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

***Teacher Background* Data for 1997-1998**

(Working Paper #24)

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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.)

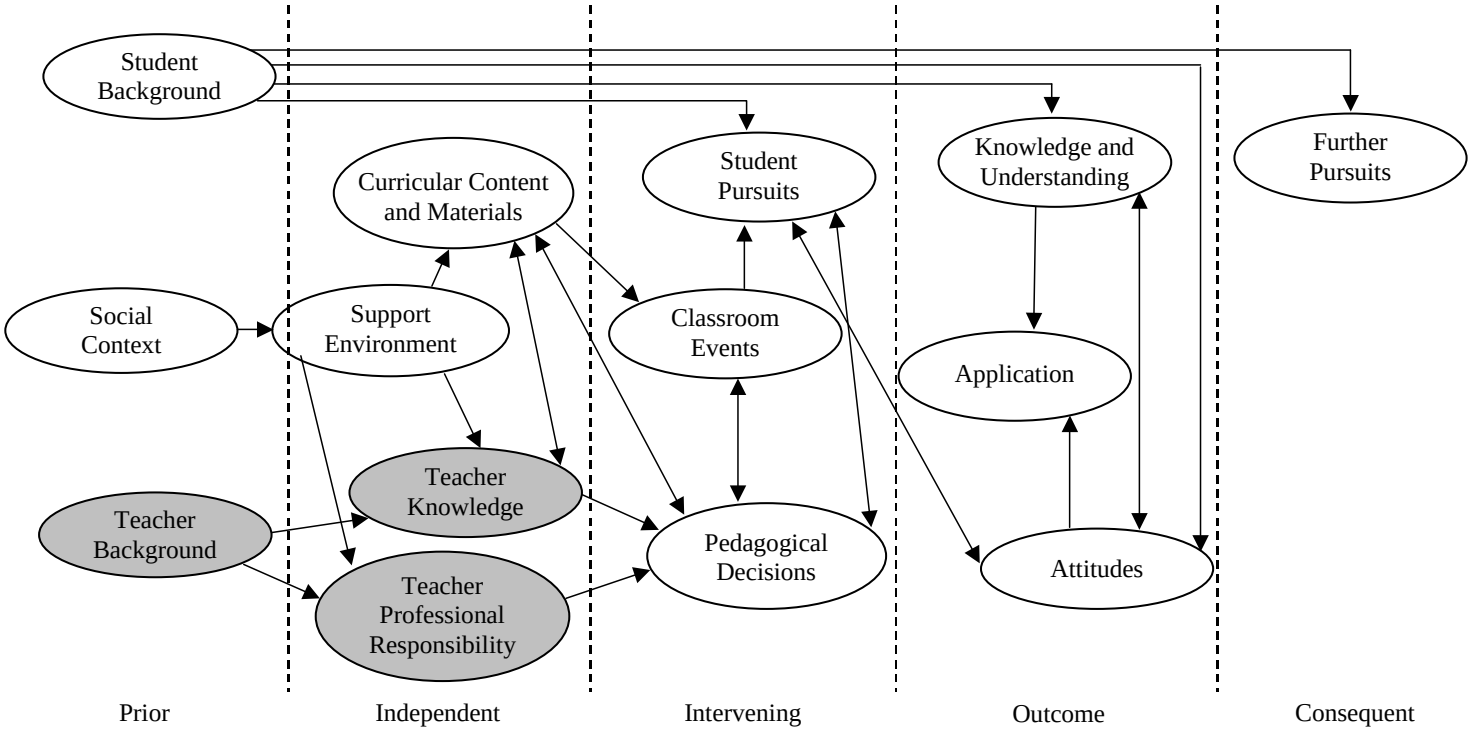

Figure 1. Revised model for the monitoring of school mathematics.

Overview: Teacher Background Data for 1997-1998

The purpose of this working paper is to summarize the information of the *Teacher Background* variable collected during fall 1997 on teachers at the beginning of the longitudinal/cross-sectional study of the impact of *Mathematics in Context* on student performance. The purpose of gathering this information was to describe similarities and differences among the Grade 5, Grade 6, and Grade 7 study teachers. Characteristics for teachers at each grade level — sex, ethnicity, educational background, teaching experience, experience teaching mathematics, and experience teaching at the current school — were gathered via Teacher Questionnaire: Background and Experience (Shafer, Davis, & Wagner, 1997) and data about experience teaching *Mathematics in Context* were gathered via Teacher Questionnaire: Experience Teaching *Mathematics in Context* (Shafer, 1997). Information about each teacher's conceptions about mathematics teaching and learning and their assessment of student learning is gathered via Teacher Questionnaire: School Context (Shafer, Davis, & Wagner, 1997). (See Figure 2).

Nineteen fifth-grade teachers, 19 sixth-grade teachers, and 15 seventh-grade teachers from 17 schools in four districts participated in the study. Districts are identified by number; school and teacher names are pseudonyms. Also noted are the type of materials used (MiC materials or a conventional text).

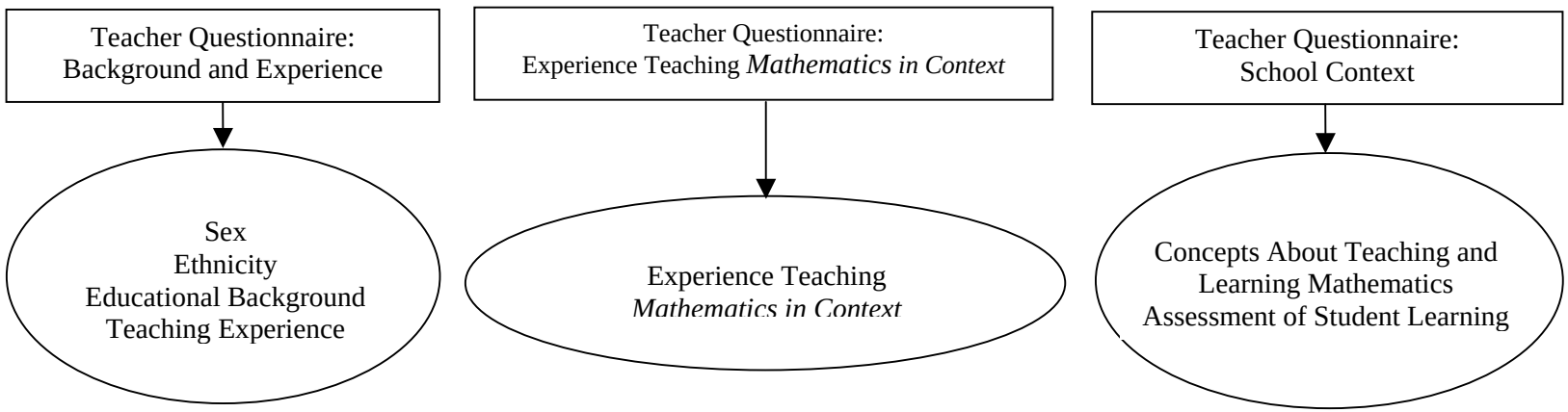

Figure 2. Teacher background characteristics in longitudinal/cross-sectional study of the impact of *Mathematics in Context* on student performance and their sources.

Grade 5

District 1

In District 1, eight fifth-grade teachers participated in the study. MiC was used by six of these teachers; conventional curricula were used by the other two teachers. A summary of the variations in the teacher background characteristics is presented in Table 1. In District 1, one fifth-grade teacher is male (Fulton). One teacher is African American (Mitchell); the others are White. Teaching experience varied among the teachers. Most of the teachers had taught in elementary schools for 10 or more years; one teacher had taught five years. Two teachers had taught for over 20 years. All teachers had taught at least two years at their current schools. Seven of the eight teachers had taught at multiple grade levels. One teacher (Fulton) was a mathematics specialist at his school. Two teachers were mentor teachers in their buildings. One teacher (Linne) was the department chair, team leader, and union representative for her school.

Table 1
Summary Data on Background Characteristics, Fifth-Grade Teachers, District 1

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Levels Taught	Current Position
				— MiC —				
Banneker-Greene	F	White	26	1	7	5	K,1,2,4 and College	Classroom teacher
Beethoven-Kipling	F	White	5	1	2	5	3,4,5	Classroom teacher
Beethoven-LaSalle	F	White	15	0	8	5	2,3,4,5,6	Classroom teacher, Mentor teacher
Beethoven-Linne	F	White	10	0	8	5	4,5,6,7	Classroom teacher, Mentor teacher, Department chair, Union Rep., Team Leader
Dewey-Hamilton	F	White	18	5	14	5	4,5,6	Classroom teacher
Dewey-Mitchell	F	African American	19	1	4	5	K,1,3,4,5	Classroom teacher
				— Conventional —				
Dewey-Kershaw	F	White	10	1	6	5	5	Classroom teacher
River Forest-Fulton	M	White	23	0	20	5	5,6	Mathematics specialist for the school

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 2. Three fifth-grade MiC teachers in District 1 taught units for less than one semester; Kipling and LaSalle indicated that they did not have any experience teaching MiC. Greene did not report. Mitchell and Hamilton in Dewey Elementary School had each taught one MiC unit in the previous year.

Table 2
Experience Teaching MiC, Fifth-Grade Teachers, District 1

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
		— MiC —	
Banneker-Greene	No response	No response	No response
Beethoven-Kipling	None	None	No response
Beethoven-LaSalle	None	None	No response
Beethoven-Linne	Less than one semester	None	No response
Dewey-Hamilton	Less than one semester	One	Patterns and Symbols
Dewey-Mitchell	Less than one semester	One	Patterns and Symbols
		— Conventional —	
Dewey-Kershaw	None		
River Forest-Fulton	None		

The educational backgrounds of the fifth-grade teachers in District 1 are presented in Table 3. Most teachers had completed a bachelor's degree in elementary education; one teacher (LaSalle) had completed a bachelor's degree in psychology. The teachers varied in their undergraduate mathematics preparation from no courses to 6–7 courses. Six of the eight teachers had completed a master's degree: three teachers had studied education; two teachers had studied school leadership or administration; and one teacher had studied family studies. Five of these teachers had taken at least one graduate-level course in mathematics. One teacher (Greene) had completed doctoral work in family studies; another teacher (LaSalle) had completed an elementary certification program.

Table 3
Professional Training, Fifth-Grade Teachers, District 1

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	Minor	Courses	Major	Minor	Courses	Major	Minor	Courses	
— MiC —										
Banneker-Greene	Elementary Education	Music	2	Ind. & Family Studies		4	Family Studies		2	Post-graduate work
Beethoven-Kipling	Elementary Education		4							
Beethoven-LaSalle	Psychology		2	School Leadership and Instruction		1			2	Elementary Certification
Beethoven-Linne	Elementary Education	Special Education	2	Education		1				Several math- related workshops and in services
Dewey-Hamilton	Elementary Education	Science	2	Elementary Education		1				
Dewey-Mitchell	Elementary Education									
— Conventional —										
Dewey-Kershaw	Elementary Education		6-7	Elementary Education		2				
River Forest-Fulton	Elementary Education		3	Educational Administration						

A summary of the variations in teacher characterization of mathematics is presented in Table 4. Teachers' perspective on the nature of mathematics varied. LaSalle was the only teacher to distinctively categorize mathematics as dynamic discipline; Linne and Kershaw tended to agree with this. The other five teachers responded that mathematics was both static and dynamic in nature.

Table 4
Characterization of Mathematics, Fifth-Grade Teachers, District 1

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
		— MiC —		
Banneker-Greene	Agree	Agree	Agree	Agree
Beethoven-Kipling	Agree	Agree	Agree	Agree
Beethoven-LaSalle	Strongly disagree	Disagree	Strongly agree	Agree
Beethoven-Linne	No opinion	Disagree	Agree	Agree
Dewey-Hamilton	Agree	Disagree	Agree	Agree
Dewey-Mitchell	Strongly agree	Agree	Agree	Agree
		— Conventional —		
Dewey-Kershaw	No opinion	Disagree	Agree	Strongly agree
River Forest-Fulton	Strongly agree	No opinion	Strongly agree	Strongly agree

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variations in teacher perspectives on mathematics teaching and learning is presented in Tables 5 and 6. Every teacher believed that students learned best when they studied mathematics in the context of everyday situations and they believed that calculators did not inhibit students learning of mathematics (see Tables 5 and 6). Generally teachers thought that students learned mathematics best in classes where they were able to work in small groups and that students should write about how they solved mathematical problems. Two teachers (Hamilton and Kershaw) did not believe basic skills had to be mastered before students could effectively learn more mathematics or before students could engage in higher order thinking including analysis, comparison, and generalization. Linne agreed that students needed to master basic computation facts and skills before they could engage effectively in studying more mathematics, but she did not believe that students had to learn basic skills before they could be expected to use higher order thinking. In contrast, the other five teachers responded that students had to master basic skills before they could study more mathematics or engage in higher order thinking.

Table 5
Mathematics Teaching and Learning, Fifth-Grade Teachers, District 1, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skill before More Math**	**3. Skills before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
— MiC —						
Banneker-Greene	Agree	Agree	Agree	Agree	Disagree	Agree
Beethoven-Kipling	Agree	Agree	Agree	Agree	No opinion	Agree
Beethoven-LaSalle	Strongly agree	Agree	No opinion	Agree	Disagree	Agree
Beethoven-Linne	Agree	Agree	Disagree	Agree	Disagree	Agree
Dewey-Hamilton	Agree	Disagree	Disagree	Agree	Disagree	Agree
Dewey-Mitchell	Strongly agree	Agree	Agree	Agree	Disagree	Strongly agree
— Conventional —						
Dewey-Kershaw	Strongly agree	Disagree	Disagree	Agree	Strongly disagree	Disagree
River Forest-Fulton	Strongly agree	Agree	Agree	No opinion	Disagree	Strongly agree

udent Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won't learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

All eight teachers thought that it was more important to cover fewer topics in greater depth than to cover the entire textbook, and that more algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculum. They also agreed or strongly agreed that a) instruction should be based on their knowledge of their students' understanding; b) instruction should include many open-ended tasks; c) students should learn mathematics through regularly discussing their ideas with other students. In general, most teachers agreed that a) teaching a mathematical concept should begin with a concrete example or model; b) more emphasis should be given to simple mental computation and estimation, and less emphasis to practicing lengthy pencil-and paper calculation; c) teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient; d) connections among mathematical topics and between mathematics and other disciplines should be emphasized; and e) problem solving should be a central feature of the elementary and middle school curriculum. Teachers varied, however, in their responses about the importance of other elements of instruction: Whether instruction should include step-by-step instruction and whether teachers' primary goal should be to help student master basic concepts and procedures.

Table 6
Mathematics Teaching and Learning, Fifth-Grade Teachers, District 1, Part II

School-Teacher	**Pedagogy***					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
			— MiC —			
Banneker-Greene	Agree	Agree	Agree	Agree	Disagree	Agree
Beethoven-Kipling	Agree	Agree	Agree	Agree	-	Agree
Beethoven-LaSalle	No opinion	Strongly agree	Strongly disagree	Agree	Disagree	Agree
Beethoven-Linne	Strongly agree	Strongly agree	Agree	No opinion	Agree	Agree
Dewey-Hamilton	Agree	Strongly agree	Disagree	Agree	Disagree	Strongly agree
Dewey-Mitchell	Strongly agree	Strongly agree	No opinion	Agree	Agree	Agree
			— Conventional —			
Dewey-Kershaw	Disagree	No opinion	Disagree	Strongly agree	Agree	Agree
River Forest-Fulton	Strongly agree	Strongly agree	Agree	Strongly agree	Disagree	Agree

School-Teacher	**Pedagogy**					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
			— MiC —			
Banneker-Greene	Agree	Agree	Agree	Agree	Agree	Agree
Beethoven-Kipling	No opinion	Agree	Agree	Agree	No opinion	No opinion
Beethoven-LaSalle	Strongly agree	No opinion	Agree	Agree	No opinion	Agree
Beethoven-Linne	Agree	Strongly agree	Agree	Agree	Strongly agree	Strongly agree
Dewey-Hamilton	Strongly agree	Strongly agree	Agree	Agree	Agree	Agree
Dewey-Mitchell	Agree	Agree	Strongly agree	Agree	Strongly agree	Strongly agree
			— Conventional —			
Dewey-Kershaw	Strongly agree	Agree	Agree	Agree	Strongly agree	Strongly agree
River Forest-Fulton	Strongly agree	Agree	Agree	Strongly agree	Strongly agree	Strongly agree

* See questionnaire items1-12 on next page.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculu.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variations in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 7. In general, even though fifth-grade teachers in District 1 used students' performance on standardized tests, classroom projects, and portfolios of student work sometimes or often, they varied in the importance they assigned to each in determining student grades or what to teach next. Students' performance on standardized tests was regarded as not very important or not important at all by three of the teachers. On the other hand, teachers thought that performance on classroom projects and quizzes and tests were more important in considering what to teach next and in determining student grades. Most of teachers responded that performance on classroom projects was somewhat important whereas performance on quizzes and tests were somewhat to very important for these purposes.

