general stages of cognitive development have been distinguished. The five stages of Collis and Biggs used to describe the stages in children's judgment and reasoning ability are:

- pre-operational stage (5 to 6 years);
- early concrete operational stage (7 to 9 years);
- middle concrete operational stage (10 to 12 years);
- concrete generalization stage (13 to 15 years); and
- formal operational stage (16 years onward).

The development from pre-operational to formal operational runs the gamut from the judgment of a situation made on the basis of superficial appearances to one based on highly abstract principles.

Piaget observed his stages of cognitive development under rather "ideal" conditions involving individual testing on quite clear-cut tasks involving general logical concepts. His stages, therefore, tend to outline the *upper limit* of intellectual functioning. However, when performance in school subjects that require specific knowledge is considered, a different picture emerges (Collis & Biggs, 1979, p. 13). These authors argued that the response a student makes to a typical school task is more complex. In fact, only under ideal conditions could the level of response to such tasks be equivalent to the student's stage of cognitive development. The level of response most often is much lower for a variety of reasons such as lack of knowledge of prerequisites and lack of interest in the subject. Furthermore, they argued that when confronted with new or unfamiliar content, an individual's initial reasoning about that content will be several stages lower than would be demonstrated with familiar content.

Based on this reasoning, Collis and Biggs proposed a way of describing responses to typical school tasks, those tasks for which a student is given a specific, finite set of information (a story, a problem in mathematics, a set of data describing and examining a concept or principle, a poem) and, on the basis of prior learning, students answer comprehensive questions to show that the data, their interrelationships, and their possible relevance to other concepts were understood. Collis and Biggs chose to call this analysis the

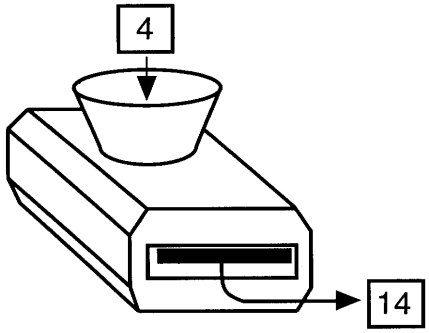
structure of the observed learning outcome (SOLO) to emphasize that the responses a student makes to school content reflect more than level of cognitive development.

The development of the *Collis-Romberg Profiles* (Romberg, Collis, Donovan, Buchanan, & Romberg, 1982) used the SOLO framework to create a series of questions for a variety of problem situations. Each question was designed to require more and more sophisticated use of the information from the stem in order to obtain a correct result. This increase in sophistication should parallel the increasing complexity of structure noted in the SOLO categories, so that a correct response to each question would be indicative of an ability to respond to the information in the stem at least at the level reflected in the SOLO structure of the particular question. For each category the question was as follows:

- Uni-structural (U): Use of *one obvious* piece of information coming directly from the stem.
- Multi-structural (M): Use of two or more discrete closures directly related to *separate pieces* of information contained in the stem.
- Relational (R): Use of two or more closures directly related to an integrated understanding of the information in the stem.
- Extended Abstract (E): Use of an abstract general principle or hypothesis, which is derived from or suggested by the information in the stem.

In each superitem, the correct achievement of question 1 would indicate an ability to respond to the problem concerned at least the uni-structural level. Likewise, success on question 2 corresponds to an ability to respond at multi-structural level, and so on. An example of items constructed in this manner is shown in Figure 3-3. The stem provides information and each question that follows requires the student to reason at a different level in order to produce a correct response.

This is a machine that changes numbers. It adds the number you put in three times and then adds 2 more. So if you put in 4, it puts out 14.



U If 14 is put out, what number was put in?

M If we put in a 5, what number will the machine put out?

R If we got out a 41, what number was put in?

E If x is the number that comes out of the machine when the number y is put in, write down a formula that will give us the value of y whatever the value of x.

Figure 2. Example of a superitem written to reflect the SOLO taxonomy.

