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ABSTRACT

This document contains the appendices to a study of problem-solving instruction. In Appendix A are sample instruments for the teacher problem-solving interview and instructional planning interview, the teacher post-study interview, coversheet for narrative notes and narrative notepad page, rating form for the lesson rating instrument, lesson segments summary sheet, questionnaire for teacher's perceptions of today's lesson, classroom description instrument, and teacher planning questionnaire. Appendix B presents the observer's manual, providing detailed methodological information. Sections focus on an overview of the study, completing narrative reports, the lesson rating instrument, the lesson segments summary sheet, perceptions of today's lesson, and data collection procedures. Interview excerpts are found in Appendix C, with sections on problem-solving views, planning process, plans for the problem-solving unit, and post-study problem-solving unit views. (MNS)

Secondary Science and Mathematics Improvement Program

Appendices to

A STUDY OF TEACHERS' PLANNING AND DELIVERY OF PROBLEM-SOLVING INSTRUCTION IN SEVENTH-GRADE MATHEMATICS

Final Report

Robert B. Burns
Andrea A. Lash

November 30, 1984

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* This is one of three documents reporting the "Results of the Problem-Solving in Intermediate Mathematics Study" which was designated on the February 27, 1984 List of Deliverables.

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The Teacher Problem-Solving Interview

As you know, we are interested in problem solving and problem-solving instruction. We have chosen however, to approach the issue from the teacher's perspective, focusing on the concerns and conceptions you have about teaching mathematics in general and problem solving in particular. Rest assured that all your comments will be kept completely confidential.

TEACHER: _____

DATE: _____

Teacher Problem-Solving Interview Questions

1. HOW WOULD YOU CHARACTERIZE YOUR TYPICAL MATH LESSON?

   Probes: WHAT ACTIVITIES WOULD STUDENTS DO?

   WHAT TYPE OF GROUPING ARRANGEMENTS WOULD YOU USE?

   HOW OFTEN WOULD ALTERNATIVE METHODS BE USED?
   (e.g., small groups working on problems, use of media, students projects)

   WHY SO MUCH (LITTLE)?

2. HAVE YOU ATTENDED WORKSHOPS OR INSERVICE TRAINING SPECIFICALLY ON MATH PROBLEM SOLVING? HOW MANY AND WHEN?

3. SOME EDUCATORS HAVE DESCRIBED TODAY'S MATH TEXTBOOKS AS GLORIFIED WORKBOOKS THAT ARE FILLED WITH PROBLEMS BUT CONTAIN VERY LITTLE INSTRUCTION. DO YOU AGREE OR DISAGREE?

Probes: <u>If agree</u>:

WHERE DO YOUR IDEAS ABOUT HOW TO TEACH COME FROM IF SO LITTLE INSTRUCTION IS PROVIDED IN THE TEXTBOOK?

<u>If disagree</u>:

HOW GOOD IS THE INSTRUCTION IN THE TEXTBOOK?

4. HOW DO YOU LIKE THE WAY YOUR TEXTBOOK HANDLES PROBLEM SOLVING?

Probes: DO YOU HAVE THE PROBLEM-SOLVING SECTION OF THE TEACHERS' RESOURCE BOOK? IF YES, DO YOU USE IT? WHY OR WHY NOT?

HOW ARE THE WORD PROBLEMS IN YOUR TEXTBOOK?

ARE THERE ENOUGH WORD PROBLEMS?

5. IS DRILL AND PRACTICE IMPORTANT IN MATH? WHY OR WHY NOT?

Probes: CAN STUDENTS GET BY WITH LESS DRILL AND PRACTICE?

CAN THEY GET BY WITH LESS SEATWORK?

6. A NUMBER OF NATIONAL SURVEYS HAVE INDICATED THAT STUDENTS HAVE DIFFICULTIES WITH WORD PROBLEMS IN MATH. WHY DO YOU THINK WORD PROBLEMS CAUSE SO MUCH TROUBLE?

Probes: HOW MUCH TROUBLE DO STUDENTS HAVE WITH VOCABULARY?

HOW MUCH TROUBLE DO STUDENTS HAVE WITH UNDERSTANDING THE PROBLEM?

HOW MUCH TROUBLE DO STUDENTS HAVE WITH COMPUTING THE ANSWER ONCE THEY FIGURE OUT THE PROBLEM?

7. HOW MUCH PROBLEM SOLVING DO YOU THINK YOUR STUDENTS ARE DOING DURING A TYPICAL MATH LESSON? WHY DO YOU SAY THAT?

Probes: DO HIGH ABILITY STUDENTS DO MORE OR LESS PROBLEM SOLVING THAN AVERAGE OR LOW ABILITY STUDENTS? WHY OR WHY NOT?