Table 7
Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Fifth-Grade Teachers, District 1

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Grades**	**Frequency**	**What to Teach Next**	**Grades**
— MiC —						
Banneker-Greene	Often	Very important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Beethoven-Kipling	Sometimes	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Beethoven-LaSalle	Sometimes	Not important at all	Not important at all	Sometimes	Somewhat important	Somewhat important
Beethoven-Linne	Sometimes	Not important at all	Not important at all	Often	Somewhat important	Somewhat important
Dewey-Hamilton	Sometimes	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Dewey-Mitchell	Sometimes	Not very important	Somewhat important	Sometimes	Somewhat important	Somewhat important
— Conventional —						
Dewey-Kershaw	Often	Not important at all	Somewhat important	Often	Somewhat important	Somewhat important
River Forest-Fulton	Sometimes	Somewhat important	Not important at all	Often	Somewhat important	Very important

School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Grades**	**Frequency**	**What to Teach Next**	**Grades**
— MiC —						
Banneker-Greene	Often	Very important	Somewhat important	Sometimes	Not very important	Not very important
Beethoven-Kipling	Often	Somewhat important	Somewhat important	Sometimes	Not very important	Not very important
Beethoven-LaSalle	Sometimes	Very important	Very important	Often	Somewhat important	Somewhat important
Beethoven-Linne	Always	Somewhat important		Often	Not very important	Somewhat important
Dewey-Hamilton	Sometimes	Somewhat important	Somewhat important	Often	Very important	Very important
Dewey-Mitchell	Often	Very important	Somewhat important	Often	Somewhat important	Very important
— Conventional —						
Dewey-Kershaw	Always	Very important	Very important	Never	Somewhat important	Not very important
River Forest-Fulton	Often	Very important	Somewhat important	Sometimes	Somewhat important	Somewhat important

A summary of the variations in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 8. All eight teachers reported using various methods of informal assessment in varying degrees from sometimes to always, with one exception (Kershaw did not use a student's written explanations). Generally, methods of informal assessments were somewhat to very important in determining what to teach next. Students' oral and written explanations and observed work were somewhat to very important in assigning student grades. Teachers varied in the importance given to student questions and assessments across time as elements of their grading practices. Student questions were not thought to be an important element in student grades to three of the eight teachers, despite reportedly used by all teachers, and regarded very or somewhat important in determining what to teach next.

Table 8

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Fifth-Grade Teachers, District 1

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
— MiC —									
Banneker-Greene	Often	Somewhat important	Somewhat important	Often	Very important	Somewhat important	Often	Very important	Somewhat important
Beethoven-Kipling	Often	Somewhat important	Not very important	Often	Somewhat important	Somewhat important	Often	Very important	Somewhat important
Beethoven-LaSalle	Often	Very important	Not important at all	Often	Very important	Somewhat important	Sometimes	Not very important	Not very important
Beethoven-Linne	Sometimes	Somewhat important	Not very important	Sometimes	Somewhat important	Not important at all	Always	Very important	Very important
Dewey-Hamilton	Often	Somewhat important	Somewhat important	Often	Very important	Very important	Often	Very important	Very important
Dewey-Mitchell	Often	Very important	Very important	Often	Very important	Very important	Often	Somewhat important	Somewhat important
— Conventional —									
Dewey-Kershaw	Always	Very important	Very important	Often	Somewhat important	Somewhat important	Never	Somewhat important	Not important at all
River Forest-Fulton	Always	Very important	Somewhat important	Always	Very important	Somewhat important	Often	Somewhat important	Somewhat important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
— MiC —						
Banneker-Greene	Often	Very important	Very important	Often	Very important	Very important
Beethoven-Kipling	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Beethoven-LaSalle	Often	Very important	Somewhat important	Often	Very important	Not important at all
Beethoven-Linne	Often	Somewhat important	Not very important	Sometimes	Not very important	Not very important
Dewey-Hamilton	Often	Very important	Very important	Often	Very important	Very important
Dewey-Mitchell	Often	Very important	Very important	Often	Very important	Very important
— Conventional —						
Dewey-Kershaw	Always	Very important	Very important	Sometimes	Somewhat important	Not important at all
River Forest-Fulton	Always	Very important	Very important	Often	Somewhat important	Very important

District 2

In District 2, five fifth-grade teachers participated in the study. MiC was used by four of these teachers; a conventional curriculum was used by one teacher. A summary of the variations in the teacher background characteristics is presented in Table 9. All five teachers are female and two of them are African American/Black. They taught from 8-15 years. Gant has multiple positions in her school: she is a classroom teacher, lead teacher, the mathematics department chair, and a USI teacher consultant.

Table 9
Summary Data on Background Characteristics, Fifth-Grade Teachers, District 2

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Level Taught	Current Position
				— MiC —				
Armstrong-Murphy	F	White	8	15	8	5	Computers,2,4	Classroom teacher
Armstrong-Nash	F	Black	15	10	12	5	3,4,5	Classroom teacher
Ogden-Fiske	F	White	11	1	3	5	5,6	Classroom teacher
Ogden-Piccolo	F	White	11	0	3	5	4,5,6	Classroom teacher
					— Conventional —			
Von Steuben-Gant	F	African American	12	0	11	5	3,4,5	Classroom teacher, Lead teacher, Department chair, USI Teacher Consultant

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 10. Among the 4 teachers using MiC, Murphy and Nash taught 2-4 units in previous years including Side Seeing, Some of the Parts, Grasping Sizes, Patterns and Symbols, Dry and Wet Numbers, and Picturing Numbers. Fiske has less than one semester experience teaching MiC, but did not report teaching any units in the previous year.

Table 10
Experience Teaching MiC, Fifth-Grade Teachers, District 2

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
		— MiC —	
Armstrong-Murphy	One year	2-4	Side Seeing, Some of the Parts, Patterns and Symbols, Dry and Wet Numbers, Picturing Numbers
Armstrong-Nash	One year	2-4	Side Seeing, Grasping Sizes, Dry and Wet Numbers, Picturing Numbers
Ogden-Fiske	Less than one semester	None	
Ogden-Piccolo	None	None	
		— Conventional —	
Von Steuben-Gant	None	None	

A summary of the variations in teacher professional training is presented in Table 11. Among the fifth-grade teachers in District 2, Murphy, Piccolo, and Gant did not take or report any mathematics credits in their bachelor degree. Piccolo studied administration in elementary education and holds certification in administration. Nash studied elementary education and took 5 courses in mathematics education; she studied reading for her master's degree. Fiske studied music and took one mathematics education course; she studied computer applications for her master's degree. Murphy completed a master's degree in elementary education.

Table 11
Professional Training, Fifth-Grade Teachers, District 2

School-Teacher	**B.A.**			**M.A.**			**PhD**			**Other Credentials**
	Major	**Minor**	**Courses**	**Major**	**Minor**	**Courses**	**Major**	**Minor**	**Courses**	
				— *MiC* —						
Armstrong-Murphy				Elementary Education						
Armstrong-Nash	Elementary Education		5	Reading						
Ogden-Fiske	Education	Music	1	Computer Applications						
Ogden-Piccolo	Elementary Education			Elementary Educational Administration						Certified in Administration
				—	*Conventional*	—				
Von Steuben-Gant	English									

A summary of the variations in teacher characterization of mathematics is presented in Table 12. The teachers of the fifth-grade in District 2 generally agreed that mathematics has both static and dynamic characteristics. Though Mrs. Nash and Gant also agreed that mathematics is static in the sense that it is a collection of concepts and skills used to obtain answers to problems, they have a neutral or negative opinion, respectively, that mathematical facts, skills, rules and concepts are applied in work and future study.

Table 12
Characterization of Mathematics, Fifth-Grade Teachers, District 2

School-Teacher	**Static 1**	**Static 2**	**Dynamic 3**	**Dynamic 4**
	— MiC —			
Armstrong-Murphy	Agree	Agree	Strongly agree	Strongly agree
Armstrong-Nash	Strongly agree	No opinion	Agree	Agree
Ogden-Fiske	Agree	Agree	Agree	Agree
Ogden-Piccolo	Agree	Agree	Agree	Strongly agree
	— Conventional —			
Von Steuben-Gant	Agree	Disagree	Agree	Agree

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variations in teacher perspectives on mathematics teaching and learning is presented in Tables 13 and 14. All teachers agreed that students learn mathematics best in the context of everyday situations and that they need to write about their problem solving procedures. They also did not think calculators during mathematics class inhibits students' mathematical development. Except for Gant, the teachers agreed that small groups are effective for mathematics learning of students. Teachers varied, however, with respect to the mastering of basic skills before students' engagement in higher order thinking or instruction in more mathematics. Fiske responded that students must have basic skills before they use higher order skills, and both Fiske and Nash responded that students must have mastered basic skills before being introduced to more mathematics.

Table 13
Mathematics Teaching and Learning, Fifth-Grade Teachers, District 2, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Armstrong-Murphy	Strongly agree	Disagree	Disagree	Strongly agree	Strongly disagree	Strongly agree
Armstrong-Nash	Agree	Agree	Disagree	Strongly agree	Disagree	Agree
Ogden-Fiske	Strongly agree	Strongly agree	Agree	Agree	Disagree	Agree
Ogden-Piccolo	Strongly agree	Disagree	Strongly disagree	Agree	Strongly disagree	Strongly agree
		— Conventional —				
Von Steuben-Gant	Agree	Disagree	Disagree	Disagree	Strongly disagree	Agree

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won’t learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

All teachers agreed that more content strands should be introduced in the elementary and middle school mathematics curriculum, but only three agree that it is important to cover fewer topics in greater depth. All teachers agreed on many elements of pedagogy, which include 1) teaching a mathematical concept should begin with a model or example; 2) teachers should encourage students to find their own strategies; 3) instruction should include many open-ended tasks; 4) students should learn mathematics through regularly discussing ideas with other students; 5) problem solving should be a central feature of the curriculum; and 6) connections among mathematical topics and between mathematics and other subjects should be made during instruction. Four of the five teachers thought that instruction should not include step-by-step directions. Gant, the conventional teacher in this group, differed from the other teachers by responding that the primary goal of instruction was not to help students master basic skills and that instruction should not be based on students' understanding, and had no opinion about emphasizing estimation and mental computation rather than lengthy paper-and-pencil computation.

Table 14
Mathematics Teaching and Learning, Fifth-Grade Teachers, District 2, Part II

School-Teacher	**Pedagogy***					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Armstrong-Murphy	Strongly agree	Strongly agree	Strongly agree	Strongly Agree	Agree	Agree
Armstrong-Nash	Disagree	Agree	Disagree	Agree	No opinion	Agree
Ogden-Fiske	Strongly agree	Agree	Disagree	Strongly Agree	Agree	Agree
Ogden-Piccolo	No opinion	Strongly agree	Disagree	Agree	Agree	Agree
					— Conventional —	
Von Steuben-Gant	Agree	Strongly agree	Disagree	Agree	Disagree	Disagree

School-Teacher	**Pedagogy**					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
		— MiC —				
Armstrong-Murphy	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree
Armstrong-Nash	Disagree	Strongly agree	Agree	Agree	Agree	Agree
Ogden-Fiske	Agree	Agree	Agree	Agree	Agree	Agree
Ogden-Piccolo	Agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree
		— Conventional —				
Von Steuben-Gant	No opinion	Strongly agree	Strongly agree	Agree	Strongly agree	Agree

* See questionnaire items1-12 on next page.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculum.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variations in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 15. In assessing student learning, performance on standardized tests, though used sometimes to always, was regarded as very important for one teacher and somewhat important for two teachers in determining what to teach next and not important to somewhat important for assigning student grades. The teachers preferred to use students' performance on classroom projects and quizzes and tests, and they felt these are somewhat to very important in considering what to teach next and for assigning student grades. Although used often by four of the five teachers, portfolios of student work were deemed not very important or somewhat important for determining what to teach next and only one teacher felt it somewhat important for assigning student grades. One teacher reported never using this method of assessment.

Table 15

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Fifth-Grade Teachers, District 2

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
					— MiC —	
Armstrong-Murphy	Sometimes	Not very important	Not important at all	Always	Very important	Very important
Armstrong-Nash	Often	Somewhat important	Somewhat important	Always	Somewhat important	Very important
Ogden-Fiske	Always	Very important	Somewhat important	Often	Very important	Very important
Ogden-Piccolo	Sometimes	Somewhat important	Not very important	Always	Somewhat important	Very important
					— Conventional —	
Von Steuben-Gant	Often			Often		

School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Armstrong-Murphy	Often	Somewhat important	Somewhat important	Often	Somewhat important	Not very important
Armstrong-Nash	Often	Somewhat important	Somewhat important	Often	Not very important	Somewhat important
Ogden-Fiske	Often	Somewhat important	Somewhat important	Never	Not important at all	Not important at all
Ogden-Piccolo	Often	Somewhat important	Somewhat important	Often	Somewhat important	Not very important
Von Steuben-Gant	Always			Often		

A summary of the variations in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 16. Generally, the fifth-grade teachers in District 2 frequently used informal classroom assessment methods and regarded them as somewhat to very important in determining what to teach next. Except for Nash, the teachers generally agreed that student questions and students' oral and written explanations were somewhat to very important in determining student grades. Although Nash reported never thinking about student work across assessments, other teachers frequently used this method for purposes of determining what to teach next and in assigning student grades. The use of such assessment, however, varied among the four teachers from not very important to very important.

Table 16

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Fifth-Grade Teachers, District 2

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations On Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
							— MiC —		
Armstrong-Murphy	Always	Very important	Very important	Always	Very important	Very important	Always	Very important	Very important
Armstrong-Nash	Often	Somewhat important	Not very important	Often	Somewhat important	Not very important	Often	Somewhat important	Somewhat important
Ogden-Fiske	Always	Very important	Very important	Often	Very important	Somewhat important	Often	Somewhat important	Somewhat important
Ogden-Piccolo	Always	Somewhat important	Somewhat important	Always	Somewhat important	Somewhat important	Always	Somewhat important	Somewhat important
					— Conventional —				
Von Steuben-Gant	Always			Sometimes			Often		

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Armstrong-Murphy	Always	Very important	Very important	Often	Very important	Somewhat important
Armstrong-Nash	Often	Somewhat important	Not very important	Never	Not very important	Somewhat important
Ogden-Fiske	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Ogden-Piccolo	Always	Somewhat important	Somewhat important	Always	Not very important	Not very important
Von Steuben-Gant	Often			Always		

District 3

In District 3, the six fifth-grade teachers are female and are from one school, Taft Elementary. MiC was used by all of these teachers. A summary of the variations in the teacher background characteristics is presented in Table 17. Dodge is the only multiracial teacher; other teachers are White. Teaching experience varied from 4 to 23 years. Although Cameron is the most experienced teacher in this group, she began teaching at Taft Elementary one year prior to the study. Dodge is also a mentor teacher at Taft Elementary school.

Table 17
Summary Data on Background Characteristics, Fifth-Grade Teachers, District 3

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Level Taught	Current Position
				— MiC —				
Taft-Allen*	F							
Taft-Cameron	F	White	23	3	1	5	1,2,3,4,5,6	Classroom teacher
Taft-Cooper	F	White	11	0	10	5	K,1,5	Classroom teacher
Taft-DeLaCruz	F	White	7	N/A	7	5	1,5	Classroom teacher
Taft-Dodge	F	Multiracial	20	2	9	5	K,2,3,4,5,6	Mentor teacher
Taft-Edgebrook	F	White	4	N/A	4	5	5	Classroom teacher

*Allen did not submit teacher questionnaires.

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 18. All of the fifth-grade teachers in District 3 have one year experience teaching MiC. They commonly used 2-4 units in the previous year. Several teachers taught Side Seeing, Patterns and Symbols, and Picturing Numbers.

Table 18
Experience Teaching MiC, Fifth-Grade Teachers, District 3

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
		— *MiC* —	
Taft-Allen*	One year	2-4	Side Seeing, Patterns and Symbols, Picturing Numbers
Taft-Cameron	One year	2-4	Side Seeing, Patterns and Symbols, Picturing Numbers
Taft-Cooper	One year	2-4	Side Seeing, Patterns and Symbols, Picturing Numbers
Taft-DeLaCruz	One year	2-4	Side Seeing, Figuring All the Angles, Some of the Parts, Picturing Numbers
Taft-Dodge	One year	1	Side Seeing, Grasping Sizes, Dry and Wet Numbers
Taft-Edgebrook	One year	2-4	Side Seeing, Patterns and Symbols, Picturing Numbers

*Allen did not submit teacher questionnaires.