The structure of the SOLO taxonomy assumes a latent hierarchical and cumulative cognitive dimension. Consequently, the response structure associated with any level of reasoning determines the response structure associated with all lower levels, in the sense that the presence of one response structure implies the presence of all lower response structures. The five expected response patterns for each of the superitems are shown in Table 1.

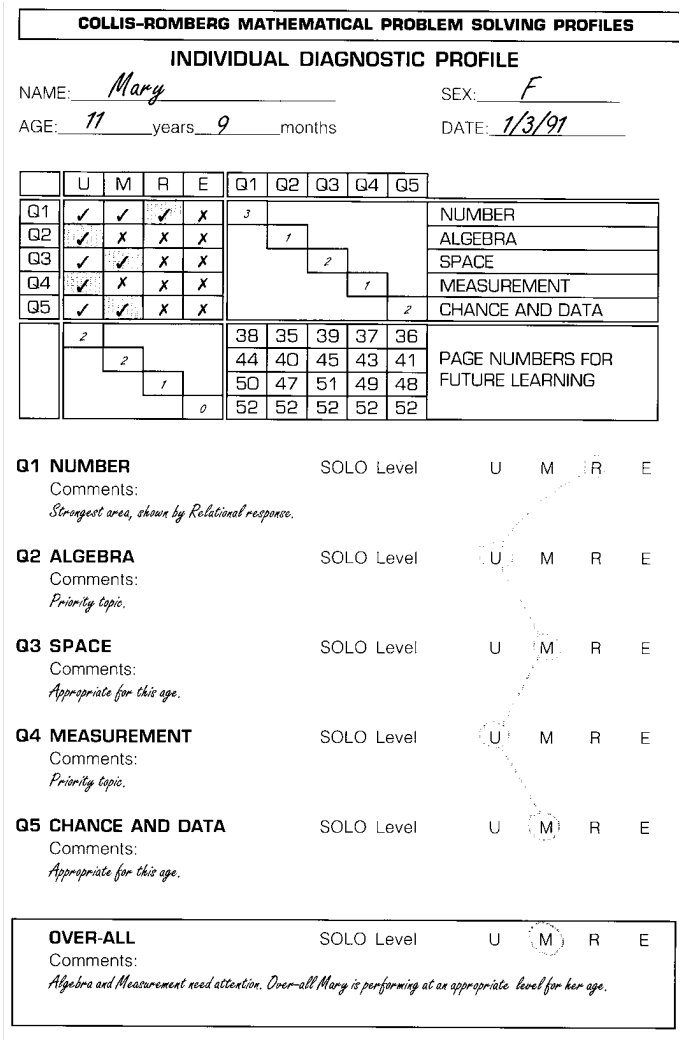
Table 1.
Response Patterns for a SOLO Superitem

Response Pattern	SOLO Response Level			
	U	M	R	E
Pre-Structural	0	0	0	0
Uni-Structural	1	0	0	0
Multi-Structural	1	1	0	0
Relational	1	1	1	0
Extended Abstract	1	1	1	1

The aggregated scores of students on superitems corresponding to the four levels of reasoning in the SOLO taxonomy provide a basis for a possible natural arrangement of subjects into homogeneous groups. Note: If students are unable to answer questions at the uni-structural level, they are labeled as pre-structural. If a student is at a particular base stage of development, one would expect the average response pattern across several superitems to reflect that base stage of development. It would not be expected that the response patterns would be identical for every superitem since knowledge of prerequisites, familiarity, procedural errors, and so on are also operative. Furthermore, for a large number of students at any age level, one would expect that groups of students with similar response patterns for a set of items could be identified. It is plausible that the profiles of response patterns for the groups can be interpreted in terms of the SOLO taxonomy. The profiles which would be interpretable are based on the notions of equilibrations which involve "formation instability combined with a progressive movement toward stability" (Langer, 1969, p. 93). Cognitive development is seen as "spiral" and, in particular, it is assumed that "to go forward it is necessary to go backward: the first step toward progress is regress" (Langer, 1969, p. 95).

