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ABSTRACT

Elementary school mathematics programs based on textbooks can be analyzed according to mathematical concepts and skills that cause students difficulty by using a telephone assistance service. The Mobile County Public School System's (MCPSS) Homework Hotline in Alabama was used to collect data from callers requesting help with homework from September 1988 through May 1989. An analysis of the calls isolated fifth grade mathematics concepts and skills that caused callers throughout the system difficulty. Concepts and skills identified were correlated to the textbook pacing guide, the MCPSS fifth grade pacing guide, and grade level requirements based on the Alabama Course of Study, Alabama Basic Competency Test, and Stanford Achievement Test. Pacing analysis indicated a need to adjust pacing requirements so that students receive the appropriate time to master concepts and skills at grade level. (Author/LL)

Mathematics Analysis Using A Homework Hotline

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Abstract

Elementary school mathematics programs, based on a textbook, can be analyzed according to mathematical concepts and skills causing students difficulty by using a telephone assistance service. The Mobile County Public School System's (MCPSS) Homework Hotline was used to collect data from callers requesting help with homework from September, 1988 through May, 1989. An analysis of the calls isolated fifth grade mathematic concepts and skills that caused callers throughout the system difficulty. Concepts and skills identified were correlated to the textbook pacing guide, MCPSS fifth grade pacing guide and to grade level requirements based on the Alabama Course of Study, Alabama Basic Competency Test and Stanford Achievement Test. Pacing analysis indicated a need to adjust pacing requirements so students receive the appropriate time to master concepts and skills at grade level.

Mathematics Analysis Using A Homework Hotline

Elementary school children, even those in the intermediate grades, exhibit difficulties with homework assignments. Parents of these children often do not know what the teacher wants to achieve through the homework assigned. Sometimes parents cannot remember how to explain an assignment and the child goes unaided. This situation has prompted many school systems to provide telephone assistance programs to help students and parents with homework assignments. The Mobile County Public School System (MCPSS), thirty-fourth largest in the nation which serves 68,000 students, reflecting ten percent of the public school student population of the state of Alabama, is one of them. The assistance program is called Homework Hotline. It is designed to give immediate professional assistance to callers experiencing difficulties with homework assignments.

Homework Hotline was developed in collaboration with Mobile College (MC), in Mobile, Alabama, in 1987. Two graduate courses (practicum and curriculum development) were restructured to provide the homework assistance service while offering a vehicle for field-based research and curriculum development. As part of the course requirements, MCPSS teachers and nontraditional fifth year program (NTFYP) graduate students take on the role of classroom teacher

researcher while manning the Homework Hotline during the academic year. The concept of classroom teacher researchers is validated in educational research (Atwell, 1989: Chattin-McNichols, & Loffler, 1989; Hay, Purvis, Burkett, Farrington, Hamilton, & Henson, 1989; Strickland, 1988; and Wanner & Purvis, 1989). Classroom teacher researchers answer telephone calls requesting help with homework assignments. Calls to Homework Hotline come from kindergarten through twelfth grade students, GED applicants, college students, parents and grandparents (Kordomenos, Wanner, & Hay, in press).

The review of the literature indicates that although homework assistance programs exist, to date analysis of the data collected from such programs for school system utilization in research and curriculum development is nonexistent. The purpose of this research is to determine if data collected through the MCPSS Homework Hotline can identify and isolate problem areas within the curriculum. The time period for this study is September, 1988, through May, 1989.

The following hypothesis and supporting questions were developed to guide researchers in this project. An analysis of mathematics calls serviced by the Homework Hotline can determine the concepts and skills in curriculum which present problems to students.

* How many total calls did each subject serviced by the Homework Hotline receive during the academic year 1988-1989?

* How many calls were received in mathematics at each grade level serviced during the time period under investigation?
* What grade level received the most mathematics calls?
* What mathematical concepts and skills at the targeted grade level received the most inquiries?
* How does the suggested textbook pacing and system pacing compare with the mathematical categories under investigation?
* How does the MCPSS's Minimum Grade Level Requirements for mathematics at the targeted grade level correlate to the Alabama Course of Study, Alabama Basic Competency Test, and Stanford Achievement Test requirements?

Method

Subjects

Subjects participating in this study were callers to MCPSS's Homework Hotline telephone assistance program from September, 1988, through May, 1989. These callers were within the toll-free calling range in Mobile and Baldwin counties in southern Alabama. There were 5475 subjects in this research. These subjects were selected because they called the Homework Hotline seeking assistance with homework assignments.

Apparatus

The Homework Hotline telephone assistance program was the apparatus for this research. The physical location of the Homework Hotline is the central office building of the MCPSS. A five line phone system is utilized to accept incoming calls. An answering machine handles the overflow of calls, which are returned as time permits. Textbooks, reference materials, and additional supplementary materials are supplied by the MCPSS's Media Center and the Mobile College Library and Curriculum Laboratory. Computer processing of data is supplied by the MCPSS.

Graduate students in elementary and secondary education, reflecting various levels of experiences, expertise and levels of higher education, participated in the study as teacher researchers. Teacher participation in the study was arranged through the cooperative efforts of MC and the MCPSS. Incentives offered to promote teacher participation were three semester hours credit, which could be applied to MC's Graduate Programs in Education, and tuition paid by the MCPSS. Teacher researchers were trained in data collection, communication skills and telephone procedures.

The Data Collection Form (See Figure 1.) was developed with the collaborative effort of the college and the school system. This form provides the means to analyze incoming calls for this research study.

The following categories from the data collection form were used for the purpose of this study: total calls received for each subject serviced during the academic year, grade level, concept and skill.

Figure 1

TUTOR: _____ DATE: _____

HOMEWORK HOTLINE DATA COLLECTION FORM
(To be completed by subject area tutor)

DAY OF WEEK: MON___ TUES___ WED___ THURS___ **START TIME:** _____

GRADE: K__, 1__, 2__, 3__, 4__, 5__, 6__, 7__, 8__, 9__, 10__, 11__, 12__, GED__

SCHOOL: PUBLIC _____

NON-PUBLIC _____

CALLER'S STATUS: STUDENT___ PARENT___ TEACHER___ OTHER___

SEX: MALE ____ FEMALE ____ **AGE:** _____

SUBJECT: MATH ___ SCIENCE ___ SOCIAL STUDIES ___ REFERENCE SKILLS / SCIENCE___
SOCIAL STUDIES___
ENGLISH/LANGUAGE ARTS/READING_____ ENGLISH_____

OTHER_____

PAGE(S) NUMBER: _____ **CONCEPT(S)/SKILL(S) INVOLVED:** _____

(Type of question/Example of problem)

END TIME: _____ **TOTAL TIME:** _____

COMMENTS: _____

Suggested textbook pacing guide, system pacing guide, grade level requirements for mathematics area and grade were used in conjunction with state course of study, state competency test, and system test requirements.