The educational backgrounds of the fifth-grade teachers in District 3 differed dramatically (see Table 19). They studied Sociology, Liberal Studies, Environmental Studies, and Behavioral Science. Credits in mathematics also differed from one statistics course to accounting, and the credits are from outside education. DeLaCruz holds a California Clear Elementary School Teaching Credential.

Table 19
Professional Training, Fifth-Grade Teachers, District 3

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	Minor	Courses	Major	Minor	Courses	Major	Minor	Courses	
				— *MiC* —						
Taft-Allen*										
Taft-Cameron	Sociology	Psychology	1(statistics)							
Taft-Cooper	Liberal Studies		3(+- think)							
Taft-DeLaCruz	Environmental Studies	Biology	3							California Clear Elementary School Teaching Credential
Taft-Dodge	Behavioral Science	Biology								
Taft-Edgebrook	Liberal		Algebra, College required I/II, accounting							

*Allen did not submit teacher questionnaires.

A summary of the variations in teacher characterization of mathematics is presented in Table 20. All fifth-grade teachers in District 3 believed that mathematics in dynamic. For the statistic nature, DeLaCruz and Dodge believed that mathematics is a collection of concepts and skills used to obtain answers to problems and is facts, skills, rules, and concepts learned in some sequence and applied in work and future study. Though the other teachers agreed that mathematics is a collection of concepts and skills to answer to problems, they did not believe or were reluctant to say mathematics is facts and skills applied in work and future study.

Table 20
Characterization of Mathematics, Fifth-Grade Teachers, District 3

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
		— MiC —		
Taft-Allen*				
Taft-Cameron	Agree	No opinion	Agree	Strongly agree
Taft-Cooper	Strongly agree	No opinion	Agree	Strongly agree
Taft-DeLaCruz	Agree	Strongly agree	Strongly agree	Strongly agree
Taft-Dodge	Strongly agree	Strongly agree	Strongly agree	Strongly agree
Taft-Edgebrook	Agree	Disagree	Strongly agree	Agree

*Allen did not submit teacher questionnaires.

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variations in teacher perspectives on mathematics teaching and learning is presented in Tables 21 and 22. All teachers agreed or strongly agreed that learning mathematics should be set in the context of everyday situation, small groups are beneficial, using technology does not inhibit learning, and students should write about problem solving. However, on the matter of basic computation facts and skills of mathematics they have divided opinions. Cameron and Edgebrook thought that basic skills must be mastered before students can study more mathematics and before they can analyze, compare, and generalize. Dodge agreed that basic skills are needed before students can engage effectively in studying more mathematics, but disagreed that basic skills are needed before students can be expected to analyze, compare, and generalize.

Table 21
Mathematics Teaching and Learning, Fifth-Grade Teachers, District 3, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Taft-Allen*						
Taft-Cameron	Agree	Agree	Agree	Agree	Disagree	Agree
Taft-Cooper	Agree	Disagree	Strongly disagree	Agree	Strongly disagree	Agree
Taft-DeLaCruz	Strongly agree	Disagree	Disagree	Agree	Strongly disagree	Strongly agree
Taft-Dodge	Strongly agree	Strongly agree	Disagree	Strongly agree	Strongly disagree	Strongly agree
Taft-Edgebrook	Agree	Agree	Agree	Agree	No opinion	Agree

*Allen did not submit teacher questionnaires.

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won't learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

Teachers in District 3 generally have a high consensus on many elements of pedagogy. All teachers agreed or strongly agreed that it is more important to cover less topics in greater depth and that more algebra, geometry, and statistics should be introduced in elementary and middle school mathematics. All teachers also agreed or strongly agreed that 1) teaching a mathematical concept should begin with a model or example; 2) instruction should be based on students' understanding; 3) more emphasis should be given to estimation and-simple mental computation; 4) problem solving should be a central feature of the curriculum; and 5) that connections among mathematical topics and between mathematics and other subjects should be made. With the exception of Edgebrook, there was also general agreement among the teachers that 1) instruction should include step-by-step directions; 2) teachers should encourage children to find their own strategies; 3) instruction should include many open-ended tasks; and 4) students should learn mathematics through regularly discussing their ideas with other students. Much variation, however, was noted with respect to whether the teachers' primary goal is to help students master basic concepts and procedures. Dodge and Edgebrook agreed, Cameron and Cooper disagreed, and DeLaCruz reported no opinion.

Table 22
Mathematics Teaching and Learning, Fifth-Grade Teachers, District 3, Part II

School-Teacher	Pedagogy*					
	1. Less Coverage & More Depth	**2. More Content Strand**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Taft-Allen**						
Taft-Cameron	Strongly agree	Agree	Agree	Strongly agree	Disagree	Agree
Taft-Cooper	Strongly agree	Agree	No opinion	Strongly agree	Disagree	Agree
Taft-DeLaCruz	Agree	Agree	Agree	Strongly agree	No opinion	Strongly agree
Taft-Dodge	Strongly agree	Strongly agree	Agree	Strongly agree	Strongly agree	Strongly agree
Taft-Edgebrook	Strongly agree	Agree	Disagree	Strongly agree	Agree	Strongly agree

School-Teacher	Pedagogy					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
Taft-Allen**						
Taft-Cameron	Agree	Agree	Agree	Strongly agree	Strongly agree	Agree
Taft-Cooper	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree
Taft-DeLaCruz	Strongly agree	Strongly agree	Agree	Agree	Strongly agree	Strongly agree
Taft-Dodge	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree
Taft-Edgebrook	Strongly agree	No opinion	No opinion	No opinion	Agree	Strongly agree

* See questionnaire items 1-12 on next page.
**Allen did not submit teacher questionnaires.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculum.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variations in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 23. In assessing student learning, the fifth-grade teachers in District 3 frequently used classroom projects, quizzes and tests, and portfolios of student work. These assessments varied in importance from somewhat important or very important for determining what to teach next and in assigning student grades, though one teacher (Cooper) thought portfolios of student work were not very important in determining what to teach next. Students' performance on standardized tests was never used by two teachers and was sometimes used by three teachers in assessing student learning. Four of the five teachers thought standardized test results were not important for determining what to teach next and in assigning student grades. Edgebrook was the exception; she regarded standardized test results as somewhat important in determining what to teach next and very important in assigning student grades.

Table 23

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Fifth-Grade Teachers, District 3

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
				— MiC —		
Taft-Allen*						
Taft-Cameron	Sometimes	Not very important	Not very important	Often	Somewhat important	Somewhat important
Taft-Cooper	Never	Not important at all	Not important at all	Often	Somewhat important	Somewhat important
Taft-DeLaCruz	Sometimes	Not important at all	Not important at all	Often	Somewhat important	Very important
Taft-Dodge	Never	Not important at all	Not important at all	Always	Somewhat important	Very important
Taft-Edgebrook	Sometimes	Somewhat important	Very important	Always	Somewhat important	Somewhat important
School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Taft-Allen*						
Taft-Cameron	Often	Very important	Somewhat important	Often	Somewhat important	Somewhat important
Taft-Cooper	Sometimes	Somewhat important	Very important	Sometimes	Not very important	Somewhat important
Taft-DeLaCruz	Often	Somewhat important	Very important	Often	Very important	Somewhat important
Taft-Dodge	Often	Somewhat important	Somewhat important	Often	Somewhat important	Very important
Taft-Edgebrook	Always	Somewhat important	Very important	Sometimes	Very important	Very important

A summary of the variations in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 24. The fifth-grade teachers in District 3 used various methods of informal assessment and consistently responded that three methods were somewhat to very important in determining both what to teach next and in assigning student grades: students' written explanations, work observed, and student work across assessments. They also regarded students' questions and oral explanations as somewhat to very important for determining what to teach next, but they did not think that these methods were important for assigning student grades.

Table 24

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Fifth-Grade Teachers, District 3

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
							— *MiC* —		
Taft-Allen									
Taft-Cameron	Often	Somewhat important	Not very important	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Taft-Cooper	Always	Very important	Very important	Often	Very important	Very important	Often	Very important	Very important
Taft-DeLaCruz	Always	Very important	Somewhat important	Always	Somewhat important	Somewhat important	Always	Very important	Very important
Taft-Dodge	Often	Somewhat important	Somewhat important	Often	Very important	Somewhat important	Always	Very important	Very important
Taft-Edgebrook	Often	Very important	Not very important	Sometimes	Very important	Not very important	Always	Very important	Very important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Taft-Allen*						
Taft-Cameron	Always	Very important	Very important	Often	Somewhat important	Somewhat important
Taft-Cooper	Always	Very important	Very important	Often	Very important	Very important
Taft-DeLaCruz	Often	Very important	Very important	Sometimes	Somewhat important	Somewhat important
Taft-Dodge	Often	Somewhat important	Somewhat important	Always	Very important	Very important
Taft-Edgebrook	Often	Somewhat important	Very important	Often	Somewhat important	Very important

*Allen did not submit teacher questionnaires.

In summary, 19 fifth-grade teachers participated in the study during 1997-1998. Sixteen teachers used MiC; the remaining teachers used the conventional curricula already in place in their schools. Generally, the fifth-grade teachers had from 4 to over 20 years experience. With the exception of two teachers in District 2, all MiC teachers had some prior experience teaching MiC, although it was limited for District 1 teachers. Educational background varied greatly among the teachers with half of District 2 and all of District 3 teachers having undergraduate degrees outside education. Many teachers took a limited number of mathematics courses as part of their professional preparation, and some did not report taking mathematics courses.

Generally, the fifth-grade study teachers agreed with dynamic nature of mathematics, but many also agreed with a static interpretation of mathematics. All teachers agreed that students learn mathematics best in the context of everyday situations. Most teachers agreed that students learn mathematics best in small groups, students should write about how they solve problems, and the use of calculators does not inhibit mathematics learning. Teachers were divided about the necessity to master basic skills before introducing more mathematics to students and before students can engage in higher order thinking.

Fifth-grade teachers in Districts 1 and 3 agreed that it is more important to cover less topics in greater depth than it is to cover the text and that more algebra, geometry, and statistics should be introduced in the elementary- and middle-school mathematics curriculum. Although District 2 teachers agreed that more algebra, geometry, and statistics should be introduced in the curriculum, only half of them thought that it is more important to cover less topics in greater depth.

Generally, the fifth-grade study teachers agreed that 1) teaching a mathematical concept should begin with a concrete example or model; 2) instruction should be based upon their knowledge of their students' understanding; 3) more emphasis should be given to simple mental computation estimation, and less emphasis to practicing lengthy pencil-and paper calculation; 4) teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient; 5) instruction should include many open-ended tasks; 6) students should learn mathematics through regularly discussing their ideas with other students; 7) problem solving should be a central feature of the elementary and middle-school curriculum; and 8) connections among mathematical topics and between mathematics and other disciplines should be emphasized. Teachers varied the most with respect to two elements of pedagogy: whether the teacher's primary goal is to help students master basic concepts and procedures and whether instruction should include step-by-step directions.

In assessing student learning through more formal methods, many teachers used results of standardized tests but did not regard them as very important in making decisions about the content to teach next and student grading. All teachers used quizzes and tests frequently, and the results informed decisions about the content to teach and grading. Results from class projects and portfolios of student work were varied in use and importance in making such decisions.

All fifth-grade teachers reported using various methods of informal classroom assessment, including students' questions, oral and written explanations, work observed, and work across assessments. The information gathered from these assessments varied in importance, however, for determining the content to teach next and assigning student grades.

Grade 6

District 1

In District 1, six sixth-grade teachers participated in the study. MiC was used by four teachers; conventional curricula were used by the other two teachers. A summary of the variations in the teacher background characteristics is presented in Table 25. Four of the sixth-grade teachers are female and two are males; all teachers are White. They have a wide range of teaching experience (from 0-24 years), and a wide range of service years in current schools (from 0-11 yrs). Two teachers have ample experience serve as lead teachers (Brown and Lee). One teacher (Tallackson) has multiple positions teaching both regular and special education students and as an educational diagnostician, although she has only four years teaching experience.

Table 25
Summary Data on Background Characteristics, Sixth-Grade Teachers, District 1

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Levels Taught	Current Position
				— MiC —				
Fernwood-Lee	F	White	24	0	11	6	1,2,3,5,6	Lead Teacher
Fernwood-Weatherspoon	F	White	0	3	0	6	Substitute teacher in grades 1, 2, 3, 4, 5, 6, 7, 8; student teaching grade 3	Classroom teacher
Von Humboldt-Brown	M	White	12	4 summers	10	6	4,5,6,7	Lead Teacher
Von Humboldt-Harvey*	M	White	2	1	1	6	8,9	Classroom teacher
				— Conventional —				
Addams-Tallackson	F	White	4	1	3	6,7,8	4,5,6,7,8	Regular and Special Ed. Teacher, Educational Diagnostician
Wacker-Krittendon	F	White	23	0	7	6	K,1,2,3,4,5,6,7,8	Classroom teacher

*Harvey did not complete some teacher questionnaires.

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 26. Of the sixth-grade teachers in District 1, Weatherspoon has experience teaching MiC, though she did not teach it in the previous year. Brown and Harvey had no previous experience teaching MiC. Lee, replaced by Weatherspoon when she accepted an administrative position in December, reported having experience teaching one MiC unit. She taught one unit, Expression and Formulas, in previous years.

Table 26
Experience Teaching MiC, Sixth-Grade Teachers, District 1

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
	— MiC —		
Fernwood-Lee	Less than one semester	One	Expressions and Formulas
Fernwood-Weatherspoon	Less than one semester	None	
Von Humboldt-Brown	None		
Von Humboldt-Harvey*	None	None	
	— Conventional —		
Addams-Tallackson	None	None	
Wacker-Krittendon	None	None	

*Harvey did not complete some teacher questionnaires.

A summary of the variations in teacher professional training is presented in Table 27. Among the six sixth-grade teachers of District 1, most teachers completed a bachelor degree in elementary education; the exception is Weatherspoon who studied History, but completed a master's degree in elementary education. The teachers who majored in elementary education generally took 3 to 6 mathematics courses. Krittendon took 3 mathematics courses for her bachelors' degree and 45 credits (about 15 courses) for her master's degree. Lee took 4 mathematics courses in her bachelors' degree and one in her masters' degree, and she also has more than 45 credits toward administrative certification.

Table 27
Professional Training, Sixth-Grade Teachers, District 1

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	Minor	Courses	Major	Minor	Courses	Major	Minor	Courses	
				— *MiC* —						
Fernwood-Lee	Elementary Education		4			1				+45 credits Administrative Certification
Fernwood-Weatherspoon	History		3	Elem. Ed		1				
Von Humboldt-Brown	Elementary Education		5-6	not yet completed						
Von Humboldt-Harvey*	Education	Elementary and Earth Science	6							
				—	*Conventional*	—				
Addams-Tallackson	Elementary and Special Education, English concentration	Theater minor	5	School Psychology						
Wacker-Krittendon	Elementary Education		3			45 credits				

*Harvey did not complete some teacher questionnaires.

A summary of the variations in teacher characterization of mathematics is presented in Table 28. Tallackson, Lee, and Krittendon agreed or strongly agreed with both static and dynamic perspective of the nature of mathematics. Weatherspoon and Brown agreed that mathematics is dynamic as well as static if it is not in a pragmatic sense. These two teachers agreed that mathematics is a collection of concepts and skills used to obtain answers to problems, but disagreed that mathematics is facts, skills, rules and concepts learned sequentially and applied in work and future study.

Table 28
Characterization of Mathematics, Sixth-Grade Teachers, District 1

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
	— MiC —			
Fernwood-Lee	Agree	Agree	Agree	Agree
Fernwood-Weatherspoon	Agree	Disagree	Strongly agree	Strongly agree
Von Humboldt-Brown	Agree	Disagree	Strongly agree	Agree
Von Humboldt-Harvey*				
	— Conventional —			
Addams-Tallackson	Agree	Agree	Agree	Agree
Wacker-Krittendon	Strongly agree	Strongly agree	Strongly agree	Strongly agree

*Harvey did not complete some teacher questionnaires.