Two studies were carried out to examine the validity of the *Collis–Romberg Mathematical Problem Solving Profiles.* The first judged whether the response patterns of students to the superitems were interpretable (Collis, Romberg, and Jurdak, 1986). These authors concluded that the data strongly support the validity of the underlying theoretical constructs. The second study used a statistical procedure (Masters and Wilson, 1988) for a partial credit IRT model of developmental change in understanding, to examine the response patterns to each item (Wilson, 1992). The results "included a 'map' of the variable representing progress through the SOLO levels that allows one to give a criterion-referenced interpretation of a given student's mathematical understanding with respect to the SOLO levels and the items that were used to elicit performance" (p. 240).

For this study, we developed a profile for every student based on their responses to the questions on the *Collis-Romberg Profiles* instrument. Since the instrument was developed for diagnostic purposes, responses for each of the five superitems are coded in terms of correct (✓) or incorrect (X), the number of correct answers to each superitem, and a visual profile created with comments (see Figure 2).



COLLIS-ROMBERG MATHEMATICAL PROBLEM SOLVING PROFILES

INDIVIDUAL DIAGNOSTIC PROFILE

NAME: Mary SEX: F

AGE: 11 years 9 months DATE: 1/3/91

	U	M	R	E	Q1	Q2	Q3	Q4	Q5	
Q1	✓	✓	✓	X	3					NUMBER
Q2	✓	X	X	X		1				ALGEBRA
Q3	✓	✓	X	X			2			SPACE
Q4	✓	X	X	X				1		MEASUREMENT
Q5	✓	✓	X	X					2	CHANCE AND DATA
	2				38	35	39	37	36	PAGE NUMBERS FOR FUTURE LEARNING
		2			44	40	45	43	41	
			1		50	47	51	49	48	
				0	52	52	52	52	52	

Q1 NUMBER SOLO Level U M R E
Comments:
Strongest area, shown by Relational response.

Q2 ALGEBRA SOLO Level U M R E
Comments:
Priority topic.

Q3 SPACE SOLO Level U M R E
Comments:
Appropriate for this age.

Q4 MEASUREMENT SOLO Level U M R E
Comments:
Priority topic.

Q5 CHANCE AND DATA SOLO Level U M R E
Comments:
Appropriate for this age.

OVER-ALL SOLO Level U M R E
Comments:
Algebra and Measurement need attention. Over-all Mary is performing at an appropriate level for her age.

Figure 2. Sample individual diagnostic profile.

For the purposes of reporting, an aggregate SOLO level for each student was created (the overall level for a student whose pseudonym is Mary in Figure 2). The highest level that the student replicated in three categories was used. For example, Mary answered three questions correctly at the multi-structural level, so her profile was labeled multi-structural.

An overall level of response was found for each student. The number of students at each level for each teacher was determined and reported as a percentage. The results, in turn, were aggregated for the MiC and conventional students and for the total number of students in that district at a particular grade.

The *Collis-Romberg Profiles* were used as a pre-test (Profile A) in each year, and in the final spring of each student's participation (Profile B) was administered as a post-test in the study.

Collis-Romberg Profile A

Fall 1997

District 1

Table 1.1
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 5, District 1 in 1997

School-Class *(N)*	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Banneker-Greene 1 (22)	19	26%	53%	21%	0%	0%
Beethoven-Kipling 1 (26)	24	33%	50%	17%	0%	0%
Beethoven-LaSalle 1 (33)	32	6%	53%	38%	3%	0%
Beethoven-Linne 1 (13)	13	46%	54%	0%	0%	0%
Dewey-Hamilton 1 (21)	20	30%	60%	10%	0%	0%
Dewey-Mitchell 1 (18)	18	6%	72%	22%	0%	0%
Dewey-Mitchell 2 (19)	18	6%	94%	0%	0%	0%
Dewey-Mitchell 3 (18)	18	44%	56%	0%	0%	0%
			—Conventional—			
Dewey-Kershaw 1 (24)	21	14%	57%	29%	0%	0%
River Forest-Fulton 1 (31)	30	0%	60%	37%	3%	0%