Procedure

The Homework Hotline accepts calls Monday through Thursday during the academic year from 5 p.m. to 8 p.m. As calls are accepted teacher researchers aid callers and complete a data collection form (Figure 1.) with information furnished by caller. The anonymity of the caller promotes self-esteem and enables callers, both students and parents, to ask questions in a nonthreatening atmosphere.

Textbooks are consulted in order to help callers and to prevent teacher researchers from using terms or procedures that are not familiar to the callers. Great care is taken to guide the callers through the process needed to find the answers to their questions and homework problems. Teacher researchers do not give out answers to problems but verify answers.

For this study information on the data collection forms were compiled by the Curriculum and Research Division of the MCPSS anentered onto computer disks. The Homework Hotline Research Assistant pulled and tallied the data under investigation. Since nominal

data were utilized, frequency distributions and percentages were calculated for each area under investigation. Pacing frameworks were investigated by using the suggested pacing of the identified subject and the system's pacing guide. Grade level requirements were based on the MCPSS's Curriculum Manual, Alabama Course of Study, Alabama State Competency Test, and Stanford Achievement Test requirements.

Results

The following data (See Table 1.) reflect all calls received by subject at the Homework Hotline from September 29, 1988 through May, 1989. Total number of calls received were 5475. Results indicate that mathematics received 48% of the total calls ranking first in number of inquiries. English received 16% of the calls and ranked second, with spelling receiving 13% which ranked third. The subjects that followed in order of inquiry were social studies, 13%, ranking fourth; science with 8%, ranking fifth; and other receiving 2%, ranking sixth in the calls received.

TABLE 1

Table of Frequency of Subject Inquiry: September 1988 through May 1989 I

Subject	Calls	Percentage
Mathematics	**2635**	**48%**
English	**882**	**16%**
Social Studies	701	13%
Science	451	8%
Spelling	**723**	**13%**
Others (include unidentified and verifying answers)	83	2%
TOTAL	5475	100%

The frequency of grade level inquiry for the time period under investigation (See Table 2.) indicated fifth grade required the most assistance with homework in mathematics. Fifth grade, with 23% of calls received, was followed by fourth grade, 15%; sixth grade, 13%; eighth grade, 12%; seventh grade, 11%; third grade, 8%; ninth grade, 6%; tenth grade, 5%; eleventh grade, 3%; unidentified grade levels, 2%; and second grade, 1%. The remainder of the categories received less than 1% of the calls.

TABLE 2

Table of Frequency of Grade Inquiry: September 1988 through May 1989

Grade	Calls	Percentage
K	4	less than 1%
1	8	less than 1%
2	39	1%
3	200	8%
4	389	15%
5	613	23%
6	341	13%
7	286	11%
8	312	12%
9	149	6%
10	140	5%
11	77	3%
12	10	less than 1%
GED	1	less than 1%
COLLEGE	2	less than 1%
Others	7	less than 1%
Unidentified Grade Level	57	2%
TOTAL	2635	100%

An analysis of concepts in mathematics calls at the fifth grade level indicates that number theory and fractions presented the most problems to students completing homework assignments. This category ranked first with 43% of the calls.

Basic operations, which included addition, subtraction, multiplication and division, ranked second with 18%. Place value ranked third in the number of inquiries with 13%. The remainder of the identified concepts and the order of ranking were word problems, 8%; verifying answers and measurement, 6%; decimals, ratios and percents, 5%; and maps, charts, graphs, grids and tables, 1%. Geometry concepts ranked last with less than 1% of the total calls received at the fifth grade level. (See Table 3.)

TABLE 3

Summary of Tables 4 Through 12:
Analysis of Concepts: 5th Grade Mathematics

Number Theory and Fractions	**43%**
Basic Operations	**18%**
Place Value	**13%**
Word Problems	8%
Measurement	6%
Decimals, Ratios, and Percents	5%
Maps, Charts, Graphs, Grids and Tables	1%
Geometry	less than 1%
Verify Answers	6%
TOTAL	100%

Tables 4 through 12 illustrate the concepts and skills that received the most inquiries during the specified months of this study. September analysis (See Table 4.) of concepts and skills at the fifth grade level indicates that place value received 62%, ranking first. Rounding specifically posed 58% of the place value problems encountered. Basic operations ranked second with 12%. Basic addition received 8%. Roman numerals ranked third receiving 10% of the inquiries. Word problems ranked fourth and vocabulary posed the most problems.

September Analysis of Concepts and Skills: 5th Grade Mathematics

TABLE 4

Concept		Percentage
Place Value		**62%**
Skill		**Percentage**
Rounding		**58%**
Estimate then round		2%
Multiply by 100's		2%
	Subtotal	62%

Concept		Percentage
Basic Operations		12%
Skill		**Percentage**
Adding		**8%**
Subtraction		2%
Multiplication		2%
Division		0%
	Subtotal	12%

Concept		Percentage
Word Problems		8%
Skill		**Percentage**
Extraneous Information		0%
Money		2%
Multi-step		2%
Reversed Order		0%
Vocabulary		**4%**
	Subtotal	8%

Concepts		Percentage
Maps, Charts, Graphs, Grids and Tables		2%
Skill		**Percentage**
Grid Construction		TOTAL 2%

Concepts		Percentage
Number patterns		2%
Roman numerals		**10%**
Other Concepts		2%
Unidentified Concepts		2%
	Subtotal	16%

TOTAL 100%

October analysis (See Table 5.) of concepts and skills at the fifth grade level indicates basic operations, specifically multiplication and division, ranked first in inquiries with 63% of the calls. Place value ranked second with 21%, specifically rounding, which comprised 9% of the place value calls. Word problems ranked third with 14% of the total calls received.