8. HOW IMPORTANT DO YOU THINK PROBLEM SOLVING SHOULD BE IN THE MATH CURRICULUM? WHY?

Probes: WILL MATH PROBLEM-SOLVING SKILLS HELP STUDENTS IN THEIR OTHER COURSES?

WILL MATH PROBLEM-SOLVING SKILLS HELP STUDENTS IN THEIR FUTURE SCHOOL WORK?

WILL MATH PROBLEM-SOLVING SKILLS HELP STUDENTS AFTER THEY GET OUT OF SCHOOL AND GET A JOB?

9. HOW WOULD YOU DEFINE PROBLEM SOLVING? (Let teachers define with little prompting if possible.)

Probes: WHAT ARE THE MAJOR COMPONENTS OR PROCESSES THAT STUDENTS GO THROUGH WHEN SOLVING PROBLEMS?

ARE THESE SKILLS LEARNED IN SCHOOL?

10. SHOULD STUDENTS MASTER COMPUTATION SKILLS FIRST BEFORE THEY ARE GIVEN WORD PROBLEMS IN THE SAME AREA?

Probes: If yes: TO WHAT DEGREE OF MASTERY?

If no: WHY NOT?

11. HOW OFTEN DO YOU TEACH PROBLEM-SOLVING SKILLS?

Probes: HOW OFTEN DO STUDENTS WORK ON WORD PROBLEMS?

12. WHAT ARE THE BEST TYPES OF PROBLEM SOLVING ACTIVITIES?

Probes: HOW OFTEN DO YOU USE THESE ACTIVITIES? WHY DO YOU USE THESE SO LITTLE (MUCH)?

HOW OFTEN DO STUDENTS WORK ON PROBLEMS IN SMALL GROUPS?

13. WHAT ARE THE MAJOR ROADBLOCKS FOR YOU IN TERMS OF TEACHING PROBLEM SOLVING?

Probes: WHAT WOULD BE THE NUMBER ONE THING THAT WOULD IMPROVE YOUR ABILITY TO TEACH PROBLEM SOLVING? WHY?

THE NUMBER TWO THING? WHY?

14. IF YOU EMPHASIZED MORE PROBLEM SOLVING IN YOUR MATH CURRICULUM, WHERE WOULD THE EXTRA TIME COME FROM?

Probes: WOULD CERTAIN TOICS OR ACTIVITIES BE ELIMINATED? WHICH ONES?

15. SHOULD WORD PROBLEMS BE INTERSPERSED THROUGHOUT THE DIFFERENT UNITS IN THE TEXTBOOK OR SHOULD THEY BE CONCENTRATED IN A UNIT ON PROBLEM SOLVING, OR BOTH? WHY?

16. WOULD YOU SAY THAT YOU USUALLY FOCUS ON COMPUTATION SKILLS OR DO YOU FOCUS ON HIGHER-ORDER SKILLS LIKE APPLICATION AND ANALYSIS? WHY?

17. DO YOU FOCUS MORE ON THE UNDERSTANDING OF WORD PROBLEMS OR THE ACTUAL SOLUTION OF WORD PROBLEMS? WHY?

18. DO YOU FOCUS MORE ON SHOWING AND EXPLAINING TO STUDENTS HOW TO DO MATHEMATICS OR DO YOU FOCUS MORE ON GETTING STUDENTS TO UNDERSTAND SOMETHING NEW ON THEIR OWN? WHY?

19. IF YOU GAVE STUDENTS A PROBLEM NOT FOUND IN THEIR TEXTBOOK, DO YOU THINK THEY WOULD HAVE DIFFICULTIES? WHY OR WHY NOT? (Show teacher the problem on the next page.)

20. WHAT DO YOU THINK ABOUT THE FOLLOWING STATEMENT?

DURING 7TH and 8TH GRADES, INTENSIVE FOCUS ON PROBLEM SOLVING SHOULD BECOME A VEHICLE TO EXERCISE, CONFIRM, AND DEVELOP FURTHER ALL BASIC SKILLS.

21. WHAT DO YOU THINK ABOUT THIS STATEMENT?

DIFFICULTY WITH PAPER-AND-PENCIL COMPUTATIONAL ALGORITHMS SHOULD NOT INTERFERE WITH THE LEARNING OF PROBLEM SOLVING STRATEGIES.