Table 1.2

Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 6, District 1 in 1997

School-Class *(N)*	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Fernwood-Lee/Weatherspoon 1 (28)	26	27%	58%	15%	0%	0%
Fernwood-Lee/Weatherspoon 2 (28)	26	23%	62%	15%	0%	0%
Fernwood-Lee/Weatherspoon 3 (25)	25	24%	64%	4%	8%	0%
VonHumboldt-Brown 1 (23)	12	25%	58%	17%	0%	0%
VonHumboldt-Brown 2 (19)	14	64%	36%	0%	0%	0%
VonHumboldt-Brown 3 (29)	28	32%	64%	4%	0%	0%
VonHumboldt-Harvey 1 (28)	25	32%	64%	4%	0%	0%
VonHumboldt-Harvey 2 (26)	20	40%	50%	10%	0%	0%
VonHumboldt-Harvey 3 (31)	27	33%	67%	0%	0%	0%
			—Conventional—			
Addams-Tallackson 1 (20)	18	56%	28%	17%	0%	0%
Wacker-Krittendon 1 (26)	24	46%	54%	0%	0%	0%
Wacker-Krittendon 2 (23)	21	57%	38%	5%	0%	0%
Wacker-Krittendon 3 (22)	20	35%	50%	15%	0%	0%

Table 1.3

Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 1 in 1997

School-Teacher *(N)*	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Fernwood-Heath 1 (30)	26	35%	62%	4%	0%	0%
Fernwood-Heath 2 (23)	22	14%	59%	23%	5%	0%
VonHumboldt-Donnely 1 (25)	23	26%	48%	17%	9%	0%
VonHumboldt-Donnely 2 (23)	20	10%	80%	10%	0%	0%
VonHumboldt-Donnely 3 (23)	21	29%	62%	5%	5%	0%
			—Conventional—			
Addams-St.James 1 (20)	20	0%	60%	35%	5%	0%
Addams-St.James 2 (19)	19	11%	68%	21%	0%	0%
Wacker-McLaughlin 1 (24)	21	29%	67%	0%	5%	0%
Wacker-McLaughlin 2 (16)	15	60%	33%	7%	0%	0%
Wacker-McLaughlin 3 (16)	15	47%	40%	13%	0%	0%

District 2

Table 1.4
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 5, District 2 in 1997

School-Class *(N)*	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Armstrong-Murphy 1 (34)	32	9%	78%	13%	0%	0%
Armstrong-Nash 1 (29)	23	0%	96%	4%	0%	0%
Ogden-Fiske 1 (30)	30	57%	37%	7%	0%	0%
Ogden-Fiske 2 (24)	21	57%	38%	5%	0%	0%
Ogden-Piccolo 1 (27)	26	42%	50%	8%	0%	0%
Ogden-Piccolo 2 (23)	22	45%	50%	5%	0%	0%
Ogden-Piccolo 3 (25)	25	24%	64%	12%	0%	0%
			—Conventional—			
VonSteuben-Gant 1 (38)	24	33%	54%	13%	0%	0%
VonSteuben-Gant 2 (37)	31	32%	65%	3%	0%	0%

Table 1.5

Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 6, District 2 in 1997

School-Class *(N)*	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Guggenheim-Broughton 1 (26)	22	32%	68%	0%	0%	0%
Guggenheim-Broughton 2 (14)	11	55%	45%	0%	0%	0%
Guggenheim-Dillard 1 (27)	18	39%	44%	17%	0%	0%
Guggenheim-Dillard 2 (16)	13	38%	62%	0%	0%	0%
HirschMetro-Davenport 1 (22)	22	23%	68%	9%	0%	0%
HirschMetro-Davenport 2 (26)	26	54%	42%	4%	0%	0%
HirschMetro-Holland 1 (27)	27	30%	63%	7%	0%	0%
HirschMetro-Holland 2 (27)	24	13%	67%	21%	0%	0%
			—Conventional—			
Newberry-Renlund 1 (29)	26	23%	46%	27%	4%	0%
Newberry-Rhaney 1 (37)	17	71%	24%	6%	0%	0%