TABLE 5

October Analysis of Concepts and Skills:
5th Grade Mathematics

Concept	Percentage
Place Value	**21%**

Skill	Percentage
Rounding	**9%**
Multiplication by 10's, 100's, & 1000's	6%
Regrouping	2%
Estimate then round	2%
Subtotal	21%

Concept	Percentage
Basic Operations	**63%**

Skill	Percentage
Adding	4%
Subtraction with and without regrouping	4%
Multiplication	**34%**
Division	**21%**
Subtotal	63%

Concept	Percentage
Word Problems	14%

Skill	Percentage
Subtraction of money	2%
Multiply money	2%
Division with remainders	2%
Multiplying 10's, 100's & 1000's	2%
Geography skills needed to work problem	2%
Unidentified word problems	4%
Subtotal	14%

Concepts	Percentage
Roman Numbers	2%
Unidentified Concepts	0%

TOTAL 103%

November analysis (See Table 6.) of concepts and skills at the fifth grade level indicates the top three concepts and skills that required assistance were basic operations, 62%; number theory, fractions and place value tied for second place with 12%. Word problems ranked third with 7%. Division, under basic operations, comprised 58% of the 62% for that category. Estimating and rounding quotients under place value and averages under number theory and fractions each received 8% of the 12% received under designated concept.

TABLE 6

November Analysis of Concepts and Skills:
5th Grade Mathematics

Concept	Skill	Percentage	Percentage
Place Value			**12%**
	Estimating and Rounding Quotients	**8%**	
	Rounding	**4%**	
	Subtotal	12%	
Basic Operations			**62%**
	Multiplication	4%	
	Division	**58%**	
	Subtotal	62%	
Word Problems			7%
	Money Problems	3%	
	Unidentified Word Problems	1%	
	Division Word Problems	3%	
	Subtotal	7%	
Maps, Charts, Graphs, Grids and Tables			1%
	Pictographs	1%	
	Subtotal	1%	
Number Theory and Fractions			**12%**
	Averages	**8%**	
	Factoring	1%	
	Multiplying Fractions	1%	
	Common Denominator	1%	
	Number Patterns	1%	
	Subtotal	12%	
Verify Answers			1%
Unidentified Concepts			5%
		TOTAL	100%

The top three concepts and skills in December (See Table 7.) were number theory and fractions, basic operations and maps, charts, graphs, grids and tables. Number theory ranked first with 37% of the calls received. Specifically least common multiple, greatest common factor and prime factors, followed by basic operations, ranked second with 36%. Division represented 36% of the inquiries under basic operations. Maps, charts, graphs, grids and tables ranked third with 11%. Pictographs received the total 11% of the calls received.

TABLE 7

December Analysis of Concepts and Skills: 5th Grade Mathematics

Concept		Percentage
Place Value		**4%**
Skill	**Percentage**	
Rounding Divisors down	**4%**	
Subtotal	4%	
Concept		**Percentage**
Basic Operations		36%
Skill	**Percentage**	
Division	**36%**	
Subtotal	36%	
Concept		**Percentage**
Number Theory and Fractions		**37%**
Skill	**Percentage**	
Finding Factors	4%	
Prime Factors	7%	
Composites	4%	
LCM	**7%**	
GCF	**11%**	
Reducing to lowest terms	4%	
Subtotal	37%	
Concept		**Percentage**
Maps, Charts, Graphs, Grids and Tables		**11%**
Skill	**Percentage**	
Pictographs	**11%**	
Subtotal	11%	
Concept		**Percentage**
Geometry		4%
Skill	**Percentage**	
Identify 6 sided figure	4%	
Subtotal	4%	
Concepts		**Percentage**
Measurement		4%
Skill	**Percentage**	
Kilometers to Miles	4%	
Subtotal	4%	
Concepts		**Percentage**
Word Problems		0%
Concept		**Percentage**
Unidentified Concepts		4%
	TOTAL	**100%**

January analysis (See Table 8.) of concepts and skills indicated number theory and fractions posed 91% of the calls. Least common multiple, 19%; greatest common factor, 9%; reducing fractions to lowest terms, 8%; identification of prime factors, 7%; equal fractions, 7%, and factoring, 6%, posed the most problems to callers. Unidentified concepts ranked second with 4%, with basic operations ranking third with 2%.

TABLE 8

January Analysis of Concepts and Skills: 5th Grade Mathematics

Concept	Skill	Percentage
Basic Operations		3%
	Multiplication	less than 1 %
	Division	3%
	Subtotal	3%
Number Theory and Fractions		**91%**
	Divisibility	less than 1%
	Factors, Primes and Composites	5%
	Common Factor Identification	3%
	Identify Prime Factors	7%
	G.C.F.	**9%**
	L.C.M.	**19%**
	Fraction Concept	less than 1%
	Fractional Part of a group	2%
	Equal Fractions	**7%**
	Reduce to Lowest Terms	**8%**
	Comparing Fractions	3%
	Writing Whole and Mixed Numbers as Fractions	3%
	Dividing to Find Mixed Numbers	2%
	Factoring	**6%**
	Adding with Unlike Denominators	3%
	Subtracting with Unlike Denominators	5%
	Adding and Subtracting Mixed Numbers	2%
	Adding and Subtracting Mixed Numbers with Unlike Denominators	less than 1%
	Subtraction with Regrouping	less than 1%
	Dividing Fractions	3%
	Subtotal	91%
Maps, Charts, Graphs, Grids and Tables		2%
	Using a schedule	2%
	Subtotal	2%
Unidentified Concepts		4%
		TOTAL 100%

Concepts and skills in February (See Table 9.) at the fifth grade level indicated that number theory and fractions ranked first with 87% of the calls in mathematics. Word problems ranked second with 5%, and basic operations, third with 4%. Within the number theory and fraction concept, least common multiple indicated 18% and subtraction with regrouping, 14%. Adding fractions with unlike denominators, 10%, presented the most problems to callers. Identifying missing information in the word problem category received 3% of the total 5%. Division under basic operations received all the calls in that category.