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variations in teacher perspectives on mathematics teaching and learning is presented in Tables 29 and 30. Teachers varied in their beliefs about prerequisite mastery of basic skills. Three MiC teachers responded that students must master basic skills before engaging in more mathematics; the conventional teachers disagreed. Two of the five teachers responded that students must learn basic skills before they engage in higher order thinking such as analysis, comparisons, and generalization; the other teachers disagreed. However, every teacher agreed on four elements of instruction: 1) students learn best when they study mathematics in the context of everyday situations; 2) the use of calculations does not inhibit student learning; 3) small groups are effective in students' learning of mathematics; and 4) students should write about how they solve problems.

Table 29
Mathematics Teaching and Learning, Sixth-Grade Teachers, District 1, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Fernwood-Lee	Agree	Agree	Disagree	No Opinion	Disagree	Agree
Fernwood-Weatherspoon	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Disagree	Strongly Agree
Von Humboldt-Brown	Agree	Agree	Disagree	Strongly Agree	Strongly Disagree	Agree
Von Humboldt-Harvey*						
			— Conventional —			
Addams-Tallackson	Strongly Agree	Disagree	Disagree	Agree	Strongly Disagree	Agree
Wacker-Krittendon	Strongly Agree	Disagree	Agree	Agree	Strongly Disagree	Strongly Agree

*Harvey did not complete some teacher questionnaires.

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won't learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

Most sixth-grade teachers in District 1 agreed that it is more important to cover fewer topics in greater depth and that more algebra, geometry, and statistics should be introduced in the mathematics curriculum. The teachers all agreed that student understanding should be considered in teachers' planning for instruction, problem solving should be the central feature of the elementary or middle school curriculum, and they tried to make connections among mathematical topics and between mathematics and other disciplines. In their pedagogy, four of the five teachers agreed that 1) teaching a mathematical concept should begin with an example or model; 2) their primary goal is to help students master skills and procedures; 3) teachers should encourage students to find their own problem-solving strategies; 4) instruction should include many open-ended tasks; and 5) students should learn mathematics through regularly discussing their ideas with other students. For two items, teachers in this group have different opinions. In considering whether instruction should include step-by-step directions, Tallackson disagreed, Weatherspoon and Brown selected no opinion, and the other teachers agreed. For the matter of emphasizing simple mental computation, estimation, and less on emphasizing on lengthy pencil-and-paper calculation, Brown disagreed, Tallackson had no opinion, and the other teachers agreed with the statement.

Table 30
Mathematics Teaching and Learning, Sixth-Grade Teachers, District 1, Part II

School-Teacher	Pedagogy*					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Fernwood-Lee	Strongly agree	Agree	Agree	Strongly agree	Agree	Agree
Fernwood-Weatherspoon	Strongly agree	No opinion	No opinion	Strongly agree	Agree	Strongly agree
Von Humboldt-Brown	No opinion	Agree	No opinion	Strongly agree	Agree	Agree
Von Humboldt-Harvey**						
					— Conventional —	
Addams-Tallackson	Agree	Agree	Disagree	No opinion	No opinion	Agree
Wacker-Krittendon	Strongly agree	Strongly agree	Agree	Strongly agree	Strongly agree	Strongly agree

School-Teacher	Pedagogy					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
	— MiC —					
Fernwood-Lee	Agree	Agree	No opinion	No opinion	Strongly agree	Agree
Fernwood-Weatherspoon	Agree	Agree	Strongly agree	Strongly agree	Strongly agree	Agree
Von Humboldt-Brown	Disagree	No opinion	Agree	Agree	Agree	Agree
Von Humboldt-Harvey**						
	— Conventional —					
Addams-Tallackson	No opinion	Agree	Agree	Agree	Agree	Agree
Wacker-Krittendon	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree

* See questionnaire items 1-12 on next page.
** Harvey did not complete some teacher questionnaires.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculum.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variation in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 31. In assessing student learning, most sixth-grade teachers in District 1 sometimes reviewed standardized test scores, but most of them reported that the results did not influence what they taught next or student grades. Weatherspoon reported never using standardized test results, which is not surprising given that she was a substitute teacher prior to this study. All teachers in this group assess student learning through quizzes and tests and classroom projects. Results of quizzes and tests are regarded as somewhat or very important in determining what to teach next and in assigning student grades, but the importance of using classroom projects for these two purposes varied widely among the teachers from somewhat important to very important. Four of the teachers reported frequent use of student portfolios, and their use varied from somewhat important to very important in making decisions about what to teach next and assigning grades.

Table 31

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Sixth-Grade Teachers, District 1

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
						— MiC —
Fernwood-Lee	Sometimes	Not important at all	Not important at all	Sometimes	Not important at all	Not very important
Fernwood-Weatherspoon	Never	Not very important	Not very important	Often		
Von Humboldt-Brown	Often	Somewhat important	Not important at all	Sometimes	Somewhat important	Somewhat important
Von Humboldt-Harvey*						
						— Conventional —
Addams-Tallackson	Sometimes	Not very important	Not important at all	Often	Somewhat important	Very important
Wacker-Krittendon	Sometimes	Not very important	Not important at all	Always	Somewhat important	Very important
School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Fernwood-Lee	Always	Somewhat important	Very important	Always	Not very important	Very important
Fernwood-Weatherspoon	Often	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Von Humboldt-Brown	Often	Very important	Very important	Never	Somewhat important	Somewhat important
Von Humboldt-Harvey*						
Addams-Tallackson	Always	Very important	Very important	Always	Very important	Very important
Wacker-Krittendon	Always	Somewhat important	Somewhat important	Always	Very important	Very important

*Harvey did not complete some teacher questionnaires.

A summary of the variation in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 32. The sixth-grade teachers in District 1 frequently used various methods of informal classroom assessment. Most teachers agreed that students' oral and written explanations, work observed, and work across assessments were somewhat or very important both in determining what to teach next and in assigning student grades. Student questions were somewhat or very important in making decisions about what to teach next, but were not regarded as highly in determining student grades. Although Lee used all of these methods of informal assessment, the information she gathered was deemed not very important in determining what to teach next and in assigning student grades.

Table 32

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Sixth-Grade Teachers, District 1

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
								— MiC —	
Fernwood-Lee	Sometimes	Not very important	Not very important	Sometimes	Not very important	Not very important	Often	Not very important	Very important
Fernwood-Weatherspoon	Often	Somewhat important	Not important at all	Often	Very important	Somewhat important	Often	Very important	Somewhat important
Von Humboldt-Brown	Always	Very important	Somewhat important	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Von Humboldt-Harvey*									
								— Conventional —	
Addams-Tallackson	Always	Very important	Not very important	Always	Very important	Somewhat important	Always	Very important	Somewhat important
Wacker-Krittendon	Always	Very important	Very important	Always	Very important	Very important	Always	Very important	Very important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Fernwood-Lee	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Fernwood-Weatherspoon	Often	Somewhat important	Somewhat important			
Von Humboldt-Brown	Often	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Von Humboldt-Harvey*						
Addams-Tallackson	Always	Somewhat important	Somewhat important	Always	Very important	Somewhat important
Wacker-Krittendon	Always	Very important	Very important	Always	Very important	Very important

*Harvey did not complete some teacher questionnaires.

District 2

A summary of the variations in the teacher background characteristics is presented in Table 33. Among the six sixth-grade teachers who participated in the study in District 2, MiC was used by four teachers and conventional curricula were used by the other two. Three are female and three are male teachers. Four of the teachers are African American; the other two teachers are White. Their teaching experiences range from one year to twelve. Broughton is the most experienced teacher among this group and is a lead teacher; Rhaney is the least experienced.

Table 33
Summary Data on Background Characteristics, Sixth-Grade Teachers, District 2

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Levels Taught	Current Position
				— MiC —				
Guggenheim-Broughton	F	African American	12	N/A	12	6,7,8	6,7,8,9	Classroom teacher, Lead teacher
Guggenheim-Dillard	M	White	4	0	3	6	6,7,8,9,10,11,12	Classroom teacher
Hirsch Metro-Davenport	F	African American	4.5	0	4	6	6,7,8,10,11	Classroom teacher
Hirsch Metro-Holland	M	White	5	2	3	6	6,7,8	Classroom teacher
							— Conventional —	
Newberry-Renlund*	F	African American	2	1	1	6,8	6,8	Classroom teacher
Newberry-Rhaney	M	African American	1	0	1	6	7	Classroom teacher

*Renlund did not complete a teacher questionnaire.

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 34. All of the sixth-grade MiC teachers in District 2 taught MiC during at least one semester, and three teachers from Hirsch Metro Middle School have two years experience teaching MiC. The number of MiC units taught in previous years varied from one to 5-7 units. Reallotment was taught by all four teachers, and Fraction Times and More or Less were used by three teachers. Other units taught by Dillard and Davenport were Expression and Formulas, Made to Measure, Tracking Graphs, Dealing with Data, Packages and Polygons, and Building Formulas.

Table 34
Experience Teaching MiC, Sixth-Grade Teachers, District 2

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
		— MiC —	
Guggenheim-Broughton	One semester	2-4	Side Seeing, Reallotment
Guggenheim-Dillard	Two years	5-7, 4 in 2 classes, 6 in 3 classes	Side Seeing, Some of the Parts, Per Sense, Grasping Sizes, Patterns and Symbols, Reallotment, Made to Measure, Fraction Times, More or Less, Expressions and Formulas, Tracking Graphs, Dealing with Data, Packages and Polygons, Building Formulas
Hirsch Metro-Davenport	Two years, MiC was practiced during the year we received training (1995-1996)	One	Reallotment, Fraction Times, More or Less, Expressions and Formulas
Hirsch Metro-Holland	Two years	2-4	Reallotment, Fraction Times, More or Less
		— Conventional —	
Newberry-Renlund*	None	None	
Newberry-Rhaney	None	None	

*Renlund did not complete a teacher questionnaire.

A summary of the variations teacher professional training is presented in Table 35. Two of the six sixth-grade teachers in District 2 studied mathematics or mathematics education as a major. Other teachers studied a business-related field, health science, or engineering. Bachelor credits in mathematics differed according to their major ranging from 0 to 18 courses.

Table 35
Professional Training, Sixth-Grade Teachers, District 2

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	Minor	Courses	Major	Minor	Courses	Major	Minor	Courses	
				— MiC —						
Guggenheim-Broughton	Business Administration	Economics	3	Computer Education						
Guggenheim-Dillard	Mathematics Education		6							
Hirsch Metro-Davenport	Health Science Education, Recertification in mathematics									
Hirsch Metro-Holland	Mathematics major	Music								Professional Musician-Studio (NYC)
				— Conventional —						
Newberry-Renlund*	Marketing		18	Mathematics Education	Accounting	5				
Newberry-Rhaney	Mechanical Engineering		12							

*Renlund did not complete a teacher questionnaire.

A summary of the variation in teacher characterization of mathematics is presented in Table 36. Without exception, the teachers of sixth-grade in District 2 agreed or strongly agreed that mathematics is static as well as dynamic. They not only agreed that mathematics is a collection of concepts and skills used to obtain answers to problems and to apply to work and future study, but also agreed that mathematics is thinking in a logical, inquisitive manner used to develop understanding.

Table 36
Characterization of Mathematics, Sixth-Grade Teachers, District 2

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
	— MiC —			
Guggenheim-Broughton	Agree	Agree	Agree	Agree
Guggenheim-Dillard	Strongly agree	Agree	Agree	Agree
Hirsch Metro-Davenport	Agree	Agree	Strongly agree	Strongly agree
Hirsch Metro-Holland	Agree	Agree	Agree	Agree
	— Conventional —			
Newberry-Renlund*				
Newberry-Rhaney	Agree	Agree	Agree	Agree

*Renlund did not complete a teacher questionnaire.

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variation in teacher perspectives on mathematics teaching and learning is presented in Tables 37 and 38. Every teacher in this group agreed or strongly agreed that students best learn mathematics in the context of everyday situations and that small groups are useful for learning mathematics. They also think that including calculators in instruction is not problematic in mathematics class. Four of the five teachers agreed that basic skills must be mastered before students learn more mathematics. Teachers' beliefs about whether basic skills are necessary before students engage in high order thinking varied: Broughton and Rhaney agreed whereas the others disagreed.

Table 37
Mathematics Teaching and Learning, Sixth-Grade Teachers, District 2, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
			— MiC —			
Guggenheim-Broughton	Agree	Strongly agree	Agree	Strongly agree	Disagree	Agree
Guggenheim-Dillard	Agree	Disagree	Disagree	Strongly agree	Disagree	Strongly agree
Hirsch Metro-Davenport	Agree	Agree	Disagree	Strongly agree	Strongly disagree	Agree
Hirsch Metro-Holland	Agree	Agree	Disagree	Agree	Disagree	Agree
			— Conventional —			
Newberry-Renlund*						
Newberry-Rhaney	Agree	Strongly agree	Agree	Agree	Strongly disagree	No opinion

*Renlund did not complete a teacher questionnaire.

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won't learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

Sixth-grade teachers in District 2 varied in their responses regarding the content of the mathematics curriculum. Three of the five teachers agreed that it is more important to cover fewer topics in greater depth; two teachers (Davenport and Holland) had no opinion about this statement. Four teachers agreed that more algebra, geometry, and statistics should be introduced in the middle-school curriculum; one teacher (Holland) had no opinion on this matter. The teachers have competing opinions about several elements of pedagogy, although they reached consensus on five elements: 1) teaching a mathematical concepts should begin with a model or example; 2) teachers should encourage students develop their own strategies in solving problems; 3) instruction should include many open-ended tasks; 4) students should learn mathematics through regularly discussing their ideas with others; and 5) instruction should include connections among mathematical ideas and between mathematics and other subjects. Three teachers agreed and two teachers (Davenport and Holland) disagreed that instruction should include step-by-step directions and the primary goal of instruction is to help students master basic skills. Teachers' responses to statements about student thinking were also varied. Two teachers (Davenport and Holland) expressed no opinion while other teachers agreed that teachers should plan instruction based upon students' understanding; and two teachers (Holland and Rhaney) disagreed while three teachers agreed that more emphasis should be given to mental computation and estimation and less emphasis on lengthy pencil-and-paper calculation.

Table 38
Mathematics Teaching and Learning, Sixth-Grade Teachers, District 2, Part II

School-Teacher	Pedagogy*					
	1. Less Coverage More & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Exampl**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Guggenheim-Broughton	Agree	Agree	Agree	Agree	Agree	Agree
Guggenheim-Dillard	Agree	Strongly Agree	Agree	Agree	Agree	Agree
Hirsch Metro-Davenport	No Opinion	Strongly Agree	Disagree	Agree	Disagree	No Opinion
Hirsch Metro-Holland	No Opinion	No Opinion	Disagree	Agree	Disagree	No Opinion
					— Conventional —	
Newberry-Renlund**						
Newberry-Rhaney	Agree	Agree	Agree	Agree	Agree	Agree

School-Teacher	Pedagogy					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
	— MiC —					
Guggenheim-Broughton	Agree	Agree	No Response	Agree	Agree	Agree
Guggenheim-Dillard	Agree	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree
Hirsch Metro-Davenport	Agree	Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
Hirsch Metro-Holland	Disagree	Agree	Agree	Agree	No Opinion	Agree
		—	*Conventional*	*—*		
Newberry-Renlund**						
Newberry-Rhaney	Disagree	Agree	Agree	Agree	Agree	Agree

* See questionnaire items 1-12 on next page.
**Renlund did not complete a teacher questionnaire.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculu.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variation in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 39. In assessing student learning, four of the five teachers reported using students' performance on standardized tests. Standardized test results were regarded as somewhat or very important in determining what to teach next, but were not important or somewhat important in assigning student grades. The fifth teacher reported that she never used results from standardized tests. In contrast, all teachers used students' performance on classroom projects and quizzes and tests. All responded that results on quizzes and tests were somewhat important in determining what to teach next and somewhat important or very important in assigning student grades. Classroom projects were regarded not important or somewhat important in making decisions about what to teach next, but were somewhat important or very important in assigning student grades. Portfolios of student work were never used by three teachers and were used sometimes by the other two teachers. Consequently, none of the teachers felt portfolios were important considerations in what to teach next and in grading.