Table 1.6

Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 2 in 1997

School-Teacher *(N)*	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Guggenheim-Keeton 1 (27)	25	20%	64%	16%	0%	0%
Guggenheim-Keeton 2 (24)	24	17%	79%	0%	4%	0%
Guggenheim-Teague 1 (27)	26	27%	73%	0%	0%	0%
Guggenheim-Teague 2 (25)	24	33%	63%	4%	0%	0%
HirschMetro-Draski 1 (26)	22	27%	59%	14%	0%	0%
HirschMetro-Draski 2 (25)	18	33%	61%	6%	0%	0%
HirschMetro-McFadden 1 (23)	22	27%	64%	9%	0%	0%
HirschMetro-McFadden 2 (30)	25	24%	76%	0%	0%	0%
			—Conventional—			
Newberry-Cunningham 1 (15)	13	38%	62%	0%	0%	0%
Newberry-Cunningham 2 (23)	18	50%	50%	0%	0%	0%
Newberry-Stark 1 (26)	16	19%	69%	13%	0%	0%

District 3

Table 1.7
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 5, District 3 in 1997

School-Class *(N)*	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Taft-Allen 1 (19)	19	26%	68%	5%	0%	0%
Taft-Cameron 1 (23)	23	13%	78%	9%	0%	0%
Taft-Cooper 1 (23)	23	26%	61%	13%	0%	0%
Taft-DeLaCruz 1 (21)	20	50%	50%	0%	0%	0%
Taft-Dodge 1 (23)	22	50%	41%	5%	5%	0%
Taft-Edgebrook 1 (23)	22	23%	55%	23%	0%	0%

Table 1.8
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 6, District 3 in 1997

School-Class *(N)*	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Calhoun North-Bragg 1 (24)	21	10%	76%	10%	5%	0%
Calhoun North-Bragg 2 (21)	21	5%	76%	19%	0%	0%
Calhoun North-Schlueter 1 (23)	20	25%	60%	15%	0%	0%
Calhoun North-Schlueter 2 (20)	17	18%	71%	12%	0%	0%
Calhoun North-Solomon 1 (21)	17	12%	71%	12%	6%	0%
Calhoun North-Solomon 2 (22)	18	6%	56%	39%	0%	0%
Calhoun North-Tierney 1 (24)	21	29%	48%	24%	0%	0%
Calhoun North-Vetter 1 (7)	7	71%	29%	0%	0%	0%

Table 1.9
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 3 in 1997

School-Teacher *(N)*	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Calhoun North-Perry 1 (19)	18	6%	56%	28%	11%	0%
Calhoun North-Perry 2 (22)	20	20%	40%	35%	5%	0%
Calhoun North-Perry 3 (22)	21	0%	52%	43%	5%	0%
Calhoun North-Perry 4 (21)	21	10%	62%	24%	5%	0%
Calhoun North-Perry 5 (27)	25	16%	68%	4%	12%	0%
Calhoun North-Perry 6 (22)	20	10%	35%	40%	15%	0%
Calhoun North-Schroeder 1 (1)	1	0%	100%	0%	0%	0%

District 4

Table 1.10
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 6, District 4 in 1997

School-Class *(N)*	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Kelvyn Park-Downer 1 (24)	24	42%	54%	4%	0%	0%
Kelvyn Park-Downer 2 (24)	23	61%	39%	0%	0%	0%
Kelvyn Park-Vega 1 (14)	14	21%	64%	14%	0%	0%
Kelvyn Park-Vega 2 (19)	19	11%	84%	5%	0%	0%