22. IS THERE ANYTHING FINAL YOU WOULD LIKE TO SAY OR ADD ABOUT PROBLEM SOLVING IN MATH?

TEACHER: _____

DATE: _____

Teacher Instructional Planning Interview Questions

1. TO GET STARTED, TAKE A FEW MINUTES AND GIVE ME AN OVERVIEW OF THE UNIT THAT YOU HAVE PUT TOGETHER. WHAT HAVE YOU PLANNED FOR THE UNIT? (Let teachers talk about what the unit looks like with little prompting, if possible.)

2. HOW DID YOU GO ABOUT PLANNING THE UNIT? WHAT STEPS DID YOU GO THROUGH? (The intent of these questions is to get at the starting point of the planning process--e.g., problems, objectives, activities, or something else--and determine how this starting point gets transformed into an actual instructional plan.)

   Probes: WHAT WAS THE VERY FIRST THING YOU DID DURING PLANNING? (Prompt teachers to go through all their steps, e.g., "AND THEN WHAT DID YOU DO?")

3. DID YOU ALREADY HAVE AN IDEA ABOUT THE ORGANIZATION OF YOUR LESSONS BEFORE THE DETAILS WERE FILLED IN (e.g., review then practice)? IF YES, WHAT WAS IT?

4. HOW MUCH TIME DID IT TAKE TO PLAN THIS UNIT? (Get in minutes or hours.) DID YOU PLAN THE ENTIRE UNIT AT ONCE OR DID YOU PLAN IT IN MORE THAN ONE SITTING?

5. WHAT WAS THE HARDEST PART OF PLANNING THIS UNIT? WHAT WAS THE EASIEST? WHAT WOULD HAVE MADE THE PLANNING EASIER?

6. HOW WAS PLANNING THIS UNIT DIFFERENT FROM PLANNING FOR YOUR REGULAR INSTRUCTION? WAS IT EASIER OR HARDER THAN PLANNING YOUR REGULAR INSTRUCTION? WHY?

7. YOU DIDN'T HAVE A TEXTBOOK TO USE. HOW DID THE ABSENCE OF A TEXTBOOK AFFECT YOUR PLANNING?

8. HOW DO YOU PLAN TO COVER EACH OF THE FOUR OBJECTIVES? (There are 4 objectives to be taught in 6 days.)

Probes: DO YOU PLAN TO COVER ONE OBJECTIVE EACH DAY OR MIX THEM WITHIN A DAY? WHY? (If teachers say one objective per day, find out about the remaining two days of instruction.)

DID YOU ADD ANY OTHER OBJECTIVES TO TEACH? IF YES, WHAT ARE THEY AND WHY DID YOU ADD THEM?

HOW DID YOU DECIDE TO SEQUENCE THE OBJECTIVES? WHY IN THIS ORDER?

HOW DID YOU DECIDE ON THE AMOUNT OF TIME TO SPEND ON EACH OBJECTIVE?

9. DID YOU MAKE PROVISIONS FOR TYING THE LESSONS TOGETHER IN SOME WAY? IF YES, WHAT WERE THEY? IF NO, IS THAT BECAUSE IT WAS A PROBLEM-SOLVING UNIT?

10. WILL HOMEWORK BE GIVEN DURING THE UNIT? IF YES, WHAT IS THE POLICY? IF NO, WHY NOT? IS THIS THE SAME AS DURING YOUR REGULAR INSTRUCTION?

11. LET'S TAKE A LOOK AT A PARTICULAR LESSON--LESSON 1. HOW DID YOU PLAN THIS LESSON? (Let teachers describe the lesson with little prompting, if possible.) HOW TYPICAL IS THIS LESSON OF THE LESSONS IN THIS UNIT?

12. IS THERE A LESSON IN THIS UNIT THAT IS DIFFERENT FROM THE REST? HOW IS IT DIFFERENT?

13. For EACH lesson, obtain the following information (use summary sheet):

    a. WHAT OBJECTIVE IS BEING TAUGHT?

    b. WHAT ACTIVITIES WILL STUDENTS DO (e.g., seatwork, games, discussion)? WHY USE THESE ACTIVITIES?

    c. WHAT PROBLEMS WILL BE USED? (Get exact page numbers of problems if chosen from our book. If other problems are to be used, get copies.)

    d. HOW DID YOU DECIDE WHAT PROBLEMS TO GIVE STUDENTS? WHY DID YOU DECIDE TO SELECT THESE PROBLEMS? WHAT ISSUES DID YOU CONSIDER IN SELECTING PROBLEMS (e.g., fractions vs. whole numbers, new material vs. review material).

    e. DID YOU SELECT ANY NON-ROUTINE PROBLEMS? WHY OR WHY NOT?

    f. ARE THERE ANY PARTICULAR CONCERNS OR POTENTIAL PROBLEM AREAS WITH THIS LESSON?

    g. HOW DO YOU EXPECT THIS LESSON TO GO--VERY GOOD, GOOD, FAIR, POOR?