TABLE 9

February Analysis of Concepts and Skills: 5th Grade Mathematics

Concept	Skill	Percentage
Basic Operations		**4%**
	Division	**4%**
	Subtotal	4%
Number Theory and Fractions		**87%**
	Reducing Fractions	**5%**
	Adding Mixed Numbers with Unlike Denominators	2%
	Subtracting Mixed Numbers with Unlike Denominators	2%
	Subtraction with Regrouping	**14%**
	Multiplying Fractions	6%
	Multiplying Fractions and Mixed Numbers	3%
	Dividing Fractions	2%
	Subtracting Fractions	4%
	Missing Numerators and/or Denominators	6%
	Inverse operations with Multiplication and Division of Fractions	2%
	LCM	**18%**
	Adding Fractions	11%
	Adding Fractions with Unlike Denominators	10%
	Subtracting Fractions with Unlike Denominators	2%
	Subtotal	87%
Word Problems		**5%**
	Identify Missing Information	**3%**
	Using Recipes	1%
	Finding Averages	1%
	Subtotal	5%
Measurement		1%
	Area of Triangle	1%
	Subtotal	1%
Unidentified Concepts		3%
	TOTAL	**100%**

March analysis (See Table 10.) of concepts and skills reveals that number theory and fractions remained first in the degree of difficulty encountered by callers, with 51%. Skills within the stated concept were multiplying fractions, 13%; dividing fractions, 9%; reducing fractions, 5%; and multiplying mixed fractions, 5%. In the area of measurement: customary (standard) and metric units ranked second with 23%. Millimeter, centimeter and meter conversion received 8% of the inquiries. Standard weight problems received 6% of the 23% under the measurement concept. Perimeter, area and volume also received 6%. Word problems ranked third with 15%. Problem solving strategies presented 11% of the 15% total.

T A B L E 10

March Analysis of Concepts and Skills: 5th Grade Mathematics

Concept	Percentage
Place Value	**3 %**

Skill	Percentage
Write Thousandths in Decimals	less than 1%
Write Tenths in Decimals	less than 1%
Rounding Decimals	**3 %**
Multiplying 10's, 100's, 1000's	less than 1%
Estimate Area	less than 1%
Subtotal	3%

Concept	Percentage
Basic Operations	less than 1%

Skill	Percentage
Multiplication	less than 1%
Subtotal	less than 1%

Concept	Percentage
Number Theory and Fractions	**5 1 %**

Skill	Percentage
Reducing Fractions	**5 %**
LCM	less than 1%
Change Improper Fractions to Mixed Numbers	2%
Dividing Mixed Numbers	less than 1%
Adding and Multiplying Mixed Numbers	3%
Factors of Numbers	less than 1%
Multiplying Fractions	**13%**
Multiplying Fractions and Mixed Numbers	4%
Missing Numerators and/or Denominators	2%
Adding Fractions	less than 1%
Reciprocals	4%
Multiplying Fractions	5%
Subtraction with Regrouping Twice	less than 1%
Dividing Fractions	**9%**
Multiplying Whole Numbers and Fractions	less than 1%
Adding Decimals	less than 1%
Adding Time	3%
Subtotal	51%

Concepts	Percentage
Measurement Customery and Metered	**23%**

Skill	Percentage
Grams and Kilograms	less than 1%
Meter, Centimeter, and Kilometer	less than 1%
Millimeters, Centimeters and Meters	8%
Yards, Feet, and Inches	3%
Weight	**6%**
Cups to Tablespoons	less than 1%
Gallons to Pints	less than 1%
Writing Equal Measures	less than 1%
Perimeter, Area, Volume	**6 %**
Subtotal	23%

Concept	Percentage
Word Problems	**1 5 %**

Skill	Percentage
Problem Solving Strategies	**11%**
Using Recipes	4%
Subtotal	15%

Unidentified concepts	8%
TOTAL	**100%**

April concepts and skills analysis (See Table 11.) indicates that place value with decimals received 28% of the total mathematics calls ranking first in order of need. Decimals, ratios and percents ranked second with 23%, and number theory and fractions with 16% ranked third. Included in the place value concept were rounding decimals and multiplying by 10's, 100's, 1000's and 10,000's which presented 20% of the skills identified in that concept. Further analysis of decimals, ratios and percents reveals that multiplying and dividing decimals by whole numbers each received 7% of the calls. Number theory and fractions had eight skills, with 2% each, totaling 16%. They were least common multiple, equal fractions, comparing fractions, subtraction of fractions with regrouping, multiplying fractions, reducing fractions to lowest terms, missing factors and averaging. Standard measurement concepts presented the most problems with 13%. Problem solving under word problems received 10% of the total 15%.

TABLE 11

Apnl Analysis of Concepts and Skills: 5th Grade Mathematics

Concept	Percentage
Place Value	**28%**

Skill	Percentage
Rounding Decimals	**13%**
Decimal Point Placement	5%
Multiplying by 10's, 100's, 1000's and 10,000's	**7%**
Zeros in Product (Ex. .7 x .08 = .056)	3%
Subtotal	28%

Concept	Percentage
Number Theory and Fractions	**16%**

Skill	Percentage
LCM	2%
Equal Fractions	2%
Comparing Fractions	2%
Subtracting Fractions with Regrouping	2%
Multiplying Fractions	2%
Reducing Fractions	2%
Missing Factors	2%
Averages	2%
Subtotal	16%

Concept	Percentage
Decimals, Ratios, and Percents	**23%**

Skill	Percentage
Subtracting Decimals	2%
Multiplying Decimals	**7%**
Dividing by Whole Numbers	**7%**
Time	2%
Unidentified Decimal Concept	5%
Subtotal	23%

Concepts	Percentage
Geometry	2%

Skill	Percentage
Identify Shapes	2%
Subtotal	2%

Concepts	Percentage
Measurement	**13%**

Skill	Percentage
Convert years to months	2%
Write Equal Measures (Standard Units-Length)	**7%**
Write Equal Measures (Standard Units-Capacity)	2%
Unidentified Measurement Concept	2%
Subtotal	13%

Concepts	Percentage
Word Problems	**15%**

Skill	Percentage
Problem Solving Strategies	**10%**
Extraneous Information	2%
Multi-step Problems	3%
Subtotal	15%

Unidentified Concepts	3%
TOTAL	**100%**

Decimals, ratios and percents placed first with 42% of the total inquiry in the concept and skills analysis for May (See Table 12.) at the fifth grade level. The three top skills identified were dividing decimals, 8%; ratios and money, 5%; and scale drawing, 5%. Word problems, specifically making drawings to solve word problems, and word problems which involved decimals ranked second with 11%. Place value in decimals ranked third with 10%. Further analysis reveals that correcting underestimates and place value of decimals were identified as troublesome skills. Unidentified word problem concepts represented 5% of the total 11% received. Measurement also ranked second with 11%; inability to use a protractor represented 5% of the total received in this category.