Table 39

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Sixth-Grade Teachers, District 2

School-Teacher	Types of Formal Assessment					
	Standardized Tests			Classroom Projects		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
					— MiC —	
Guggenheim-Broughton	Sometimes	Somewhat important	Somewhat important	Sometimes	Not very important	Somewhat important
Guggenheim-Dillard	Often	Somewhat important	Somewhat important	Often	Not very important	Somewhat important
Hirsch Metro-Davenport	Often	Very important	Not important at all	Often	Somewhat important	Somewhat important
Hirsch Metro-Holland	Often	Somewhat important	Not important at all	Often	Somewhat important	Very important
					— Conventional —	
Newberry-Renlund*						
Newberry-Rhaney	Never	Not important at all	Not important at all	Often	Somewhat important	Somewhat important

School-Teacher	Types of Formal Assessment					
	Classroom Quizzes and Tests			Portfolios of Student Work		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Guggenheim-Broughton	Often	Somewhat important	Very important	Never	Not important at all	
Guggenheim-Dillard	Always	Somewhat important	Somewhat important	Sometimes	Not very important	Not very important
Hirsch Metro-Davenport	Often	Somewhat important	Somewhat important	Never	Not important at all	Not important at all
Hirsch Metro-Holland	Often	Somewhat important	Very important	Never	Not very important	Not very important
Newberry-Renlund*						
Newberry-Rhaney	Always	Very important	Very important	Sometimes	Not very important	Not important at all

*Renlund did not complete a teacher questionnaire.

A summary of the variation in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 40. The sixth-grade teachers in District 2 reported using various methods of informal assessment. All teachers reported using students' written explanations as somewhat or very important in determining what to teach next and in assigning student grades. In general, all teachers thought that the work they observed students do in class was somewhat important in both deciding what to teach next and in determining student grades. Although all teachers thought that students' questions and oral explanations were somewhat or very important in making decisions about what to teach next, fewer teachers thought students' questions and oral explanations were important in determining student grades.

Table 40

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Sixth-Grade Teachers, District 2

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
								— MiC —	
Guggenheim-Broughton	Often	Very important	Not very important	Always	Somewhat important	Somewhat important	Always	Very important	Very important
Guggenheim-Dillard	Always	Very important	Not very important	Always	Very important	Not very important	Always	Very important	Somewhat important
Hirsch Metro-Davenport	Sometimes	Somewhat important	Not important at all	Sometimes	Somewhat important	Not very important	Sometimes	Somewhat important	Somewhat important
Hirsch Metro-Holland	Sometimes	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
								— Conventional —	
Newberry-Renlund*									
Newberry-Rhaney	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Guggenheim-Broughton	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Guggenheim-Dillard	Often	Somewhat important	Somewhat important		No response	
Hirsch Metro-Davenport	Sometimes	Somewhat important	Not very important	Sometimes	Somewhat important	Somewhat important
Hirsch Metro-Holland	Sometimes	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Newberry-Renlund*						
Newberry-Rhaney	Always	Very important	Very important	Always	Very important	Very important

*Renlund did not complete a teacher questionnaire.

District 3

A summary of the variation in teacher background characteristics is presented in Table 41. Five sixth-grade teachers in District 3 are from one school, Calhoun North. Tierney is the only male teacher, and all teachers are White. Teaching experience varied from 1 to 18 years. Solomon is a lead teacher for the grade level, and Vetter is a resource teacher teaching multiple grades.

Table 41
Summary Data on Background Characteristics, Sixth-Grade Teachers, District 3

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Level Taught	Current Position
				— MiC —				
Calhoun North-Bragg	F	White	7	0	1	6	1,6	Classroom teacher
Calhoun North-Schlueter	F	White	1	N/A	1	6	1,4 (student teaching)	Classroom teacher
Calhoun North-Solomon	F	White	9	1	8	6	6	Lead Teacher
Calhoun North-Tierney	M	White	18	5	7	6	3,4,5,6,7,8 and College-level	Classroom teacher
Calhoun North-Vetter	F	White	14	N/A	10	6,7	3,4,5,6,7	Resource Teacher

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 42. All sixth-grade teachers in District 3 used MiC. In general, they taught Some of the Parts, Measure for Measure, Fraction Times, and More or Less. Vetter has two years experience teaching MiC; and the other teachers have one semester or less than one semester experience teaching MiC.

Table 42
Experience Teaching MiC, Sixth-Grade Teachers, District 3

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
	— MiC —		
Calhoun North-Bragg	One semester	One	Some of the Parts, More or Less
Calhoun North-Schlueter	One semester	One	Measure for Measure, Fraction Times, More or Less
Calhoun North-Solomon	One year	2-4	Some of the Parts, Fraction Times, Expressions and Formulas
Calhoun North-Tierney	Less than one semester	None	
Calhoun North-Vetter	Two years	2-4	Some of the Parts, Measure for Measures, Picturing Numbers

A summary of the variation in teacher professional training is presented in Table 43. The sixth-grade teachers in District 3 have dramatically different educational backgrounds, none of which included study in education. In addition, undergraduate credits in mathematics varied from one to four. Tierney completed both bachelor and masters degrees in psychology and taught at the community college level. Bragg holds teaching credentials, and Vetter has credentials for working with learning handicapped students.

Table 43
Professional Training, Sixth-Grade Teachers, District 3

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	**Minor**	**Courses**	**Major**	**Minor**	**Courses**	**Major**	**Minor**	**Courses**	
				— MiC —						
Calhoun North-Bragg	Communications	Film	2							Teaching Credential
Calhoun North-Schlueter	Liberal studies		4							
Calhoun North-Solomon	Humanities		3							
Calhoun North-Tierney	Psychology		2	Psychology						Calif. Community college teaching, counseling
Calhoun North-Vetter	Child development		1							Learning handicapped

A summary of the variation in teacher characterization of mathematics is presented in Table 44. All of the teachers agreed that mathematics is a dynamic logical system that changes as new problem situations arise, and four of the five teachers agreed that mathematics is thinking in a logical, inquisitive manner and can be used to develop understanding. Their responses to statements about a static perspective of mathematics were more varied. Three agreed, one disagreed, and one expressed no opinion that mathematics is a set of skills used to obtain answers to problems, and two disagreed and three had no opinion that mathematics is a set of facts and skills learned sequentially and applied in work and future study.

Table 44
Characterization of Mathematics, Sixth-Grade Teachers, District 3

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
	— MiC —			
Calhoun North-Bragg	No Opinion	No opinion	Agree	Agree
Calhoun North-Schlueter	Agree	No opinion	Agree	Agree
Calhoun North-Solomon	Disagree	Disagree	Strongly agree	Strongly agree
Calhoun North-Tierney	Agree	No opinion	Agree	Agree
Calhoun North-Vetter	Agree	Disagree	No opinion	Agree

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variation in teacher perspectives on mathematics teaching and learning is presented in Tables 45 and 46. All teachers agreed that students learn mathematics best in small groups. Most teachers agreed that students learn mathematics best in the context of everyday situations and that calculator use will not undermine students' learning of mathematics. Although most teachers responded that basic skills do not need to be mastered before students studied more mathematics, they varied in perspectives on whether basic skills must be mastered before students could engage in higher order thinking (two agreed; three disagreed). Teachers also varied in response that students should write about their solution strategies (two agreed; three had no opinion).

Table 45
Mathematics Teaching and Learning, Sixth-Grade Teachers, District 3, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Calhoun North-Bragg	Strongly agree	Disagree	Disagree	Agree	Disagree	Strongly agree
Calhoun North-Schlueter	Agree	Agree	Agree	Agree	No opinion	No opinion
Calhoun North-Solomon	Strongly agree	Strongly disagree	Strongly disagree	Strongly agree	Disagree	No opinion
Calhoun North-Tierney	Agree	Disagree	Disagree	Agree	Disagree	No opinion
Calhoun North-Vetter	No opinion	No response	Agree	Agree	No response	Strongly agree

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won't learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

All sixth-grade teachers in District 3 agreed that it is more important to cover fewer topics in greater depth, but three agreed and two responded no opinion that more algebra, geometry, and statistics should be introduced in the middle-school curriculum. Teachers also agreed that 1) teachers should plan instruction based on students' understanding; 2) teachers should encourage students to find their own problem-solving strategies; 3) instruction should include many open-ended tasks; 4) problem solving should be a central feature in the curriculum; and 5) instruction should include connections among mathematical topics and between mathematics and other subjects. Four of the five teachers agreed that 1) teaching a concept should begin with a model or example; 2) more emphasis should be given to mental computation and estimation; and 3) students should learn mathematics through regularly discussing their ideas with others. Teachers varied considerably in their responses about whether instruction should include step-by-step directions and that their primary goal is to help students master basic skills.

Table 46
Mathematics Teaching and Learning, Sixth-Grade Teachers, District 3, Part II

School-Teacher	Pedagogy*					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Calhoun North-Bragg	Strongly Agree	Agree	Disagree	Agree	No Opinion	Agree
Calhoun North-Schlueter	Strongly Agree	No Opinion	Agree	Agree	Agree	Agree
Calhoun North-Solomon	Strongly Agree	Strongly Agree	No Opinion	Strongly Agree	Disagree	Strongly Agree
Calhoun North-Tierney	Agree	No Opinion	Agree	Agree	No Opinion	Strongly Agree
Calhoun North-Vetter	Agree	Agree	No Response	Disagree	Agree	Agree
School-Teacher	**Pedagogy**					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
Calhoun North-Bragg	Agree	Strongly Agree	Agree	Agree	Agree	Agree
Calhoun North-Schlueter	No Opinion	Agree	Strongly Agree	No Opinion	Agree	Agree
Calhoun North-Solomon	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree	Agree
Calhoun North-Tierney	Agree	Agree	Agree	Agree	Agree	Agree
Calhoun North-Vetter	Agree	Agree	Agree	Agree	Agree	Agree

* See questionnaire items 1-12 on next page.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculum.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variation in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 47. In assessing student learning, teachers used information from standardized tests, class projects, quizzes and test, and portfolios, but the importance of using these results to make decisions about what to teach next and grading varied considerably. Standardized test scores and student work across assessments were generally not regarded as important considerations in determining what to teach next and in assigning grades. Students' performance on class projects, quizzes and tests varied from not very important to very important in making decisions about the content to teach next and student grades.

Table 47

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Sixth-Grade Teachers, District 3

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
					— MiC —	
Calhoun North-Bragg	Sometimes	Somewhat important	Not very important	Often	Not very important	Somewhat important
Calhoun North-Schlueter	Sometimes	Not very important	Not very important	Often	Somewhat important	Very important
Calhoun North-Solomon	Sometimes	Not important at all	Not important at all	Sometimes	Not very important	Not very important
Calhoun North-Tierney	Sometimes	Not very important	Not important at all	Often	Somewhat important	Very important
Calhoun North-Vetter	Never	Not important at all	Not important at all	Always	Very important	Somewhat important

School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Calhoun North-Bragg	Sometimes	Not very important	Not very important	Sometimes	Not very important	Not very important
Calhoun North-Schlueter	Often	No Response	Very important	Sometimes	Not very important	Not very important
Calhoun North-Solomon	Often	Very important	Very important	Never	Not important at all	
Calhoun North-Tierney	Often	Somewhat important	Very important	Sometimes	Not important at all	Not important at all
Calhoun North-Vetter	Always	Very important	Somewhat important	Always	Somewhat important	Very important

A summary of the variation in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 48. The sixth-grade teachers in District 3 reported using various methods of informal assessment. In general, all teachers reported that information gathered during informal assessment was somewhat or very important in determining what to teach next and in assigning student grades.

Table 48

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Sixth-Grade Teachers, District 3

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Grades	Frequency	What to Teach Next	Grades	Frequency	What to Teach Next	Grades
							— *MiC* —		
Calhoun North-Bragg	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Calhoun North-Schlueter	Always	Very important	No Response	Often	Somewhat important	Somewhat important	Often	Somewhat important	Very important
Calhoun North-Solomon	Sometimes	Somewhat important	Not important at all	Always	Somewhat important	Not very important	Always	Very important	Very important
Calhoun North-Tierney	Often	Very important	Somewhat important	Often	Very important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Calhoun North-Vetter	Always	Very important	Somewhat important	Always	Very important	Somewhat important	Often	Somewhat important	Somewhat important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Calhoun North-Bragg	Sometimes	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Calhoun North-Schlueter	Always	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important
Calhoun North-Solomon	Often	Somewhat important	Somewhat important	Sometimes	Somewhat important	Very important
Calhoun North-Tierney	Often	Very important	Somewhat important			
Calhoun North-Vetter	Always	Very important	Very important	Always	Very important	Very important

District 4

A summary of the variation in teacher background characteristics is presented in Table 49. In District 4, both sixth-grade teachers are female; one is African American/Black and one is White. Both teachers have 10 years experience and have been teaching at the school from 5-8 years. Both were teaching MiC.

Table 49
Summary Data on Background Characteristics, Sixth-Grade Teachers, District 4

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Level Taught	Current Position
				— MiC —				
Kelvyn Park-Downer	F	African American	10	1	8	6	6,7,8	Classroom teacher
Kelvyn Park-Vega	F	White	10	3	5	6	6,7,8,9,10,11	Classroom teacher

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 50. Both teachers have one year experience teaching MiC and used 5-7 MiC units in the previous year. Some of those units are Reallotment, Fraction Times, More or Less, Expressions and Formulas.

Table 50
Experience Teaching MiC, Sixth-Grade Teachers, District 4

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
	— MiC —		
Kelvyn Park-Downer	One year	5-7	Patterns and Symbols, Reallotment, Fraction Times, More or Less, Expressions and Formulas, Comparing Quantities
Kelvyn Park-Vega	One year	5-7	Reallotment, Fraction Times, More or Less, Expressions and Formulas, Comparing Quantities

A summary of the variation in teacher professional training is presented in Table 51. Both sixth-grade teachers in District 4 reported having majors in mathematics. Both studied masters' courses related to mathematics or mathematics education as their major. Downer is currently working toward a doctoral degree in mathematics education.

Table 51
Professional Training, Sixth-Grade Teachers, District 4

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	**Minor**	**Courses**	**Major**	**Minor**	**Courses**	**Major**	**Minor**	**Courses**	
				— MiC —						
Kelvyn Park-Downer	Applied Mathematics		Over 12	Multicultural Education, Mathematics Education		45+ credits	In the process Math Ed.		Requirements	
Kelvyn Park-Vega	Mathematics	Secondary Education	Many courses	Mathematics and Secondary Education		5				

A summary of the variation in teacher characterization of mathematics is presented in Table 52. Both sixth grade teachers in District 4 agreed that mathematics has both static and dynamic characteristics.

Table 52
Characterization of Mathematics, Sixth-Grade Teachers, District 4

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
	— *MiC* —			
Kelvyn Park-Downer	Agree	Agree	Agree	Agree
Kelvyn Park-Vega	Agree	Agree	Strongly Agree	Agree

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variation in teacher perspectives on mathematics teaching and learning is presented in Tables 53 and 54. They agreed that 1) students learn mathematics best in the context of everyday situations; 2) students learn mathematics best when they are able to work in small groups; 3) calculators do not inhibit students' learning of mathematics; and 4) students should write about how they solve mathematics problems. Their responses varied, however, with respect to mastery of basic skills prior to more mathematics content and higher order thinking. Downer disagreed that students need to master skills before they study more mathematics and engage in higher order thinking such as analysis, comparison, and generalization whereas Vega thought that basic skills must be mastered before these are introduced.

Table 53
Mathematics Teaching and Learning, Sixth-Grade Teachers, District 4, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Kelvyn Park-Downer	Strongly Agree	Disagree	Disagree	Agree	Disagree	Strongly Agree
Kelvyn Park-Vega	Agree	Agree	Strongly Agree	Agree	Disagree	Agree

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won't learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

Both teachers agreed or strongly agreed that it is important to cover fewer topics in greater depth and that more algebra, geometry, and statistics should be introduced in the middle-school mathematics curriculum. Both also agreed or strongly agreed that 1) instruction should include step-by-step directions; 2) teaching a concept should begin with a model or example; 3) instruction should include many open-ended tasks; 4) students should learn mathematics through regularly discussing their ideas with other students; 5) problem solving should be a central feature of the curriculum; and 6) instruction should include connections among mathematical topics and between mathematics and other subjects. The teachers varied in their responses to four elements of pedagogy. Vega agreed but Downer disagreed that the teacher's primary goal is to help students master basic skills. Vega agreed but Downer expressed no opinion regarding the other three categories: teachers should plan instruction based on students' understanding; more emphasis should be given to mental computation and estimation; and teachers should encourage students to develop their own strategies to solve problems.

Table 54
Mathematics Teaching and Learning, Sixth-Grade Teachers, District 4, Part II

School-Teacher	**Pedagogy**					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4., Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Kelvyn Park-Downer	Strongly agree	Agree	Strongly agree	Strongly agree	Disagree	No opinion
Kelvyn Park-Vega	Strongly agree	Strongly agree	Agree	Agree	Agree	Agree
School-Teacher	**Pedagogy**					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
Kelvyn Park-Downer	No opinion	No opinion	Agree	Agree	Agree	Strongly agree
Kelvyn Park-Vega	Agree	Agree	Agree	Agree	Strongly agree	Agree

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculum.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variation in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 55. In assessing student learning, the two sixth-grade teachers in District 4 varied in their use of standardized test results. Downer never used test results whereas Vega thought they were somewhat important when making decisions about student grades. Both teachers frequently used students' performance on class projects, quizzes and tests, and portfolios in assessing student learning. However, the teachers differed in the degree these influenced determining what to teach next and assigning student grades. Downer felt that information gathered from projects, quizzes, tests, and portfolios were very important in making these decisions whereas Vega felt they were somewhat important in making such decisions.