    (To help keep track of the lesson you are discussing, you can check off the days as you proceed through the lessons.)

    [ ] Day 1 [ ] Day 2 [ ] Day 3

    [ ] Day 4 [ ] Day 5 [ ] Day 6

14. IS THERE ANYTHING ELSE YOU WOULD LIKE TO SAY ABOUT THE PLANNING OF THE UNIT?

The Teacher Post-Study Interview Questionnaire

1. CONSIDERING THE PROBLEM-SOLVING UNIT OVERALL, DID THE UNIT GO PRETTY MUCH AS PLANNED?

   Probes: If yes, did you make any changes? What were they? Why did you make them?

   If no, what changes did you make? Why did you make these changes?

2. WHAT WAS THE MAJOR DIFFICULTY YOU HAD IN TEACHING THIS PROBLEM-SOLVING UNIT?

3. WE ARE INTERESTED IN THE TIME YOU HAD FOR INSTRUCTION. DID YOU HAVE JUST ENOUGH, TOO MUCH, OR TOO LITTLE TIME TO COVER THE FOUR OBJECTIVES?

   Probes: Why too much time? How much more time would you need?

4. DID YOUR TEACHING IN THE PROBLEM-SOLVING UNIT DIFFER FROM YOUR REGULAR TEACHING? IF SO, HOW?

5. HOW DID THE STUDENTS REACT TO THE PROBLEM-SOLVING UNIT?

   Probes: Why do you think they liked it? Why did they dislike it?

6. NOW THAT YOU HAVE TAUGHT THE PROBLEM-SOLVING UNIT, DO YOU THINK THAT PROBLEM SOLVING SHOULD BE TAUGHT AS A UNIT OR PERIODICALLY THROUGHOUT THE YEAR?

7. WHAT ADVICE WOULD YOU GIVE TO OTHER TEACHERS WHO ARE INTERESTED IN TEACHING PROBLEM SOLVING?

8. IS THERE ANYTHING YOU WOULD LIKE TO ADD ABOUT YOUR PARTICIPATION IN THIS STUDY?

Coversheet for Narrative Notes

Date: _____ Day of Week: M Tu W Th F

Teacher: _____ Observer: _____

Class/Period: _____ Period Begins: _____ Period Ends: _____

Number of Students:

Boys _____

Girls _____

Number of Adults:

Teachers _____

Other Adults _____ Specify: _____

_____

What is on the chalkboard to begin class:

Special Comments:

Teacher: _____ Observer: _____ Date: _____ Page __ of __

Time	Narrative Notes	Chalkboard Description

A-24

Teacher: _____
Date: _____
Observer: _____

Rating Form for The Lesson Rating Instrument

Check the one rating that is most appropriate for the class that you just observed. Try to think of each item individually as you make your rating; do not allow a rating on one item to influence the rating on other items. You should refer to the descriptions of each scale as you make the ratings.

1. Teacher orients students to learning

   [ ] No orientation
   [ ] Low orientation
   [ ] Moderate orientation
   [ ] High orientation
   [ ] Very high orientation

2. Teacher's use of realistic and relevant examples

   [ ] No use of realistic examples
   [ ] Low use of realistic examples
   [ ] Moderate use of realistic examples
   [ ] High use of realistic examples
   [ ] Very high use of realistic examples

3. Teacher's divergent orientation

   [ ] Very low divergent orientation
   [ ] Low divergent orientation
   [ ] Moderate divergent orientation
   [ ] High divergent orientation
   [ ] Very high divergent orientation

4. Teacher's use of discovery techniques

   [ ] No discovery techniques
   [ ] Low discovery techniques
   [ ] Moderate discovery techniques
   [ ] High discovery techniques
   [ ] Very high discovery techniques

5. Lesson challenge

   [ ] Very low challenge
   [ ] Low challenge
   [ ] Moderate challenge
   [ ] High challenge
   [ ] Very high challenge

6. Lesson complexity

[ ] Very low lesson complexity
[ ] Low lesson complexity
[ ] Moderate lesson complexity
[ ] High lesson complexity
[ ] Very high lesson complexity