TABLE 12

May Analysis of Concepts and Skills: 5th Grade Mathematics

Concept	Percentage
Place Value	**10%**

Skill	Percentage
Correcting Underestimates	**5%**
Place Value With Decimals	**5%**
Subtotal	10%

Concept	Percentage
Basic Operations	**8%**

Skill	Percentage
Multiplication (Whole Numbers)	3%
Division (Whole Numbers)	5%
Subtotal	8%

Concept	Percentage
Number Theory and Fractions	**6%**

Skill	Percentage
Subtracting Fractions with Regrouping	**3%**
Division of Fractions	**3%**
Subtotal	6%

Concepts	Percentage
Decimals, Ratios and Percents	**42%**

Skill	Percentage
Adding Decimals	3%
Multiplying Decimals	3%
Dividing Decimals	**8%**
Equal Ratios	3%
Ratios and Money	**5%**
Time, Rate, and Distance	3%
Scale Drawing	**5%**
Fractions Written as Percents	3%
Writing Decimals as Percents	3%
Unidentified Fraction Concept	3%
Unidentified Decimal Concept	3%
Subtotal	42%

Concepts	Percentage
Word Problems	**11%**

Skill	Percentage
Unidentified Word Problems Concept	**5%**
Making Drawings to Solve Word Problems	3%
Decimal Word Problems	3%
Subtotal	11%

TABLE 12
(continued)

Concept			Percentage
Measurement			11%
	Skill	Percentage	
	Perimeter	3%	
	Area and Perimeter	3%	
	Using a Protractor	**5%**	
	Subtotal	11%	
Concept			**Percentage**
Geometry			**5%**
	Skill	Percentage	
	Perpendicular Lines	**5%**	
	Subtotal	5%	
Unidentified Concepts			7%
		TOTAL	**100%**

Pacing Analysis

Comparisons of the suggested textbook pacing guide and MCPSS (See Figure 2.) pacing guide at the fifth grade level covering the mathematics objectives for the 1988-1989 academic year reveals a total of 181 days were needed to follow textbook pacing. However, total days in the MCPSS school year during the time period investigated were 175 days. Further analysis indicates that the total suggested teaching days for the first quarter from the textbook tallied 55 days. MCPSS pacing required 54 days for the same time period.

Second quarter analysis indicates 43 days from the textbook against a total of 44 for the MCPSS. Third quarter was investigated and revealed 43 days were needed in order to cover the objectives according to the textbook. The school system required 47. Fourth quarter analysis indicates 40 teaching days from the textbook against 51 teaching days by the school system. A total of 181 days were needed to cover the mathematical objectives at textbook suggested pacing. The school system's suggested pacing called for 196 days.

FIGURE 2

FIRST QUARTER MATHEMATICS REQUIREMENTS
FOR 5TH GRADE - LEVEL PURPLE
COMPARISON OF SUGGESTED TEXTBOOK PACING AND SYSTEM RECOMMENDED PACING
TO COVER MATHEMATICS OBJECTIVES FOR 1988-89 SCHOOL TERM

CHAPTER	SUGGESTED TEXTBOOK OBJECTIVE COVERAGE	PAGES	SUGGESTED TEXTBOOK TEACHING DAYS	SYSTEM OBJECTIVE COVERAGE	PAGES	DAYS SYSTEM RECOMMENDS
1 Numeration	6 lessons - 12 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page	1 - 20 omit pages 15, 17-19	9	Same Same Same Same Chapter Posttest Roman Numerals - 1 lesson	1 - 20 omit pages 15, 18-19	11
2 Addition & Subtraction	12 lessons - 24 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page	21 - 54 omit pages none	19	Same Same Same Same Chapter Posttest	21 - 54 omit pages 49, 51-53	16
3 Multiplication	9 lessons - 18 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page	55 - 80 omit pages 77-78	13	Same Same Same Same Chapter Posttest	55 - 80 omit pages 75, 77-78	13
4 Division by One-Digit Numbers	8 lessons - 16 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page Quarterly Test	81 - 106 omit pages 103-105	13	Same Same Same Same Chapter Posttest 1 review day for the Quarterly Test Quarterly Test	81 - 106 omit pages 101, 103-105	14
	TOTAL SUGGESTED TEACHING DAYS		55	TOTAL TEACHING DAYS DAYS IN FIRST QUARTER		54 46

SECOND QUARTER MATHEMATICS REQUIREMENTS
FOR 5TH GRADE - LEVEL PURPLE
COMPARISON OF SUGGESTED TEXTBOOK PACING AND SYSTEM RECOMMENDED PACING
TO COVER MATHEMATICS OBJECTIVES FOR 1988-89 SCHOOL TERM

CHAPTER	SUGGESTED TEXTBOOK OBJECTIVE COVERAGE	PAGES	SUGGESTED TEXTBOOK TEACHING DAYS	SYSTEM OBJECTIVE COVERAGE	PAGES	DAYS SYSTEM RECOMMENDS
5 Dividing by Two-Digit Numbers	9 lessons - 18 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page	107 - 132 omit pages 127, 129-131	12	Same Same Same Same Chapter Posttest	107-132 omit pages 127, 129-131	13
6 Graphing	6 lessons - 12 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page	133 - 152 omit pages 149-151	10	Same Same Same Same Chapter Posttest	132 - 152 omit pages 147, 149-151	10
7 Number Theory and Fractions	15 lessons - 30 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page Quarterly Test	153-190 omit pages 185	20	Same Same Same Same Chapter Posttest 1 Review for Quarterly Test 1 Quarterly Test	153 - 190 omit pages 185, 187-188	21
	TOTAL SUGGESTED TEACHING DAYS		43	TOTAL TEACHING DAYS DAYS IN SECOND QUARTER		44 43