Table 1.11
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 4 in 1997

School-Teacher *(N)*	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Kelvyn Park-Finn 1 (30)	28	7%	46%	36%	11%	0%
Kelvyn Park-Finn 2 (24)	24	17%	75%	8%	0%	0%
Kelvyn Park-Woodward 1 (27)	18	11%	78%	11%	0%	0%
Kelvyn Park-Woodward 2 (28)	24	63%	38%	0%	0%	0%
Kelvyn Park-Yackle 1 (23)	19	32%	42%	16%	11%	0%
Kelvyn Park-Yackle 2 (20)	17	29%	65%	6%	0%	0%

Fall 1998

District 1

Table 1.12
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 6, District 1 in 1998

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Addams-Gollen (24)	24	21%	42%	38%	0%	0%
Fernwood-Weatherspoon (62)	44	20%	61%	18%	0%	0%
Von Humboldt-Brown (50)	41	10%	59%	24%	5%	2%
Von Humboldt-Parsons (52)	43	40%	44%	16%	0%	0%
Wacker-Lovell (28)	27	0%	52%	41%	7%	0%
			—Conventional—			
Fernwood-Harrison (70)	47	19%	77%	4%	0%	0%

Table 1.13
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 1 in 1998

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Fernwood-Heath (43)	28	25%	61%	14%	0%	0%
Von Humboldt-Bartlett (50)	40	15%	78%	8%	0%	0%
Von Humboldt-Muldoon (74)	27	44%	56%	0%	0%	0%
Wacker-Burton (23)	6	83%	17%	0%	0%	0%
			—Conventional—			
Addams-St. James (55)	52	10%	48%	33%	8%	2%
Fernwood-Hodge (23)	10	0%	90%	10%	0%	0%
Wacker-Rubin (22)	19	26%	63%	11%	0%	0%

Table 1.14

Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 1 in 1998

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Fernwood-Reichers (70)	40	25%	55%	18%	3%	0%
Von Humboldt-Waters (45)	39	5%	82%	8%	3%	0%
			—Conventional—			
Addams-Wolfe (52)	46	4%	59%	30%	7%	0%
Wacker-DiMatteo (23)	9	33%	67%	0%	0%	0%

District 2

Table 1.15
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 6, District 2 in 1998

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Guggenheim-Broughton (45)	37	51%	49%	0%	0%	0%
Guggenheim-Redling (51)	41	15%	61%	24%	0%	0%
Weir-Ferguson (59)	58	26%	64%	10%	0%	0%
Weir-Kellner (60)	48	54%	40%	4%	2%	0%
			—Conventional—			
Newberry-Renlund (47)	39	23%	64%	10%	3%	0%
Von Steuben-Friedman (37)	19	26%	63%	11%	0%	0%

Table 1.16
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 2 in 1998

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Guggenheim-Carlson (79)	63	44%	52%	2%	2%	0%
Guggenheim-Dillard (34)	30	10%	62%	28%	0%	0%
Weir-Caputo (56)	53	45%	47%	8%	0%	0%
Weir-Gallardo (71)	0					
			—Conventional—			
Newberry-Cunningham (29)	6	33%	67%	0%	0%	0%

Table 1.17

Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 2 in 1998

School-Teacher (*N*)	**Collis-Romberg-*Profile A* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Guggenheim-Keeton (42)	38	16%	79%	3%	0%	0%
Guggenheim-Teague (57)	48	12%	78%	10%	0%	0%
			—Conventional—			
Newberry-Cunningham (35)	15	60%	40%	0%	0%	0%
Newberry-Stark (22)	16	31%	63%	6%	0%	0%

District 3

Table 1.18
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 6, District 3 in 1998

School-Teacher *(N)*	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Calhoun North-Schlueter (42)	32	31%	53%	13%	3%	0%
Calhoun North-Solomon (39)	33	27%	64%	9%	0%	0%
Calhoun North-Tierney (40)	35	20%	74%	6%	0%	0%
Calhoun North-Vetter (5)*	0					

* Special education class

Table 1.19
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 3 in 1998

School-Teacher *(N)*	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Calhoun North-Perry (131)	101	15%	61%	22%	2%	0%
Calhoun North-Schroeder (8)*	6	50%	50%	0%	0%	0%