7. Activity flow and lesson pace

[ ] Very poor activity flow
[ ] Poor activity flow
[ ] Moderate activity flow
[ ] Good activity flow
[ ] Excellent activity flow

8. Lesson closure

[ ] No lesson closure
[ ] Low lesson closure
[ ] Moderate lesson closure
[ ] High lesson closure
[ ] Very high lesson closure

9. Classroom discipline techniques

[ ] Very low management
[ ] Low management
[ ] Moderate management
[ ] High management
[ ] Very high management

LESSON SEGMENTS SUMMARY SHEET

Page __ of __

Teacher: _____ Observer: _____ Date: _____

Official Class Beginning Time: _____ Official Class Ending Time: _____

Segment # and Name	Segment Time	Delivery Systems Used (in sequence)	Grouping Arrangement	Assignment Pattern	Content and Actual Assignment (if any)
1	Begin: _____ End: _____				
2	Begin: _____ End: _____				
3	Begin: _____ End: _____				
4	Begin: _____ End: _____				
5	Begin: _____ End: _____				

Use the back of this sheet for comments or explanations as needed.

Your Perceptions of Today's Lesson

We want your impression of how well the lesson went today. Please answer the questions on this page (both sides) as soon as possible after the lesson is completed, preferably before the next class begins.

Circle only one response for each question.

1. What proportion of the students do you estimate had difficulty learning your lesson objective today?

   a. none of the students had difficulty
   b. only a few
   c. about one-fourth
   d. about one-half
   e. about three-fourths
   f. almost all
   g. all of the students had difficulty

2. What proportion of the students do you estimate were involved in your lesson assignments today?

   a. none of the students were involved
   b. only a few
   c. about one-fourth
   d. about one-half
   e. about three-fourths
   f. almost all
   g. all of the students were involved

3. What proportion of the students do you estimate cooperated well in your lesson activities today?

   a. none of the students cooperated
   b. only a few
   c. about one-fourth
   d. about one-half
   e. about three-fourths
   f. almost all
   g. all of the students cooperated

4. Compared to what I had planned, today's lesson went

   a. exactly as planned.
   b. slight different than planned.
   c. moderately different than planned.
   d. very different than planned.

Over. . .

5. Considering the lesson overall, please rate how well you think the lesson went today?

   a. very good
   b. good
   c. fair
   d. poor

   If you selected (a) or (b), please answer number 6 only.
   If you selected (c) or (d), please answer number 7 only.

COMPLETE ONLY ONE OF THE FOLLOWING:

6. I think the main reason why today's lesson was successful was because

   a. the lesson content was at the right level of difficulty.
   b. there were few student discipline problems.
   c. the teaching methods used were appropriate.
   d. the lesson activities maintained the attention of students.
   e. the pace of the lesson did not slow down too much.
   f. the students achieved the purpose of the lesson.

7. I think the main reason why today's lesson was not particularly successful was because

   a. the lesson content was too difficult.
   b. the lesson content was too easy.
   c. there were too many student discipline problems.
   d. the teaching methods used were inappropriate.
   e. the lesson activities did not maintain student attention.
   f. the lesson pace slowed and dragged on.
   g. the students did not achieve the purpose of the lesson.

Classroom Description Instrument

1. Name of school: _____

2. Name of teacher: _____

3. Name of observer: _____

4. Grade level(s) of class: _____

5. Total number of students: _____ Boys ____ Girls ____

6. Racial composition: (Give number of students)

   ____ White ____ Asian

   ____ Black ____ Other: _____

   ____ Hispanic

7. Number of aides in class: ____ How many days per week: ____

   Who are they (parents, student teachers): _____

8. How would you characterize this class in general? (Ask teacher)

   a. remedial
   b. slightly below average
   c. average
   d. slightly above average
   e. accelerated

9. What proportion of this class entered the year already needing remedial work in math or were below grade level? (Ask teacher)

   a. all of the class
   b. most of the class
   c. about half of the class
   d. some of the class
   e. none of the class