THIRD QUARTER MATHEMATICS REQUIREMENTS
FOR 5TH GRADE - LEVEL PURPLE
COMPARISON OF SUGGESTED TEXTBOOK PACING AND SYSTEM RECOMMENDED PACING
TO COVER MATHEMATICS OBJECTIVES FOR 1988-89 SCHOOL TERM

CHAPTER	SUGGESTED TEXTBOOK OBJECTIVE COVERAGE	PAGES	SUGGESTED TEXTBOOK TEACHING DAYS	SYSTEM OBJECTIVE COVERAGE	PAGES	DAYS SYSTEM RECOMMENDS
8 Fractions: Addition and Subtraction	10 lessons - 20 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance	191 - 218 omit pages 213, 215	14	Same Same Same Same Chapter Posttest	191 - 218 omit pages 213, 215-217	14
9 Fractions: Multiplication and Division	6 lessons - 12 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance	219 - 242 omit pages 226-229, 239-241	10	8 lessons - 16 pages 1 review 1 book test 1 Skills Maintenance Chapter Posttest	191- 218 omit pages 237, 239-241	12
10 Measurement	15 lessons 1 review 1 book test 1 Skills Maintenance Quarterly Test	243 - 280 omit pages 275, 277-278	19	Same Same Same Same Chapter Posttest 1 Review for Quarterly Test Quarterly Test		21
	TOTAL SUGGESTED TEACHING DAYS		43	TOTAL TEACHING DAYS DAYS IN THIRD QUARTER		47 46

FOURTH QUARTER MATHEMATICS REQUIREMENTS
FOR 5TH GRADE - LEVEL PURPLE
COMPARISON OF SUGGESTED TEXTBOOK PACING AND SYSTEM RECOMMENDED PACING
TO COVER MATHEMATICS OBJECTIVES FOR 1988-89 SCHOOL TERM

CHAPTER	SUGGESTED TEXTBOOK OBJECTIVE COVERAGE	PAGES	SUGGESTED TEXTBOOK TEACHING DAYS	SYSTEM OBJECTIVE COVERAGE	PAGES	DAYS SYSTEM RECOMMENDS
11 Decimals: Addition and Subtraction	9 lessons - 18 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page	281 - 306 omit pages 301, 303-305	12	Same Same Same Same Chapter Posttest	281 - 306 omit pages 301, 303-305	13
12 Decimals: Multiplication and Division	7 lessons - 14 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance	307 - 328 omit pages 323, 325-327	10	Same Same Same Same Chapter Posttest	307 - 328 omit pages 323, 325-327	11
13 Geometry	9 lessons - 18 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page	329 - 358 omit pages 346-349, 355, 357	10	10 lessons - 20 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page Chapter Posttest	329 - 358 omit pages 334-335, 353, 355-357	14
14 Ratio and Percent	4 lessons - 8 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page Quarterly Test	359 - 382 omit pages 368-375, 377, 379-380	8	7 lessons - 14 pages 1 review - 1 page 1 book test - 1 page 1 Skills Maintenance - 1 page Chapter Posttest 1 Review for Quarterly Test 1 Quarterly Test	359 - 382 omit pages 368-369, 377, 379-380	13
	TOTAL SUGGESTED TEACHING DAYS		40	TOTAL TEACHING DAYS		51
				DAYS IN FOURTH QUARTER		40
	TOTAL DAYS IN SCHOOL YEAR			175		
	TOTAL DAYS TO TEACH REQUIRED MATERIAL			196		

Grade Level Requirements Analysis

An analysis of the minimum grade level requirements for mathematics necessitated a correlation of stated skills with the Alabama Course of Study for Mathematics (ACS), Alabama Basic Competency Test (ABCT) requirements and Stanford Achievement Test (SAT) requirements for fifth grade. The following pages (See Figure 3.) show the interrelations between these documents. The analysis reveals that 40 skills were included in the MCPSS minimum grade level requirements that were not included in any of the above documents.

Grade Level Requirements
Grade 5 Mathematics

FIGURE 3

Homework Analysis

TEXTBOOK PAGE NUMBER		OBJECTIVE NUMBER	OBJECTIVE
2 & 3	ACS*	1	Identify the expanded form for a number and vice versa. (ST)*
4 & 5	ACS	2	Identify place value of a digit in numbers to six digits. (ST)
6 & 7	ACS	3	Identify digits in large numbers; identify numbers in the million and billion periods. (ST)
8 & 9	ACS	4	Compare and order large numbers, including numbers in tables. (ABCT* 6, ST)
10 & 11	ACS only through 1,000's	5	Round a number to nearest ten, hundred, thousand, ten thousand, or hundred thousand. (ST)
12 & 13		6	Solve a problem involving rounding, based on a table containing large numbers. (ST)
22 - 25 24 - 25	ACS	7	Identify a number sentence that belongs to a family of facts or find the missing number in a number sentence. (ST)
28 & 29	ACS	8	Estimate sums by rounding to nearest ten, hundred, or thousand. (ABCT 6, ST)
30 & 31	ACS	9	Add two three-digit numbers with regrouping (horizontal or vertical). (ST)
32 - 35	ACS	10	Add columns of numbers with regrouping (horizontal or vertical). (ST)
36 & 37	ACS	11	Estimate differences by rounding to the nearest ten, hundred, or thousand. (ABCT 6, ST)
38 & 39	ACS	12	Subtract three-digit numbers, regrouping once. (ST)
40 & 41	ACS	13	Solve word problems by adding or subtracting money. (ABCT 6, ST)
42 - 45	ACS	14	Subtract greater numbers, grouping more than once. (ST)
46 & 47	ACS	15	Solve money problems by making change. (ABCT 6, ST)
56 & 57	ACS	16	Multiply two one-digit numbers according to the properties of multiplication (order, grouping, one, zero). (ST)
58 & 59	ACS	17	Multiply tens, hundreds, and thousands by a one-digit number. (ST)
60 & 61		18	Multiply a two-digit number by a one-digit number.
62 & 63		19	Multiply greater numbers by a one-digit number. (ST)
64 & 65	ACS	20	Multiply by tens and hundreds.
66 & 67	ACS	21	Choose the best estimate and multiply by a two-digit number. (ABCT 6, ST)
68 & 69	ACS	22	Multiply amounts of money in a word problem. (ST)
70 & 71	ACS	23	Multiply by a three-digit number. (ABCT 6, ST)
72 & 73	ACS	24	Determine if an amount of money is sufficient for a purchase. (ABCT 6, ST)
82 & 83		25	Divide a one-digit number by a one-digit number with no remainder. (ST)
86 & 87		26	Find the quotient (one-digit) and remainder when dividing a two-digit number by a one-digit number.