* Special education class

Table 1.20
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 3 in 1998

School-Teacher *(N)*	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Calhoun North-Wells (74)	57	18%	60%	21%	2%	0%

District 4

Table 1.21
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 6, District 4 in 1998

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Kelvyn Park-Becker (44)	39	51%	44%	3%	0%	0%
Kelvyn Park-Downer (38)	37	38%	62%	0%	0%	0%
Kelvyn Park-Vega (35)	35	23%	66%	11%	0%	0%

Table 1.22
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 4 in 1998

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Kelvyn Park-Finn (73)	69	30%	49%	19%	1%	0%
Kelvyn Park-Kane (73)	20	15%	85%	0%	0%	0%
Kelvyn Park-Woodward (67)	33	61%	36%	3%	0%	0%

Table 1.23

Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 4 in 1998

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Kelvyn Park-Catalano (61)	40	28%	63%	10%	0%	0%
Kelvyn Park-Novak (83)	67	33%	48%	18%	1%	0%
Kelvyn Park-Woods (50)	19	26%	63%	11%	0%	0%

Fall 1999

District 1

Table 1.24
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 1 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Addams-St. James (8)	8	13%	63%	25%	0%	0%
Von Humboldt-Botkin (44)	33	21%	42%	36%	0%	0%
Von Humboldt-Muldoon (61)	44	30%	52%	11%	5%	2%
			—Conventional—			
Fernwood-Hodge (16)	12	17%	83%	0%	0%	0%

Table 1.25
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 1 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Fernwood-Dunn (26)	20	25%	55%	15%	5%	0%
Von Humboldt-Reichers (60)	39	26%	72%	3%	0%	0%
Von Humboldt-Waters (43)	26	31%	62%	8%	0%	0%
			—Conventional—			
Addams-Wolfe (50)	46	11%	43%	35%	9%	2%
Fernwood-Pimm (5)	3	33%	67%	0%	0%	0%

District 2

Table 1.26
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 2 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Guggenheim-Broughton (16)	13	31%	62%	8%	0%	0%
Guggenheim-Redling (37)	29	17%	59%	24%	0%	0%
Weir-Flader (19)	15	20%	73%	7%	0%	0%
			—Conventional—			
Von Steuben-Friedman (26)	18	39%	61%	0%	0%	0%

Table 1.27
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 2 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Guggenheim-Carlson (57)	44	36%	57%	7%	0%	0%
Guggenheim-Dillard (20)	14	7%	57%	36%	0%	0%
Weir-Gallardo (23)	10	50%	40%	10%	0%	0%
Weir-Shepard (19)	5	80%	20%	0%	0%	0%
			—Conventional—			
(none)						

District 3

Table 1.28
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 3 in 1999

School-Teacher *(N)*	**Collis-Romberg *Profile B* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Calhoun North-Perry (104)	77	4%	29%	62%	4%	1%
Calhoun North-Schroeder (2)	1	0%	100%	0%	0%	0%

Table 1.29
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 3 in 1999

School-Teacher *(N)*	**Collis-Romberg *Profile B* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Calhoun North-Wells (49)	38	0%	34%	66%	0%	0%
Calhoun North-Schroeder (7)	6	17%	67%	17%	0%	0%

District 4

Table 1.30
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 4 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile A* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Kelvyn Park-Kane (14)	14	43%	50%	7%	0%	0%
Kelvyn Park-Lux (13)	11	9%	82%	9%	0%	0%
Kelvyn Park-Woodward (17)	15	67%	33%	0%	0%	0%

Table 1.31
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 4 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Kelvyn Park-Downer (21)	8	0%	50%	50%	0%	0%
Kelvyn Park-Novak (38)	12	33%	33%	33%	0%	0%
Kelvyn Park-Woods (20)	11	36%	27%	36%	0%	0%

Collis-Romberg Profile B

This profile was administered only to students when they were in their last semester of the study.