Table 55
Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Sixth-Grade Teachers, District 4

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
					— MiC —	
Kelvyn Park-Downer	Never	Not important at all	Not important at all	Often	Very important	Very important
Kelvyn Park-Vega	Sometimes	Not important at all	Somewhat important	Often	Somewhat important	Somewhat important
School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Kelvyn Park-Downer	Often	Very important	Very important	Often	Very important	Very important
Kelvyn Park-Vega	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important

A summary of the variation in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 56. The sixth-grade teachers in District 4 reported using various methods of informal assessment. Both teachers frequently used students' questions, oral and written explanations, observed work, and work across assessments in assessing student learning. Similarly, the teachers differed in the degree these influenced both determining what to teach next and assigning student grades. Downer again felt that information gathered during informal classroom assessment was very important in making these decisions whereas Vega felt they were somewhat important in making such decisions.

Table 56

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Sixth-Grade Teachers, District 4

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
							— MiC —		
Kelvyn Park-Downer	Often	Very important	Very important	Often	Very important	Very important	Often	Very important	Very important
Kelvyn Park-Vega	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Kelvyn Park-Downer	Often	Very important	Very important	Often	Very important	Very important
Kelvyn Park-Vega	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important

In summary, 19 sixth-grade teachers participated in the study during 1997-1998. Fifteen teachers used MiC and four teachers used the conventional curricula already in place in their schools. Generally, the sixth-grade teachers had wide range of teaching experience from 1 to 30 years; the average, however, was 8.5 years.

Among the fifteen MiC teachers, six had no prior experience teaching MiC and other teachers had one to 4 semesters experience teaching MiC. Educational background varied among the sixth-grade teachers with eight teachers having undergraduate degrees outside education. Many teachers took a limited number of mathematics courses as part of their professional preparation. Some teachers did not indicate that they took mathematics courses.

Generally, the sixth-grade study teachers agreed with the dynamic nature of mathematics, but many teachers also agreed with a static interpretation of mathematics. The sixth-grade teachers in District 3, however, characterized mathematics as a dynamic discipline rather than static one. All nineteen teachers agreed that students learn mathematics best in the context of everyday situations. Most teachers agreed that students learn mathematics best in small groups, students should write about how they solve problems, and that the use of calculators does not inhibit mathematics learning. Teachers were divided about the necessity to master basic skills before students are introduced to more mathematics and before students can engage in higher order thinking.

Most sixth-grade teachers agreed or strongly agreed that it is more important to cover less topics in greater depth and that more algebra, geometry, and statistics should be introduced in elementary- and middle-school mathematics curricula. They all agreed that 1) teaching a mathematical concept should begin with a concrete example or model, and 2) connections among mathematical topics and between mathematics and other disciplines should be emphasized. Despite no opinion from some teachers, many teachers also agreed that 1) teachers should plan instruction based upon their knowledge of their students' understanding; 2) teachers should encourage students to find their own problem-solving strategies even if the strategies are inefficient; 3) instruction should include many open-ended tasks; 4) students should learn mathematics through regularly discussing their ideas with other students; and 5) problem solving should be a central feature of the mathematics curriculum.

In assessing student learning through more formal methods, every sixth-grade teacher used performance on classroom projects and performance on quizzes and tests. However, most District 1 and 2 teachers thought these two methods were not as helpful in deciding what to teach next and assigning student grades, as District 3 and 4 teachers who thought they were important for such purposes. Many teachers used results of standardized tests but did not regard them as very important in making decisions about the content to teach next and student grading. District 1 and 3 teachers thought results of standardized tests were not important at all, while District 2 and 4 teachers had divided opinions from not important at all to very important for these purposes.

All sixth-grade teachers reported using various methods of informal classroom assessment, including students' questions, oral and written explanations, work observed and work across assessments. The information gathered from these assessments varied in importance (from somewhat to very important) for determining the content to teach next and assigning student grades.

Grade 7

District 1

A summary of the variation in teacher background characteristics is presented in Table 57. Four seventh-grade teachers in District 1 participated in this study. MiC was used by two of these teachers, conventional curricula were used by the other two teachers. Two teachers are female and two are male; all are White. Most have 3 to 4 years of teaching experience, but one teacher (Donnely) has been teaching for 13 years. St. James is also the mathematics chair at his school.

Table 57
Summary Data on Background Characteristics, Seventh-Grade Teachers, District 1

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Level Taught	Current Position
				— MiC —				
Fernwood-Heath	F	White	4	0	3	7	7,10,11,12	Classroom teacher
Von Humboldt-Donnely	M	White	13	7	0	7	5,6,7,8,9,10,11,12 and College	Classroom teacher
				— Conventional —				
Addams-St.James	M	White	3	3	2	7	6,9,10,11	Classroom teacher, Department chair
Von Humboldt-McLaughlin	F	White	4+	0	4	7	7,8	Classroom teacher

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 58. Among the two teachers who are using MiC, Heath taught one MiC unit, Building Formulas, prior to the study; Donnely had no previous experience teaching MiC.

Table 58
Experience Teaching MiC, Seventh-Grade Teachers, District 1

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
	— MiC —		
Fernwood-Heath Von Humboldt-Donnely	Less than one semester	One	Building Formulas
	— Conventional —		
Addams-St.James Von Humboldt-McLaughlin			

A summary of the variation in teacher professional training is presented in Table 59. The seventh-grade teachers in District 1 have majors or minors in mathematics, each listing 9 to 10 courses in mathematics. Among these teachers, Donnely has teaching certification from Delaware, Missouri and West Virginia. He is also studying math education at the master's level. McLaughlin is currently enrolled in a master's program in Curriculum and Instruction.

Table 59
Professional Training, Seventh-Grade Teachers, District 1

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	Minor	Courses	Major	Minor	Courses	Major	Minor	Courses	
				— MiC —						
Fernwood-Heath	Psychology Education	Secondary Mathematics	9							
Von Humboldt-Donnely	Mathematics		10	Math		10				Teacher Certification in DE, MO, WV
				— Conventional —						
Addams-St.James	Mathematics Education		10							
Von Humboldt-McLaughlin	Elementary Education	Middle level mathematics	10							Currently enrolled in master's program for Curriculum & Instruction.

A summary of the variation in teacher characterization of mathematics is presented in Table 60. With the exception of McLaughlin, the seventh-grade teachers in District 1 agreed with dynamic perspectives about mathematics. The teachers, however, varied with respect to static perspectives. Heath and St. James agreed that mathematics is a set of skills used to obtain answers to problems; the other teachers responded no opinion. St. James agreed, Donnely disagreed, and the others had no opinion that mathematics is a set of facts and skills learned sequentially and applied in work and future study.

Table 60
Characterization of Mathematics, Seventh-Grade Teachers, District 1

School-Teacher	**Static 1**	**Static 2**	**Dynamic 3**	**Dynamic 4**
	— MiC —			
Fernwood-Heath	Agree	No opinion	Agree	Agree
Von Humboldt-Donnely	No opinion	Disagree	Strongly agree	Strongly agree
	— Conventional —			
Addams-St.James	Strongly agree	Agree	Strongly agree	Agree
Von Humboldt-McLaughlin	No opinion	No opinion	No opinion	Strongly agree

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variation in teacher perspectives on mathematics teaching and learning is presented in Tables 61 and 62. All teachers agreed that students learn best when they study mathematics in the context of everyday situations and that students should write about how they solve problems. Three of the four teachers also agreed that the use of calculators does not inhibit student learning, and three did not express an opinion about whether students learn mathematics best in small groups. Two teachers (Donnely and St. James) agreed that students need to master basic skills before they study more mathematics and before they engage in higher order thinking such as analysis, comparison, and generalization. Although Heath responded no opinion and McLaughlin disagreed that students need to master basic skills before they study more mathematics, both of these teachers thought that students did not need to master basic skills before engaging in higher order thinking.

Table 61
Mathematics Teaching and Learning, Seventh-Grade Teachers, District 1, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Fernwood-Heath	Strongly agree	No opinion	Disagree	No opinion	No opinion	Agree
Von Humboldt-Donnely	Agree	Agree	Agree	No opinion	Disagree	Agree
		— Conventional —				
Addams-St.James	Strongly agree	Strongly agree	Strongly agree	No opinion	Disagree	Strongly agree
Von Humboldt-McLaughlin	Strongly agree	Disagree	Disagree	Agree	Strongly disagree	Strongly agree

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won't learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

All teachers agreed that more algebra, geometry, and statistics should be introduced in the middle-school curriculum. With the exception of St.James, the teachers agreed that it is more important to cover fewer topics in greater depth. All teachers agreed that 1) teachers should plan instruction based on student understanding; 2) students should learn mathematics through regularly discussing their ideas with other students; and 3) instruction should include connections among mathematical ideas and between mathematics and other disciplines. Three of the four teachers agreed that 1) teaching a concept should begin with a model or example; 2) more emphasis should be given to mental computation and estimation; 3) teachers should encourage students to develop their own solution strategies; and 4) problem solving should be a central feature of the curriculum. Teachers also varied in their responses to two elements of pedagogy: 1) mathematics instruction should include step-by-step direction (Donnely and St. James strongly agreed, McLaughlin disagreed and Heath expressed no opinion); and 2) the teacher's primary goal is to help students master basic skills (St. James agreed, Heath and McLaughlin disagreed but Donnely expressed no opinion).

Table 62
Mathematics Teaching and Learning, Seventh-Grade Teachers, District 1, Part II

School-Teacher	**Pedagogy***					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Fernwood-Heath	Agree	Agree	No Opinion	Disagree	Disagree	Agree
Von Humboldt-Donnely	Agree	Agree	Strongly Agree	Agree	No Opinion	Agree
					— Conventional —	
Addams-St.James	Disagree	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree
Von Humboldt-McLaughlin	Strongly Agree	Strongly Agree	Disagree	Agree	Disagree	Strongly Agree
School-Teacher	**Pedagogy**					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
Fernwood-Heath	No Opinion	Agree	Agree	Agree	Agree	Agree
Von Humboldt-Donnely	Agree	Agree	Agree	Agree	Disagree	Agree
Addams-St.James	Agree	Disagree	Disagree	Agree	Agree	Strongly Agree
Von Humboldt-McLaughlin	Agree	Agree	Agree	Agree	Strongly Agree	Agree

* See questionnaire items 1-12 on next page.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculu.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variation in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 63. Three of the seventh-grade teachers in District 1 sometimes used standardized test results but they varied in the significance for making decisions about the content to teach next and assigning student grades. Donnely thought results from standardized tests were somewhat important in determining both what to teach next and student grades whereas McLaughlin thought students' performance on standardized tests was not important in making such decisions. St. James, however, thought that results from standardized tests were not important for determining the context to teach next, but they were somewhat important in assigning students grades. Heath reported never using standardized test results, though she thought it is somewhat important for determining what to teach next. Although all teachers reported using students' performance on class projects, quizzes and tests, and portfolios, they consistently felt that information gathered from quizzes and tests were very important both for making decisions about the content to teach next and assigning student grades, and three of the teachers felt that portfolios of student work were somewhat important in making such decisions. The importance of students' performance on class projects, however, varied widely. In making decisions about what to teach next, two teachers felt that information from class projects was somewhat important and two teachers felt it was not very important. In making decisions about student grades, the importance of results from class projects varied from not very important to very important.

Table 63
Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Seventh-Grade Teachers, District 1

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
					— MiC —	
Fernwood-Heath	Never	Somewhat important	Not important at all	Often	Not very important	Very important
Von Humboldt-Donnely	Sometimes	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
					— Conventional —	
Addams-St.James	Sometimes	Not important at all	Somewhat important	Sometimes	Not very important	Not very important
Von Humboldt-McLaughlin	Sometimes	Not very important	Not important at all	Often	Somewhat important	Very important
School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Fernwood-Heath	Always	Very important	Very important	Sometimes	Somewhat important	Somewhat important
Von Humboldt-Donnely	Often	Very important	Very important	Sometimes	Somewhat important	Somewhat important
Addams-St.James	Always	Very important	Very important	Sometimes	Not very important	Not very important
Von Humboldt-McLaughlin	Always	Very important	Very important	Often	Somewhat important	Somewhat important

A summary of the variation in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 64. All seventh-grade teachers in District 1 frequently used various forms of informal classroom assessment, and they generally felt that the information gathered was very important in determining what to teach next and somewhat or very important in assigning student grades. Although all teachers thought about student work across assessments, generally the information gathered in this way was regarded as somewhat important in making decisions about the content to teach next and student grading.

Table 64

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Seventh-Grade Teachers, District 1

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
							— MiC —		
Fernwood-Heath	Often	Very important	Somewhat important	Often	Very important	Somewhat important	Often	Somewhat important	Somewhat important
Von Humboldt-Donnely	Often	Very important	Very important	Often	Very important	Very important	Always	Very important	Very important
						— Conventional—			
Addams-St.James	Always	Very important	Very important	Always	Very important	Very important	Always	Very important	Very important
Von Humboldt-McLaughlin	Always	Very important	Somewhat important	Always	Very important	Somewhat important	Often	Very important	Very important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Fernwood-Heath	Always	Very important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Von Humboldt-Donnely	Often	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Addams-St.James	Always	Very important	Very important	Often	Somewhat important	Somewhat important
Von Humboldt-McLaughlin	Always	Very important	Very important	Often	Very important	Somewhat important

District 2

A summary of the variation in teacher background characteristics is presented in Table 65. In District 2, six seventh-grade teachers participated in the study. MiC was used by four teachers and conventional curricula were used by the other two teachers. and The seventh-grade teachers in District 2 are all female; three are White and three are African American. The two teachers who are teaching with conventional curricula have 6 to 11 years of teaching experience. MiC teachers in this group range from 4 to 24 years of teaching experience. Teague, who has 24 years of experience, is also working as a team leader. The next most experienced teachers (Keeton and McFadden) are mathematics chairs in their schools. Cunningham is also a lead teacher.

Table 65
Summary Data on Background Characteristics, Seventh-Grade Teachers, District 2

School-Teacher	Sex	Ethnicity	Full-Time Teaching (years)	Part-Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Level Taught	Current Position
				— MiC —				
Guggenheim-Keeton	F	African American	18	0	13	6	6,7,8,9	Department chair
Guggenheim-Teague	F	White	24	0	10	7	3,6,7,8	Classroom teacher, Team Leader
Hirsch Metro-Draski	F	African American	4	0	34	7	6,7,8	Classroom teacher
Hirsch Metro-McFadden	F	White	18	0	10	7	4,6,7,8,9,10,11,12	Department chair
				— Conventional —				
Newberry-Cunningham	F	African American	11	0	10	7,8	K,6,7,8,9,10,11,12	Lead Teacher
Newberry-Stark	F	White	6	10	1	7	6,7,8,College (freshman) and Non-credit adults	Classroom teacher

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 66. Each of the seventh-grade MiC teachers in District 2 taught at least 2-4 MiC units in the previous year and three teachers have two years or more experience teaching MiC. The specific units taught were different according to schools. For example, teachers from Guggenheim Middle School used Side Seeing, Per Sense, Patterns and Symbols, Picturing Numbers, Reallotment, Ratios and Rates, Expressions and Formulas, and Building Formulas. The teachers in Hirsch Metro Middle School used Dealing with Data, Packages and Polygons, Cereal Numbers, and Building Formulas.

Table 66
Experience Teaching MiC, Seventh-Grade Teachers, District 2

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
	— MiC —		
Guggenheim-Keeton	More than two years	2-4	Side Seeing, Per Sense, Patterns and Symbols, Reallotment, Ratios and Rates; parts of Grasping Sizes, Picturing Numbers, Powers of Ten, Comparing Quantities, and Digging Numbers
Guggenheim-Teague	Less than one semester	2-4	Per Sense, Picturing Numbers, Expressions and Formulas, Building Formulas
Hirsch Metro-Draski	Two years	2-4	Packages and Polygons, Cereal Numbers, Building Formulas
Hirsch Metro-McFadden	Two years, 1995-1996 MiC training began in February and covered 1 unit only through January. 1996-1997 3 units covered during year	2-4	Dealing with Data, Cereal Numbers, Building Formulas
	— Conventional —		
Newberry-Cunningham	None		
Newberry-Stark	None		

A summary of the variation in teacher professional training is presented in Table 67. The seventh-grade teachers in District 2 varied in their majors and the mathematics credits they studied. Three business-related majors and three education majors were reported. Keeton is completing graduate work. The number of mathematics courses taken varied from 0 to 4 courses.