*ABCT - Alabama Basic Competency Test
ACS - Alabama Course of Study
ST - Stanford Achievement Test

Homework Analysis

TEXTBOOK PAGE NUMBER		OBJECTIVE NUMBER	OBJECTIVE
88 & 89		27	Find the quotient (two-digit) and remainder when dividing a two-digit number by a one-digit number. (ST)
90 & 91		28	Divide a three-digit number by a one-digit number to find quotient and remainder. (ST)
92 & 93		29	Divide greater numbers by a one-digit number. (ST)
94 & 95	ACS	30	Solve a word problem by dividing an amount of money.
96 & 97		31	Divide two numbers with zero in the quotient.
98 & 99	ACS	32	Find the average of a group of numbers (up to 5). (ABCT 6, ST)
112 & 113		33	Round divisors up and divide by tens and ones with or without a remainder (second-digit 6, 7, 8, or 9). (ST)
114 & 115	ACS	34	Solve a word problem by multiplication or division. (ST)
116 & 117		35	Divide a three-digit number by a two-digit number with a one-digit quotient and remainder, correcting over- and underestimating. (ST)
118 & 119		36	Divide a three-digit number by a two-digit number with a two-digit quotient remainder.
120 & 121		37	Divide greater numbers with two-digit quotients and remainder. (ST)
122 & 123		38	Solve a division problem, considering the remainder.
124 & 125		39	Divide a five-digit number by a two-digit number with three-digit and four-digit quotients.
134 & 135			Pictograph
136 & 137	ACS	40	Solve a word problem by using a bar graph. (ABCT 6)
138 & 139	ACS	41	Solve a word problem by using a line graph. (ABCT 6)
140 & 141	ACS	42	Locate ordered pairs on a grid and tell the location of a point. (ABCT 6)
144 & 145 149 & 150	ACS	43	Solve a word problem by reading a map.
154 & 155		44	Determine the divisibility of a one-digit or two-digit number (ST)
156 & 157	ACS	45	Identify factors of a number or identify prime and composite numbers.
158 & 159	ACS	46	Identify prime factors. (ST)
160 & 161	ACS	47	Identify the greatest common factor.
162 & 163	ACS	48	Identify the least common multiple.
166 & 167		49	Identify the fractional part of a whole. (ST)
168 & 169		50	Identify the factional part of a group.
170 - 173	ACS	51	Find equivalent fractions. (ST)
174 & 175	ACS	52	Reduce a fraction to lowest terms. (ST)
176 - 179	ACS	53	Compare fractions by using <, >, and =. (ABCT 6, ST)
180 & 181		54	Divide to find mixed number. (ST)

*ABCT - Alabama Basic Competency Test
ACS - Alabama Course of Study
ST - Stanford Achievement Test

Homework Analysis

TEXTBOOK PAGE NUMBER		OBJECTIVE NUMBER	OBJECTIVE
192 & 193, 196 & 197	ACS	55	Add fractions with like and unlike denominators. (ABCT 6, ST)
194 & 195 198 & 199	ACS	56	Subtract fractions with unlike denominators. (ABCT 6, ST)
200 & 201	ACS	57	Add or subtract mixed numbers with like denominators, no regrouping. (ABCT 6, ST)
202 & 203	ACS	58	Add mixed numbers with unlike denominators, no regrouping. (ABCT 6)
206 & 207	ACS	59	Subtract mixed numbers with like denominators, with regrouping. (ABCT 6)
208 & 209	ACS	60	Subtract mixed numbers with unlike denominators, regrouping twice. (ABCT 6, ST)
210 & 211	ACS	61	Identify missing information when solving a problem. (ABCT 6, ST)
220 & 221		62	Identify the fractional part of a figure. (ST)
222 & 223	ACS	63	Multiply fractions, answering in lowest terms. (ABCT 6, ST)
224 & 225	ACS	64	Multiply fractions and whole numbers, answering in lowest terms. (ABCT 6, ST)
226 & 227	ACS	65	Multiply fractions and mixed numbers, answering in lowest terms. (ABCT 6)
228 & 229	ACS	66	Multiply mixed numbers, answering in lowest terms.
230 & 231		67	Solve recipe problems using fractions.
232 & 233		68	Identify the reciprocal of a fraction or mixed number.
234 & 235	ACS	69	Divide fractions, answering in lowest terms.
244 & 245	ACS	70	Identify the value of a centimeter and a millimeter. (ABCT 6, ST)
246 & 247	ACS	71	Identify the value of a meter, decimeter,and a kilometer. (ABCT 6, ST)
248 & 249	ACS	72	Find the perimeter of a geometric figure. (ABCT 6)
250 & 251	ACS	73	Find the area of a rectangle.
252 & 253	ACS	74	Find the area of a triangle. (ABCT 6)
254 & 255	ACS	75	Find the volume of a rectangular solid. (ST)
256 & 257		76	Solve a problem without numbers.
258 & 259	ACS	77	Identify the value of a milliliter and a liter. (ST)
260 & 261	ACS	78	Identify the value of a gram and a kilogram. (ST)
262 & 263	ACS	79	Read temperature on a Celsius scale. (ST)
264 & 265	ACS	80	Tell time. (ABCT 6, ST)
266 & 267	ACS	81	Identify customary units of length: inch, foot, yard, mile. (ABCT 6)
268 & 269	ACS	82	Find perimeter, area, and volume, using customary units.
270 & 271	ACS	83	Identify customary units of capacity: ounce, cup, pint, quart, gallon. (ABCT 6)