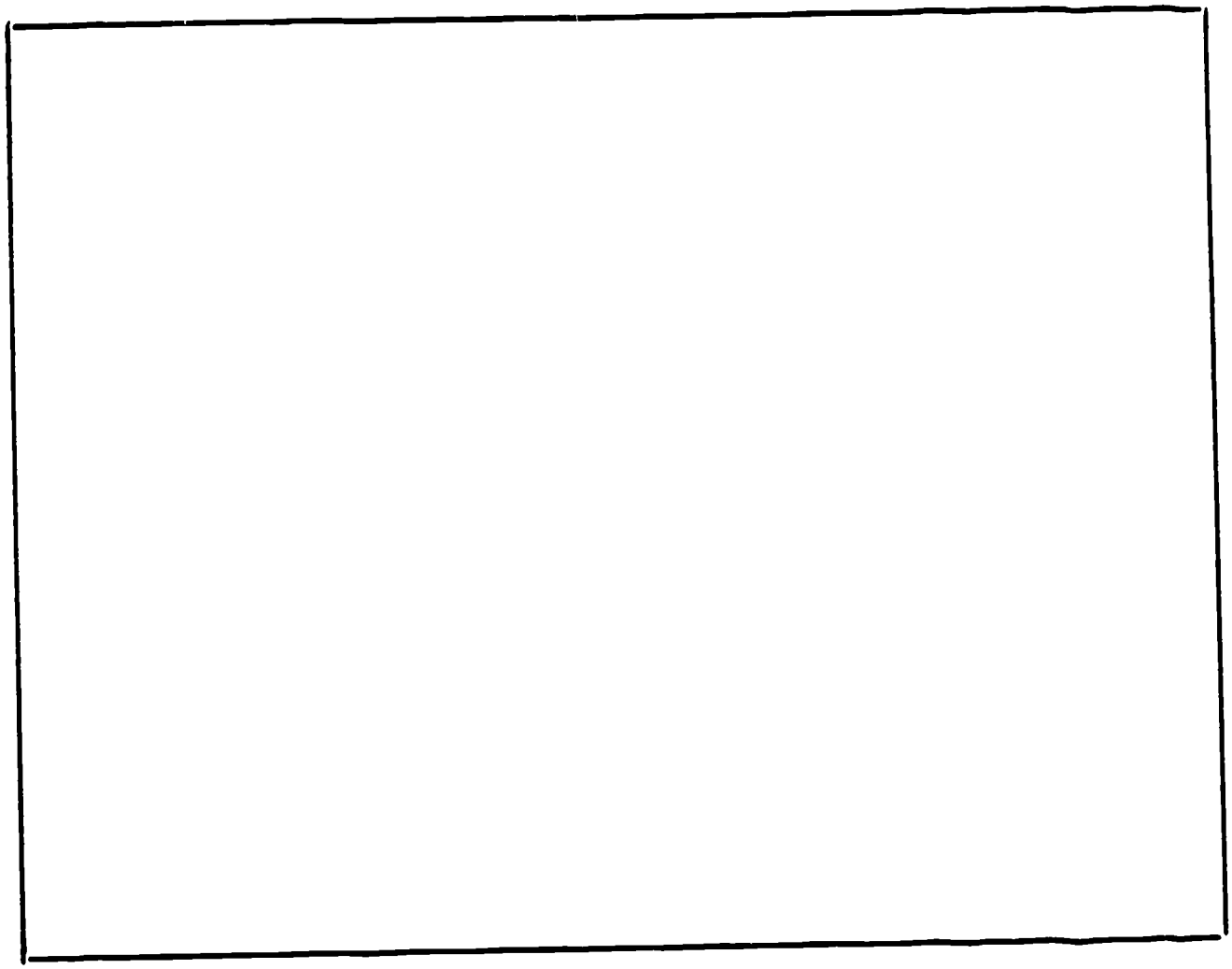
10. How homogeneous in mathematical ability is this class? (Ask teacher)

    a. little range in ability
    b. some range in ability
    c. normal range in ability
    d. large range in ability
    e. extreme range in ability

10. Draw a map of the physical lay out of the classroom within the boundaries provided on the next page. Identify doors, windows, furniture, teacher's desk, special displays or materials, student centers, and bulletin boards. Use the space below the diagram to decribe locations that need special explanation.

11. Give a general description of the classroom, including size, general appearance, carpets, windows, student projects exhibited, what is on the walls, etc.

Observer _____ School _____ Teacher _____



Use this space for any special explanations necessary.

Teacher Planning Questionnaire

Thank you for participating in the Intermediate Math Study. Without your assistance and help, we would not be able to carry out our research project.

This questionnaire is designed to help us describe some of the major aspects of your approach to the planning of curriculum and instruction. Since teachers have different ways of planning for instruction that are equally effective, there are no right or wrong answers to the questions that follow. We are interested in teacher planning because we think we can get a better understanding of how you teach by obtaining information on how you plan. So please answer the questions honestly and carefully.

We realize that this is a long questionnaire and that it will take some time to complete. The questions can be completed at your convenience and they need not all be completed in a single sitting. All we request of you is that you do not discuss the questions with your colleagues before you answer them.