Table 67
Professional Training, Seventh-Grade Teachers, District 2

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	**Minor**	**Courses**	**Major**	**Minor**	**Courses**	**Major**	**Minor**	**Courses**	
				— MiC —						
Guggenheim-Keeton	Finance			In process		9 credits				
Guggenheim-Teague	Education		3							
Hirsch Metro-Draski	Secondary Education									
Hirsch Metro-McFadden	Secondary Education (endorsement in Mathematics)	Art								
				— Conventional —						
Newberry-Cunningham	Accounting major		4							
Newberry-Stark	Business	Statistics	2 and accounting / economics courses	Teaching English as a second lang.						

A summary of the variation in teacher characterization of mathematics is presented in Table 68. Generally, all seventh-grade teachers in District 2 characterized mathematics as a dynamic discipline. Five of the six teachers also thought that mathematics is a set of skills used to obtain answers to problems, and four agreed that mathematics is a set of facts and skills learned sequentially and is applied in work and future study.

Table 68
Characterization of Mathematics, Seventh-Grade Teachers, District 2

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
	— MiC —			
Guggenheim-Keeton	Strongly Agree	Disagree	Strongly Agree	Strongly Agree
Guggenheim-Teague	Strongly Agree	Strongly Agree	Agree	Agree
Hirsch Metro-Draski	Agree	Agree	Agree	Strongly Agree
Hirsch Metro-McFadden	Agree	Agree	Strongly Agree	Strongly Agree
	— Conventional —			
Newberry-Cunningham	Strongly Disagree	Agree	Strongly Agree	Strongly Agree
Newberry-Stark	Strongly Agree	Strongly Disagree	Strongly Agree	Strongly Agree

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variation in teacher perspectives on mathematics teaching and learning is presented in Tables 69 and 70. All teachers also agreed or strongly agreed that students learn mathematics best in the context of everyday situations and that they should write about how they solve problems, and, with the exception of no opinion reported by Teague, all teachers agreed that students learn best in small groups and that the use of calculators does not inhibit learning mathematics. The two conventional teachers (Cunningham and Stark) disagreed with other teachers by responding that students must master basic skills before they are introduced to more mathematics content, and two teachers (Keeton and Teague) disagreed with other teachers by responding that students must master basic skills before they can engage in higher order thinking.

Table 69
Mathematics Teaching and Learning, Seventh-Grade Teachers, District 2, Part I

School-Teacher	Student Learning					
	1. Context(a)	**2. Skill before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Guggenheim-Keeton	Strongly Agree	Agree	Agree	Agree	Disagree	Strongly Agree
Guggenheim-Teague	Agree	Strongly Agree	No Opinion	No Opinion	No Opinion	Agree
Hirsch Metro-Draski	Agree	Agree	Disagree	Agree	Disagree	Agree
Hirsch Metro-McFadden	Agree	Agree	Disagree	Strongly Agree	Strongly Disagree	Agree
		— Conventional —				
Newberry-Cunningham	Strongly Agree	Disagree	Disagree	Strongly Agree	Strongly Disagree	Strongly Agree
Newberry-Stark	Strongly Agree	Strongly Disagree	Strongly Disagree	Strongly Agree	Strongly Disagree	Strongly Agree

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won't learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

With the exception of Draski and McFadden, the seventh-grade teachers in District 2 agreed or strongly agreed that less content should be covered in greater depth, and, with the exception of Draski, all teachers agreed or strongly agreed that more algebra, geometry, and statistics should be introduced in the middle-school curriculum. All teachers agreed or strongly agreed that 1) teaching a concept should begin with a model or example; 2) students should be encouraged to create their own solution strategies; 3) instruction should include many open-ended tasks; 4) students should learn mathematics through regularly discussing their ideas with other students; 5) problem solving should be a central feature of the mathematics curriculum; and 6) instruction should include connections among mathematical ideas and between mathematics and other subjects. With the exception of Teague, all teachers agreed that instruction should include step-by-step directions and that more emphasis should be given to mental computation and estimation. Most teachers, with the exception of Keeton and Teague, disagreed or strongly disagreed that the teacher's primary goal was to help students master basic skills.

Table 70
Mathematics Teaching and Learning, Seventh-Grade Teachers, District 2, Part II

School-Teacher	Pedagogy*					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Guggenheim-Keeton	Strongly Agree	Agree	Disagree	Agree	Agree	Strongly Agree
Guggenheim-Teague	Agree	Agree	Agree	Agree	Strongly Agree	No Opinion
Hirsch Metro-Draski	No Opinion	No Opinion	Disagree	Agree	Disagree	No Opinion
Hirsch Metro-McFadden	No Opinion	Strongly Agree	Disagree	Agree	Disagree	No Opinion
					— Conventional —	
Newberry-Cunningham	Strongly Agree	Strongly Agree	Disagree	Strongly Agree	Strongly Disagree	Strongly Agree
Newberry-Stark	Strongly Agree	Strongly Agree	Disagree	Strongly Agree	Strongly Disagree	No Opinion

School-Teacher	Pedagogy					
	7. Student Thinking	**8. Invented Strategies**	**9.Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
Guggenheim-Keeton	Agree	Strongly Agree	Agree	Agree	Agree	Strongly Agree
Guggenheim-Teague	No Opinion	Agree	Agree	Agree	Agree	Agree
Hirsch Metro-Draski	Strongly Agree	Agree	Agree	Strongly Agree	Agree	Strongly Agree
Hirsch Metro-McFadden	Agree	Agree	Agree	Strongly Agree	Strongly Agree	Strongly Agree
Newberry-Cunningham	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
Newberry-Stark	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree

* See questionnaire items 1-12 on next page.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculu.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variation in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 71. Although the seventh-grade teachers in District 2 used students' performance on standardized tests, their general consensus was that the results were not important in making decisions about student grades. In determining the content to teach next, the importance of using standardized test results was quite varied from not very important to very important. All teachers frequently used students' performance on class projects and quizzes and tests, and they thought that both forms of assessment were somewhat or very important in determining what to teach next and assigning student grades. Teachers in this group rarely used portfolios of student work. Keeton reported using information from portfolios often and regarded the information somewhat important in making decisions about the content to teach next and student grades. Although Cunningham reported never using portfolios, she felt that the information gained from them would be very important in making decisions about content and grades.

Table 71

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Seventh-Grade Teachers, District 2

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
					— MiC —	
Guggenheim-Keeton	Sometimes	Not very important	Not important at all	Often	Very important	Very important
Guggenheim-Teague	Sometimes	Not very important	Not important at all	Sometimes	Not very important	Somewhat important
Hirsch Metro-Draski	Often	Very important	Not important at all	Often	Somewhat important	Somewhat important
Hirsch Metro-McFadden	Often	Very important	Not important at all	Often	Somewhat important	Somewhat important
					— Conventional —	
Newberry-Cunningham	Sometimes	Somewhat important	Not very important	Always	Somewhat important	Very important
Newberry-Stark	Often	Somewhat important	Somewhat important	Sometimes	Somewhat important	Not very important
School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Guggenheim-Keeton	Often	Very important	Very important	Often	Somewhat important	Somewhat important
Guggenheim-Teague	Often	Somewhat important	Very important	Never	Not important at all	Not important at all
Hirsch Metro-Draski	Often	Somewhat important	Somewhat important	Never	Not important at all	Not important at all
Hirsch Metro-McFadden	Often	Somewhat important	Somewhat important	Never	Not important at all	Not important at all
Newberry-Cunningham	Sometimes	Very important	Somewhat important	Never	Very important	Very important
Newberry-Stark	Often	Somewhat important	Somewhat important	Sometimes	Not very important	Not important at all

A summary of the variation in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 72. In assessing student learning, all teachers used various methods of informal classroom assessment, and they generally thought that the information gathered was somewhat or very important in determining what to teach next. Most teachers regarded information from student work across assessments as very important in determining student grades, and information gathered from students' questions, oral and written explanations, and work observed were generally regarded as somewhat or very important in grading.

Table 72

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Seventh-Grade Teachers, District 2

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Guggenheim-Keeton	Always	Very important	Somewhat important	Always	Very important	Very important	Always	Very important	Very important
Guggenheim-Teague	Always	Very important	Somewhat important	Often	Very important	Somewhat important	Sometimes	Not very important	Somewhat important
Hirsch Metro-Draski	Sometimes	Somewhat important	Not important at all	Sometimes	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Hirsch Metro-McFadden	Sometimes	Somewhat important	Not important at all	Sometimes	Somewhat important	Not very important	Sometimes	Somewhat important	Somewhat important
						— Conventional —			
Newberry-Cunningham	Always	Very important	Very important	Sometimes	Somewhat important	Very important	Often	Very important	Very important
Newberry-Stark	Always	Very important	Somewhat important	Always	Very important	Somewhat important	Sometimes	Very important	Not important at all

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Guggenheim-Keeton	Always	Very important	Very important	Often	Very important	Somewhat important
Guggenheim-Teague	Often	Somewhat important	Somewhat important		No Response	
Hirsch Metro-Draski	Often	Somewhat important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Hirsch Metro-McFadden	Sometimes	Somewhat important	Not very important	Sometimes	Somewhat important	Somewhat important
Newberry-Cunningham	Always	Very important	Very important	Never	Very important	Very important
Newberry-Stark	Always	Very important	Very important	Always	Very important	Very important

District 3

A summary of the variation in teacher background characteristics is presented in Table 73. Two seventh grade teachers in District 3 participated in the study. MiC was used by both teachers. Both are female and White. Perry has 9 years teaching experience. Schroeder is a special education teacher and has 25 years experience.

Table 73
Summary Data on Background Characteristics, Seventh-Grade Teachers, District 3

School-Teacher	Sex	Ethnicity	Full time Teaching (years)	Part Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Levels Taught	Current Position
				— MiC —				
Calhoun North-Perry	F	White	9	0	9	7	7,8,9 and Adult	Classroom teacher
Calhoun North-Schroeder	F	White	25	0	19	7,8	2,3,5,6	Special Education Teacher

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 74. Both teachers have two years experience teaching MiC and used 2 to 4 units in the previous year. Both used Fraction Times, Operations, Powers of Ten, and several other units.

Table 74
Experience Teaching MiC, Seventh-Grade Teachers, District 3

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
		— *MiC* —	
Calhoun North-Perry	Two years	2-4 units	Dry and Wet Numbers, Reallotment, Fraction Times, Comparing Quantities, Operations, Packages and Polygons, Powers of Ten
Calhoun North-Schroeder	Two years	2-4 units	Some of the Parts, Measure for Measure, Fraction Times, More or Less, Operations, Packages and Polygons, Powers of Ten

A summary of the variation in teacher professional training is presented in Table 75. Perry studied business and took 10 mathematics credits for her bachelor's degree. She also completed a supplemental credential in mathematics. Schroeder majored in Social Science and holds credentials as a resource specialist for learning handicapped students.

Table 75
Professional Training, Seventh-Grade Teachers, District 3

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	Minor	Courses	Major	Minor	Courses	Major	Minor	Courses	
				— *MiC* —						
Calhoun North-Perry	Business		10							Math supplement
Calhoun North-Schroeder	Soc Sci	Anthropology	3-4							Learning handicapped, Resource specialist

A summary of the variation in teacher characterization of mathematics is presented in Table 76. Generally, Perry and Schroeder agreed or strongly agreed in both static and dynamic perspectives of mathematics.

Table 76
Characterization of Mathematics, Seventh-Grade Teachers, District 3

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
	— MiC —			
Calhoun North-Perry	Strongly Agree	Agree	Strongly Agree	Strongly Agree
Calhoun North-Schroeder	Strongly Agree	No Opinion	Agree	Agree

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variation in teacher perspectives on mathematics teaching and learning is presented in Tables 77 and 78. Both teachers also agreed or strongly agreed that students 1) learn best when they study mathematics in the context of everyday situations; 2) learn mathematics best in small groups; 3) should write about how they solve problems; 4) do not need to master basic skills before they study more mathematics and before they engage in higher order thinking. The teachers also thought that the use of calculators does not inhibit students' learning.

Table 77
Mathematics Teaching and Learning, Seventh-Grade Teachers, District 3, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Calhoun North-Perry	Strongly Agree	Disagree	Strongly Disagree	Agree	Strongly Disagree	Strongly Agree
Calhoun North-Schroeder	Strongly Agree	Strongly Disagree	Strongly Disagree	Strongly Agree	Disagree	Agree

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won’t learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

Both seventh-grade teachers in District 3 agreed that it is important to cover fewer topics in greater depth and that more algebra, geometry, and statistics should be introduced in the middle-school curriculum. The teachers also agreed that 1) instruction should be based on students' understanding; 2) more emphasis should be given to mental computation and estimation; 3) students should find their own strategies to solve problems; 4) instruction should include many open-ended tasks; 5) students should learn mathematics through regularly discussing their ideas with other students; 6) problem solving should be a central feature of the mathematics curriculum; and 7) connections should be made among mathematical ideas and between mathematics and other subjects. Both teachers disagreed that instruction should include step-by-step directions and that teachers' primary goal is to help students master basic skills. They varied (Perry disagreed and Schroeder had no opinion) with respect to the statement that teaching a concept should begin with a model or example.

Table 78
Mathematics Teaching and Learning, Seventh-Grade Teachers, District 3, Part II

School-Teacher	**Pedagogy**					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Calhoun North-Perry	Strongly Agree	Agree	Strongly Disagree	Strongly Disagree	Strongly Disagree	Agree
Calhoun North-Schroeder	Agree	Agree	Disagree	No Opinion	Disagree	Agree
School-Teacher	**Pedagogy**					
	7. Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
Calhoun North-Perry	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Agree	Agree
Calhoun North-Schroeder	Agree	Agree	Agree	Agree	Agree	Strongly Agree

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculu.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variation in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 79. In assessing student learning, Perry never used and Schroeder sometimes used the results of standardized tests, but this information did not influence their decisions in the content to teach next and assigning student grades. Both teachers used students' performance on class projects and quizzes and tests and thought they were somewhat important in determining what to teach next and in assigning grades. Although both teachers frequently used portfolios of student work, Schroeder regarded the information as very important in deciding what to teach next and in student grading whereas Perry thought the information was not important in making such decisions.

Table 79
Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, Seventh-Grade Teachers, District 3

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
					— MiC —	
Calhoun North-Perry	Never	Not important at all	Not important at all	Sometimes	Somewhat important	Somewhat important
Calhoun North-Schroeder	Sometimes	Not very important	No Response	Always	Very important	Somewhat important
School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Calhoun North-Perry	Sometimes	Somewhat important	Somewhat important	Always	Not important at all	Not very important
Calhoun North-Schroeder	Often	Somewhat important	Somewhat important	Always	Very important	Very important

A summary of the variation in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 80. Both seventh-grade teachers in District 3 frequently used various forms of informal classroom assessment and felt the information gathered through these assessments was very important in determining the content to teach next. The teachers varied, however, in the importance of this information in assigning student grades. Perry thought that student questions, oral and written explanations, and work observed were not important in making decisions about grading. Work across assessments was regarded as somewhat important in determining grades. In contrast, Schroeder thought that student questions and work observed were very important in grading, and oral and written explanations were somewhat important for making decisions about grades.

Table 80

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Seventh-Grade Teachers, District 3

School-Teacher	Types of Informal Assessment								
	Student Qestions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
							— *MiC* —		
Calhoun North-Perry	Always	Very important	Not important at all	Always	Very important	Not very important	Always	Very important	Very important
Calhoun North-Schroeder	Always	Very important	Very important	Always	Very important	Somewhat important	Often	Somewhat important	Somewhat important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work Across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
Calhoun North-Perry	Always	Very important	Not very important	Always	Very important	Somewhat important
Calhoun North-Schroeder	Always	Very important	Very important		No Response	No Response

District 4

A summary of the variation in teacher background characteristics is presented in Table 81. MiC was used by all three teachers. Of the three seventh-grade teachers in District 4, one teacher is female and two are male. The teachers varied in ethnicity: Hispanic, Black, and White. Their teaching experience varied widely from 1-27 years, and, although Woodward was a first-year teacher, Finn and Yackle taught at the school for 6 and 10 years, respectively.