*ABCT - Alabama Basic Competency Test
ACS - Alabama Course of Study
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TEXTBOOK PAGE NUMBER		OBJECTIVE NUMBER	OBJECTIVE
272 & 273	ACS	84	Identify customary units of weight: ounce, pound, ton.
275			Read temperature on a Fahrenheit scale.
282 & 283	ACS	85	Identify a decimal to tenths corresponding to a fraction. (ABCT 6)
284 & 285	ACS	86	Identify a decimal to hundredths corresponding to a fraction or written expression. (ABCT 6, ST)
286 & 287, 288 & 289	ACS ACS	87	Identify place value in decimals to thousandths. (ST)
290 & 291	ACS	88	Compare decimals using <, >, and =. (ABCT 6, ST)
292 & 293	ACS	89	Round decimals to the nearest whole number, tenth, or hundredth.
294 - 297	ACS	90	Add and subtract decimals. (ABCT 6, ST)
298 & 299	ACS	91	Solve problems and identify excess information. (ABCT 6, ST)
301	ACS		Estimating & measuring.
308 & 309	ACS	92	Estimate the product of two decimals or a decimal and whole number by placing the decimal (no more than 3 places in answers).
310 & 311	ACS	93	Multiply a decimal by a decimal (no zeros in product).
314 & 315		94	Multiply a decimal by 10, 100, or 1,000.
316 & 317	ACS	95	Solve money problems with more than one step. (ABCT 6, ST)
318 & 319		96	Divide a decimal by a whole number (no remainder).
320 & 321		97	Divide a decimal by a whole number with zero in the quotient.
330 & 331	ACS	98	Identify the vocabulary of geometry.
332 & 333	ACS	99	Identify right, acute, and obtuse angles.
336 & 337	ACS	100	Identify parallel, perpendicular, and intersecting lines. (ABCT 6)
340 & 341	ACS	101	Identify different types of polygons. (ABCT 6)
342 & 343	ACS	102	Identify congruent polygons.
362 & 363		107	Identify equal ratios.
344 & 345		103	Identify similar polygons.
348 & 349	ACS	104	Identify symmetrical figures.
350 & 351	ACS	105	Identify solid figures. (ABCT 6)
360 & 361		106	Identify the fraction corresponding to a ratio.
364 & 365	ACS	108	Use ratio to find cost.
366 & 367		109	Solve problems of time, rate, and distance. (ST)
370 & 371		110	Find the percent equal to a ratio. Not in ACS.
374 & 375	ACS	111	Solve a problem based on a circle graph.
17	ACS	112	Use Roman numerals to D.

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TEXTBOOK PAGE NUMBER		OBJECTIVE NUMBER	OBJECTIVE
Not in book		113	Divide with three-digit divisors with regrouping.
Not in book		114	Round numbers to obtain quotients.
Not in book		115	Recognize and locate calculating errors.
Not in book		116	Recognize fractions of 1/2 and 1/4 dollar as decimals.
277		117	Add and subtract units of time.
		118	Continue to practice reading scales to measure mass/weight in grams, kilograms, ounces, or pounds.
Not in book		119	Continue practicing the identification of telephone, area code, zip code.
Supplied by system	ACS	120	Complete time fact drills.
216 & 217		121	Identify several of the major developments in the history of computers.

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Discussion

Curriculum evaluation and revision depends upon accurate identification of concepts and skills in the subject under investigation. School systems traditionally utilize system and statewide standardized testing results and teacher input to accomplish this task. These results, although representative, do not allow school systems to monitor curriculum needs in a specific area of study throughout the academic year in a manner which excludes test anxiety.

The purpose of this research was to determine if data collected through MCPSS's Homework Hotline could identify and isolate problem concepts and skills within mathematics curriculum during a given period of time. Investigation verified that the structure of the telephone assistance program allowed sufficient verifiable data to be collected about the school system's mathematics curriculum in order to pinpoint subject, grade level and the concepts and skills causing students difficulty. The following conclusions and theoretical implications are drawn from the investigation.

* The MCPSS's Homework Hotline is accomplishing its goal of giving immediate professional help to callers encountering problems with homework assignments as evidenced by the 5475 calls received.

* Data collected through providing aid to callers are representative of the problems callers are having throughout the county's classroom, and therefore representative of the total system. This was verified by the teacher researchers aiding callers, personal experiences of classroom teacher researchers and research in educational literature.
* Data are collected and processed by certified teachers and NTFYP graduate students. Data collection is monitored by the Homework Hotline Research Assistant to insure accuracy. Example problems and page numbers are included on the data collection form in order to verify concept and skill identification.
* As a result of the structure of the Homework Hotline, only those callers concerned with learning contact the service for assistance with homework problems.
* The subject posing the greatest number of problems to callers is mathematics with 48% (2635) of the 5475 calls. Educational research indicates that mathematics poses the greatest problem to students.

* Fifth grade is the level that requires the most assistance with 23% of the 2635 mathematics calls received. Therefore, it is assumed that mathematics at the fifth grade level presents the most problems to callers and requires further analysis.
* Concept identification isolated eight areas of need within the mathematics curriculum. They are listed in Table 3 in order of rank. The table suggests that number theory and fractions (43%), require further investigation. Basic operations received 18% of the mathematics calls and requires further investigation. A greater emphasis is also needed on the concept development of place value (13%) and whole numbers and fractions.
* Skills are identified within each category. Frequency distributions and percentages are calculated to determine need. A summary of the needs illustrates the ability to isolate skills within a specified subject during a given time period.
* Pacing analysis indicates a need to adjust pacing requirements at the system level. ACS, ABCT, and SAT requirements should receive the appropriate amount of learning time for students to master at the appropriate grade level.
* Grade level requirements analysis indicates a need to adjust textbook requirements to meet the requirements of the ACS, ABCT, and SAT.

* Developmental levels of students also need to be addressed because callers lack prerequisite skills to do some homework assignments.
* Theoretically, a homework telephone assistance service can aid in curriculum investigation, planning and revision.

As a result of this research it has been determined that a telephone assistance service, such as the MCPSS's Homework Hotline can be utilized to analyze a school system's elementary school textbook based mathematics curriculum. It is limited only by the format of the data collection form and abilities of teacher researchers to accurately record data. The benefits of the MCPSS's Homework Hotline hav surpassed its original intent to provide immediate professional assistance to callers encountering difficulties with homework. The Mobile County Public School System through the Homework Hotline has broken ground for curriculum evaluation and revision based on the specific needs of the population it serves. It provides an additional avenue to analyze data, to enable the system to closely monitor mathematics curriculum and to identify areas that need to be addressed.

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