Spring 1999

District 1

Table 2.1
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 1 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Fernwood-Reichers (70)	35	29%	57%	14%	0%	0%
Von Humboldt-Waters (45)	42	5%	52%	43%	0%	0%
			—Conventional—			
Addams-Wolfe (52)	49	0%	33%	67%	0%	0%
Wacker-DiMatteo (23)	21	19%	81%	0%	0%	0%

District 2

Table 2.2
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 2 in 1999

School-Teacher *(N)*	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Calhoun North-Wells (74)	42	2%	26%	69%	2%	0%

District 3

Table 2.3
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 3 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Guggenheim-Keeton (42)	40	3%	40%	58%	0%	0%
Guggenheim-Teague (57)	54	15%	65%	20%	0%	0%
			—Conventional—			
Newberry-Cunningham (35)	31	16%	71%	13%	0%	0%
Newberry-Stark (22)	16	38%	56%	6%	0%	0%

District 4

Table 2.4
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 4 in 1999

School-Teacher (*N*)	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Kelvyn Park-Catalano (61)	50	2%	60%	38%	0%	0%
Kelvyn Park-Novak (83)	69	33%	35%	32%	1%	0%
Kelvyn Park-Woods (50)	33	36%	36%	27%	0%	0%

Spring 2000

District 1

Table 2.5
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 1 in 2000

School-Teacher (*N*)	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Addams-St. James (8)	8	13%	25%	63%	0%	0%
Von Humboldt-Botkin (44)	23	13%	35%	48%	4%	0%
Von Humboldt-Muldoon (61)	29	14%	28%	55%	3%	0%
			—Conventional—			
Fernwood-Hodge (16)	14	7%	57%	36%	0%	0%

Table 2.6
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 1 in 2000

School-Teacher (*N*)	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Fernwood-Dunn (26)	19	16%	47%	37%	0%	0%
Von Humboldt-Reichers (60)	37	0%	35%	59%	3%	0%
Von Humboldt-Waters (43)	21	10%	33%	57%	0%	0%
			—Conventional—			
Addams-Wolfe (50)	1	0%	100%	0%	0%	0%
Fernwood-Pimm (5)	2	0%	100%	0%	0%	0%

District 2

Table 2.7
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 2 in 2000

School-Teacher (*N*)	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Guggenheim-Broughton (16)	12	33%	50%	17%	0%	0%
Guggenheim-Redling (37)	17	6%	29%	65%	0%	0%
Weir-Flader (19)	14	14%	43%	43%	0%	0%
			—Conventional—			
Von Steuben-Friedman (26)	7	0%	71%	14%	14%	0%

Table 2.8
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 8, District 2 in 2000

School-Teacher (*N*)	Collis-Romberg-*Profile B* Level of Student Performance					
	(N)	Prestructural	Unistructural	Multistructural	Relational	Extended Abstract
			—MiC—			
Guggenheim-Carlson (57)	19	53%	37%	11%	0%	0%
Guggenheim-Dillard (20)	14	0%	50%	50%	0%	0%
Weir-Gallardo (23)	6	0%	33%	50%	17%	0%
Weir-Shepard (19)	3	67%	0%	33%	0%	0%
			—Conventional—			
(none)						

District 3

The Collis-Romberg Profile B was not administered in District 3 in Spring, 2000.

District 4

Table 2.9
Collis-Romberg Mathematical Problem-Solving Profile Percent of Class at each Level, Grade 7, District 4 in 2000

School-Teacher (*N*)	**Collis-Romberg-*Profile B* Level of Student Performance**					
	(N)	**Prestructural**	**Unistructural**	**Multistructural**	**Relational**	**Extended Abstract**
			—MiC—			
Kelvyn Park-Kane (14)	11	9%	55%	36%	0%	0%
Kelvyn Park-Lux (13)	10	10%	60%	30%	0%	0%
Kelvyn Park-Woodward (17)	11	45%	18%	36%	0%	0%

The Collis-Romberg Profile B was not administered to Grade 8 studnets in District 4 in Spring, 2000.

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