Table 81
Summary Data on Background Characteristics, Seventh-Grade Teachers, District 4

School-Teacher	Sex	Ethnicity	Full time Teaching (years)	Part Time Teaching (years)	Teaching at School (years)	Current Grade Level	Grade Level Taught	Current Position
				— MiC —				
Kelvyn Park MS-Finn	F	Hispanic	9	0	6	7	6,7,8	Classroom teacher
Kelvyn Park MS-Woodward	M	Black	1	0	1	7	7,8	Classroom teacher
Kelvyn Park MS-Yackle	M	White	27	1/2	10	7		Classroom teacher

A summary of the variations in experience teaching *Mathematics in Context* is presented in Table 82. Although three seventh-grade teachers were teaching MiC, none had prior experience teaching MiC.

Table 82
Experience Teaching MiC, Seventh-Grade Teachers, District 4

School-Teacher	Years of Experience	Units Taught in Previous year (#)	Unit(s) Taught
	— MiC —		
Kelvyn Park MS-Finn	None	None	
Kelvyn Park MS-Woodward	None	None	
Kelvyn Park MS-Yackle	None	None	

A summary of the variation in teacher professional training is presented in Table 83. Finn majored in Computer Science and studied mathematics as a minor, taking 15 courses in mathematics. She also studied mathematics education with a minor in mathematics at the master's level and took 18 mathematics courses. Woodward studied business administration and took approximately 12 credits in mathematics. Yackle did not report his educational background.

Table 83
Professional Training, Seventh-Grade Teachers, District 4

School-Teacher	B.A.			M.A.			PhD			Other Credentials
	Major	Minor	Courses	Major	Minor	Courses	Major	Minor	Courses	
				— *MiC* —						
Kelvyn Park MS-Finn	Computer Sci.	Mathematics	15 courses	Math Ed.	Mathematics	18 courses				
Kelvyn Park MS-Woodward	Bus. Admin.		Approximately 12							
Kelvyn Park MS-Yackle										

A summary of the variation in teacher characterization of mathematics is presented in Table 84. Woodward and Yackle thought that mathematics has both static and dynamic characteristics. Finn, however, thought that mathematics is dynamic rather than static.

Table 84
Characterization of Mathematics, Seventh-Grade Teachers, District 4

School-Teacher	Static 1	Static 2	Dynamic 3	Dynamic 4
	— MiC —			
Kelvyn Park MS-Finn	Disagree	Disagree	Strongly Agree	Strongly Agree
Kelvyn Park MS-Woodward	Agree	Agree	Strongly Agree	Agree
Kelvyn Park MS-Yackle	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree

Characterization of Mathematics

Static

1. Mathematics is a collection of concepts and skills used to obtain answers to problems.
2. Mathematics is facts, skills, rules, and concepts learned in some sequence and applied in work and future study.

Dynamic

3. Mathematics is thinking in a logical, inquisitive manner and is used to develop understanding.
4. Mathematics is an interconnected logical system that is dynamic and changes as new problem-solving situations arise.

A summary of the variation in teacher perspectives on mathematics teaching and learning is presented in Tables 85 and 86. All teachers agreed or strongly agreed that students 1) learn best when they study mathematics in the context of everyday situations; 2) learn mathematics best in small groups; 3) should write about how they solve problems; 4) do not need to master basic skills before they study more mathematics and before they engage in higher order thinking. The teachers also thought that the use of calculators does not inhibit students' learning.

Table 85
Mathematics Teaching and Learning, Seventh-Grade Teachers, District 4, Part I

School-Teacher	**Student Learning**					
	1. Context	**2. Skills Before More Math**	**3. Skills Before Higher Order Thinking**	**4. Small Groups**	**5. Technology**	**6. Writing**
		— MiC —				
Kelvyn Park MS-Finn	Agree	No Opinion	Disagree	Agree	Disagree	Strongly Agree
Kelvyn Park MS-Woodward	Strongly Agree	Disagree	Disagree	Agree	Disagree	Strongly Agree
Kelvyn Park MS-Yackle	Strongly Agree	Disagree	Disagree	Strongly Agree	Disagree	Strongly Agree

Student Learning

1. Students learn best when they study mathematics in the context of everyday situations.
2. Students need to master basic computation facts and skills before they can engage effectively in studying more mathematics.
3. Students must learn basic skills before they can be expected to analyze, compare, and generalize.
4. Students learn mathematics best in classes where they are able to work in small groups.
5. If students use calculators, they won’t learn the mathematics they need to know.
6. Students should write about how they solve mathematical problems.

All seventh-grade teachers in District 4 agreed that more algebra, geometry, and statistics should be introduced in the middle-school curriculum. Finn and Woodward agreed, but Yackle disagreed, that it is important to cover fewer topics in greater depth. The teachers also agreed that 1) students should find their own strategies to solve problems; 2) instruction should include many open-ended tasks; 3) students should learn mathematics through regularly discussing their ideas with other students; 4) problem solving should be a central feature of the mathematics curriculum; and 5) connections should be made among mathematical ideas and between mathematics and other subjects. The teachers varied, however, in their responses with respect to several elements of pedagogy. Finn and Woodward disagreed and Yackle agreed that instruction should include step-by-step directions and that teaching a concept should begin with a model or example. Although Finn responded no opinion, Woodward and Yackle agreed that teachers' primary goal is to help students master basic skills. Woodward and Yackle agreed but Finn disagreed that instruction should be based on students' understanding. Although Yackle reserved opinion, Finn and Woodward agreed that more emphasis should be given to mental computation and estimation rather than lengthy pencil-and-paper calculation.

Table 86
Mathematics Teaching and Learning, Seventh-Grade Teachers, District 4, Part II

School-Teacher	Pedagogy*					
	1. Less Coverage & More Depth	**2. More Content Strands**	**3. Directive**	**4. Model/Example**	**5. Mastery of Concepts**	**6. Student Thinking**
					— MiC —	
Kelvyn Park MS-Finn	Strongly Agree	Agree	Disagree	Disagree	No Opinion	Disagree
Kelvyn Park MS-Woodward	Agree	Agree	Disagree	Disagree	Agree	Agree
Kelvyn Park MS-Yackle	Disagree	Strongly Agree	Agree	Agree	Strongly Agree	Strongly Agree

School-Teacher	Pedagogy					
	7.Student Thinking	**8. Invented Strategies**	**9. Open-Ended Tasks**	**10. Discussion**	**11. Problem Solving**	**12. Connections**
Kelvyn Park MS-Finn	Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree
Kelvyn Park MS-Woodward	Agree	Agree	Agree	Strongly Agree	Agree	Agree
Kelvyn Park MS-Yackle	No Opinion	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree

* See questionnaire items 1-12 on next page.

Pedagogy

1. It is more important to cover fewer topics in greater depth than it is to cover the text.
2. More algebra, geometry, probability and statistics should be introduced in the elementary and middle school curriculu.
3. Instruction should include step-by-step directions.
4. Teaching a mathematical concept should begin with a concrete example or model.
5. In teaching mathematics, my primary goal is to help students master basic concepts and procedures.
6. Teachers should plan instruction based upon their knowledge of their students' understanding.
7. More emphasis should be given to simple mental computation, estimation, and less emphasis to practicing lengthy pencil-and-paper calculation.
8. Teachers should encourage children to find their own strategies to solve problems even if the strategies are inefficient.
9. Instruction should include many open-ended tasks.
10. Students should learn mathematics through regularly discussing their ideas with other students.
11. Mathematical problem solving should be a central feature of the elementary and middle school curriculum.
12. In my teaching I try to make connections among mathematical topics and between mathematics and other disciplines.

A summary of the variation in teacher perspectives on the importance of student performance on formal assessments in determining instructional decisions and grades is presented in Table 87. Finn and Woodward sometimes used the results from standardized tests and felt they were somewhat or very important, respectively, in determining the content to teach next. Although Woodward considered standardized test results somewhat in assigning student grades, Finn thought they were not important for this purpose. Yackle reported never using results from standardized tests, although he felt that they were very important in assigning student grades. In assessing student learning, all teachers frequently used students' performance on quizzes and tests and thought that this information was very important in making decisions related to the content to teach next and student grades. Although all teachers used class projects, the results were regarded as somewhat to very important in assigning student grades, but not important for one teacher in determining what to teach next. Two teachers frequently used portfolios of student work and felt they were somewhat or very important in both determining the content to teach next and student grades. Woodward chose not to use portfolios, although he thought they were somewhat important in determining student grades.

Table 87

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Formal Assessment and Frequency of Use, `Seventh-Grade Teachers, District 4

School-Teacher	**Types of Formal Assessment**					
	Standardized Tests			**Classroom Projects**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
					— MiC —	
Kelvyn Park MS-Finn	Sometimes	Somewhat important	Not important at all	Often	Very important	Very important
Kelvyn Park MS-Woodward	Sometimes	Very important	Somewhat important	Sometimes	Somewhat important	Somewhat important
Kelvyn Park MS-Yackle	Never	Not important at all	Very important	Often	Not very important	Somewhat important
School-Teacher	**Types of Formal Assessment**					
	Classroom Quizzes and Tests			**Portfolios of Student Work**		
	Frequency	**What to Teach Next**	**Student Grades**	**Frequency**	**What to Teach Next**	**Student Grades**
Kelvyn Park MS-Finn	Often	Very important	Very important	Always	Very important	Very important
Kelvyn Park MS-Woodward	Often	Very important	Very important	Never	Not important at all	Somewhat important
Kelvyn Park MS-Yackle	Always	Very important	Somewhat important	Always	Somewhat important	Somewhat important

A summary of the variation in teacher perspectives on the importance of student performance on informal assessments in determining instructional decisions and grades is presented in Table 88. The seventh-grade teachers in District 4 frequently used various forms of informal classroom assessment. Finn and Woodward generally agreed that students questions, oral and written explanations, work observed, and work across assessments were very important in making decisions regarding the content to teach next and student grades. Yackle thought the information gathered was somewhat important for making such decisions.

Table 88

Importance of Student Performance in Determining Instructional Decisions and Grades, Type of Informal Assessment and Frequency of Use, Seventh-Grade Teachers, District 4

School-Teacher	Types of Informal Assessment								
	Student Questions			Student Explanations			Student Written Explanations on Classwork and Assignments		
	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades	Frequency	What to Teach Next	Student Grades
							— *MiC* —		
Kelvyn Park MS-Finn	Always	Very important	Very important	Always	Very important	Very important	Always	Very important	Very important
Kelvyn Park MS-Woodward	Always	Very important	Very important	Always	Very important	Very important	Always	Very important	Very important
Kelvyn Park MS-Yackle	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important	Often	Somewhat important	Somewhat important

School-Teacher	Types of Informal Assessment					
	Observation of Student Work			Student Work across Assessments Inferred Growth of Student Knowledge and Reasoning Power		
	Frequency	What to Teach Next	Student Grades		What to Teach Next	Student Grades
Kelvyn Park MS-Finn	Always	Very important	Very important	Often	Very important	Very important
Kelvyn Park MS-Woodward	Always	Not very important	Somewhat important	Always	Somewhat important	Very important
Kelvyn Park MS-Yackle	Always	Somewhat important	Somewhat important	Always	Somewhat important	Somewhat important

In summary, 15 seventh-grade teachers participated in the study during 1997-1998. Eleven teachers used MiC and four teachers used the conventional curricula already in place in their schools. Generally, the seventh-grade teachers had 11 years experience teaching.

Seven of the 11 MiC teachers in Districts 1, 2, and 3 had one to four semesters experience teaching MiC, but none of the District 4 teachers had such experience.

Educational background varied greatly among the teachers with half the teachers having undergraduate degrees outside education. Many teachers took around 10 courses of mathematics or mathematics education; the exception was the District 2 teachers who took a limited number of mathematics courses.

Primarily, the seventh-grade study teachers thought that mathematics is thinking in a logical, inquisitive manner that can be used to develop understanding and that mathematics is a dynamic discipline. Generally, however, they also regarded mathematics as static discipline.

Most teachers agreed that students learn mathematics best when they write about how they solve problems and when they study mathematics in the context of everyday situations. The teachers also thought that the use of calculators does not inhibit students' learning. Teachers were divided about the necessity to master basic skills before students are introduced to more mathematics and before they can engage in higher order thinking.

All seventh-grade teachers agreed or strongly agreed that 1) teaching mathematics should cover less topics in greater depth; 2) students should be encouraged to create their own solution strategies even if the strategies are inefficient; 3) students should learn mathematics through regularly discussing their ideas with other students; 4) problem solving should be a central feature of the mathematics curriculum; and 5) instruction should include connections among mathematical ideas and between mathematics and other subjects.

In assessing student learning through more formal methods, many teachers used results of classroom projects and quizzes and tests rather than standardized tests or portfolios. Several teachers in District 2 never used portfolios of student work, nor did they think that standardized tests and portfolios were important in deciding what to teach next and in assigning student grades. Generally, all teachers thought that classroom projects and quizzes and tests were important for such purposes.

All seventh-grade teachers reported using various methods of informal classroom assessment, including students' questions, oral and written explanations, work observed and work across assessments. Every seventh-grade teacher reported using these methods often or always, and most teachers thought those assessment methods were important in deciding what to teach next and assigning student grades.

Conclusion

Nineteen fifth-grade, 19 sixth-grade, and 15 seventh-grade teachers participated in the study during 1997-98. Forty-two teachers used MiC; the remaining 11 teachers used the conventional curricula already in place in their schools. Among the respondents, 38 teachers are White and the other 15 are minority teachers. Generally, the participating teachers had varied teaching experience: 27% of the respondents had more than 15 years of teaching experience, 23% had 10-15 years, 17% had 5-10, and 33% of participants had less than 5 years of teaching experience. About 57% of the respondents finished education or education related majors. The number of courses related to mathematics or mathematics education were also different: 55% took less than 5 courses and 17% of participants took more than 11 courses. About 50% had a master's degree or were taking courses towards a masters' degree, and 66% of the teachers were taking additional mathematics or mathematics education courses. Among the participating teachers, 8 teachers reported that they had other credential certifications.

Generally, the fifth-grade teachers agreed with dynamic nature of mathematics, and almost all seventh- and eight-grade teachers agreed with this characterization. However, agreement on static interpretation of mathematics varied greatly: About 80% of participating teachers agreed or strongly agreed that mathematics is a collection of concepts and skills used to obtain answers to problems, but only 52% agreed or strongly agreed that mathematics is facts, skills, rules and concepts learned in some sequence and applied in work and future study.

On four statements related to mathematics teaching and learning, most teachers agreed or strongly agreed. About 98% agreed or strongly agreed that students learn best when they study mathematics in the context of everyday situations, and about 90% thought that using calculators in mathematics class did not inhibit mathematics learning. 90% of teachers also thought students should write about how they solve mathematics problems, and 86% agreed or strongly agreed that students learn mathematics best in classes where they are able to work in small groups. However, only 52% of teachers agreed or strongly agreed that students need to master basic computation facts and skills before they can engage effectively in studying more mathematics, and only 34% of teachers thought students must learn basic skills before they can do higher order thinking such as to analyze, compare, and generalize.

Forty-two percent of participating teachers agreed or strongly agreed that mathematics instruction should include step-by-step directions and 47% thought that teachers should plan instruction based upon their knowledge of their students' understanding. However, most teachers agreed or strongly agreed that is more important to cover fewer topics in greater depth and that more algebra, geometry, and statistics should be included in the mathematics curriculum. Almost every teacher thought 1) instruction should include many open-ended tasks; 2) students should learn mathematics through regularly discussing their ideas with other students; 3) mathematical problem solving should be a central feature of the elementary- and middle-school curriculum, and 4) connections should be made among mathematical topics and between mathematics and other disciplines.

Results from standardized test and portfolios of student work were not regarded as important in making decisions about the content to teach next and student grading. Only 24% of the teachers often or always used results of standardized tests and 46% used portfolios of student work; around 50% of

teachers felt that such assessment was somewhat or very important in deciding what to teach next and in assigning student grades. In contrast 70% of teachers preferred to use classroom project and 88% used quizzes and tests. Forty-five percent of the teachers thought quizzes and tests were important in deciding what to teach next whereas 98 percent thought it was important in deciding student grades.

Many teachers preferred to use student questions (86%), students' oral and written explanations (82%), student work observed (92%), and student work across assessments (71%). Ninety-eight percent of the teachers thought student questions were somewhat or very important in deciding what to teach next whereas only 55% thought it was somewhat or very important in deciding student grades. Ninety-five percent of teachers said they thought students' oral and written explanations, work observed, and student work across assessments were somewhat or very important in deciding what to teach next whereas about 90% of teachers reported information gathered though these assessments were somewhat or very important in assigning student grades.