We are interested in your typical planning for math classes. Therefore, answer these questions with your regular mathematics classes in mind.

Please rest assured that your responses to the questions will be treated with the strictest confidence and will be used for research purposes only. Your name will not be associated with your responses (we will code your questionnaire) and only the research staff will read your questionnaire. No one from your school or district will see your questionnaire.

Thank you again for your assistance.

I. BACKGROUND

1. Name: _____

2. School: _____

3. Sex: [ ] Male [ ] Female

4. Age: [ ] 20-24 [ ] 25-29 [ ] 30-39
   [ ] 40-49 [ ] 50-59 [ ] 60 or older

5. Grade level certification: (Please specify) _____
   _____

6. Teaching experience: (Fill in number of years)

   Total years experience as teacher _____

   Total years experience as math teacher _____

   Total years experience as middle school math teacher _____

7. Graduate training: [ ] Masters degree; Area: _____
   [ ] Specialist degree; Area: _____
   [ ] Other; Please specify: _____
   _____
   [ ] None

8. Specialized training in math: (Circle one)

   a. Masters degree in math
   b. Specialist degree in math
   c. Math major during teacher training
   d. Math minor during teacher training
   e. No degree or major/minor in math

II. CURRICULUM AND EVALUATION

1. How are math textbooks chosen at this school (e.g., by individual teachers, a school committee, a district committee)?

_____

2. How important is the math textbook to you in designing and planning your instruction? (Circle one)

1	2	3	4	5
not important		moderately important		very important

3. Are there journals for math teachers that you enjoy reading on a regular basis? [ ] Yes [ ] No If yes, which ones?

_____

_____

_____

4. If you wanted information about the math curriculum, say ideas for teaching a particular topic or concept, where would you go to find the information?

_____

_____

_____

5. Are there math teacher associations to which you belong? [ ] Yes [ ] No If yes, which ones?

_____

_____

6. How accessible is a ditto (or mimeo or Xerox) machine to reproduce worksheets or other seatwork activities?

[ ] easy access [ ] difficult access [ ] no access

7. Is inservice training available to you? [ ] Yes [ ] No If yes, please answer (a) and (b). If no, skip to #8.

(a) How often and when is inservice available?

_____

_____

_____

(b) Are inservice topics specific to mathematics available to you (e.g., teaching fractions) or are the topics in general teaching areas (e.g., classroom management)?

[ ] Math topics are usually available

[ ] Math topics are usually not available

8. Are you expected to teach a formal set of instructional objectives in math? [ ] Yes [ ] No If yes, please answer (a) through (c). If no, skip to #9.

(a) Who developed or selected the objectives (e.g., school committee or department, school administration, district office or committee, state department administration)?

_____

_____

(b) Are the objectives related to some type of minimum competency or proficiency test? [ ] Yes [ ] No If yes, what test?

_____

_____

(c) How important are these objectives to you in designing and planning your instruction? (Circle one)

1	2	3	4	5
not important		moderately important		very important

9. Is there a school, district, or state standardized achievement testing program at your school? [ ] Yes [ ] No If yes, please answer (a) and (b). If no, skip to #10.

   (a) Does the testing program influence your choice of math topics [ ] Yes [ ] No If yes, how so?

   _____

   _____

   _____

   (b) How important is the testing program in designing and planning your instruction? (Circle one)

1	2	3	4	5
not important		moderately important		very important

10. Do you assess your students' mathematical ability at the beginning of the school year? [ ] Yes [ ] No If yes, how?

    _____

    _____

    _____

11. How often do you use quizzes and tests (other than standardized tests) to find out how students are progressing (e.g., once a week, once a month)?

    _____

    _____

12. Where do you get the test items for your quizzes or tests (e.g., make them up, the textbook)?

    _____

    _____

13. How important are these quizzes and tests in designing and planning your instruction? (Circle one)

1	2	3	4	5
not important		moderately important		very important

14. On what basis do you assign grades to students? Please assign percentages to the following four areas to indicate their relative contribution to a student's grade. If an area does not enter into your grading system, enter 0%. Specify additional areas if necessary. The percents should total 100%, however.

Achievement _____%

Effort _____%

Cooperation _____%

Other _____% Specify area: _____

TOTAL 100 %

15. What grade would be given a student who is working below grade level but trying hard and making some progress?

_____

16. I move to the next topic when (circle one):

a. every student has mastered the topic.
b. about three-quarters have mastered the topic.
c. about half the students have mastered the topic.
d. about one-quarter of the students have mastered the topic.
e. only the top few students hae mastered the topic.

17. With respect to mastery versus coverage of material, I try to (check one):

[ ] make sure students master material even if they do not cover all the material they should.

[ ] make sure students cover all the material they should even if they do not necessarily master it.

18. Do you use any type of within-class grouping for mathematics? [ ] Yes [ ] No If yes, answer (a) through (c).

(a) Describe how you group and the number of groups.

_____

_____

_____

(b) How often do you use the groups (e.g., everyday, once a week)?

_____

_____

(c) How often would the members of the groups be changed and new groups formed?

_____

_____

_____

III. TEACHER PLANNING

Teachers typically do some or all of four different kinds of planning during the school year: long-term planning for a term or year, learning unit planning for 2-4 weeks (or even longer), weekly planning, and lesson planning for a day. We are interested in which types of planning you do and the similarities and differences between these types of planning.

In this section, we ask you a number of questions about each of these four types of planning. What makes this difficult for us (but also interesting) is that different teachers plan in different ways and even the same teacher may plan differently depending on the course or subject matter. Because of this, we need to ask some of the same questions about each type of planning if we are to "cover" all the possibilities. So please bear with us.

Following the first three questions, this section is divided into four parts, one for each of the four types of planning in which we are interested. Before you begin, it may be helpful to scan through this section quickly and see the types of questions that are asked and the general nature of the information requested. This should give you a "framework" for organizing your thoughts and describing your planning activities accurately.

1. How important to you are these four types of planning? Please rank order this list by using a "1" to indicate the most important down to "4" for the least important.

   _____ Term or year planning

   _____ Learning-unit planning

   _____ Weekly planning

   _____ Lesson planning for a day

2. Why is the type of planning you ranked first in question #1 the most important or useful for you?

   _____

   _____

   _____

   _____

3. There are two very general styles of teacher planning. A comprehensive planner completes much of the course planning early in the school year and does not deviate too far from this plan. An incremental planner, on the other hand, completes much of the planning on a week-to-week basis and updates and changes plans based on how the preceding week or weeks have gone.

   If you had to characterize your style of planning, would you best be characterized as a comprehensive or incremental planner? Answer assuming you were not teaching a course for the first time.

   [ ] Comprehensive [ ] Incremental

   What is the major benefit of the style you selected?

PART A: LESSON PLANNING For questions 4-12, please think of how you plan for a single lesson when you answer the questions.

4. When you begin planning a lesson, where do you start (e.g., objectives, activities, textbook, topics)? Why do you start there?

5. Where do your ideas on how to teach come from when you plan a lesson?

6. What factors do you take into account when you plan a lesson?

7. Do you use the suggested teaching practices in the margins of the teacher's edition of the textbook?

[ ] Yes, for almost every lesson.
[ ] Yes, for one or two lessons a week.
[ ] Yes, but for less than one lesson a week.
[ ] No, not at all. (If you check here, skip to #7b.)

(a) What do you like the most about these teaching notes?

_____

_____

_____

(b) What do you like the least about these teaching notes?

_____

_____

_____

8. What do you pay attention to or monitor during a lesson to let you know that the lesson is going okay?

_____

_____

_____

9. How likely would you be to change a lesson plan (and do something different) during the lesson? (Circle one)

1	2	3	4	5
not likely		moderately likely		very likely

10. What, if anything, would make you change a lesson plan during the lesson?

_____

_____

_____

11. How do you assess student understanding during a lesson?

_____

_____

_____

12. Do you consider the day of the week when planning a lesson (that is, does a Monday require a different type of lesson than a Thursday, for example)? [ ] Yes [ ] No If yes, please answer (a) and (b). If no, skip to Part B.

(a) How does the day of the week influence the type of lesson you plan? Give any rules of thumb you might follow.

_____

_____

_____

(b) Please rank order the days of the week with respect to being good instructional days. Use a "1" for the best day down to "5" for the worst day. If there is no difference between some or all of the days, use the same rank (e.g., 1, 1, 2, 1, 3)

___ Monday ___ Tuesday ___ Wednesday ___ Thursday ___ Friday

PART B: WEEKLY PLANNING For questions 13-20, please think of how you complete weekly planning.

13. How many different course preps do you have each day? _____ In a typical week of teaching, estimate how much time goes into course preparation for a single course. Give the number of minutes per week. _____

14. When you begin to plan a week's worth of instruction, where do you start (e.g., objectives, activities, textbook, topics)? Why do you start there?

_____

_____

_____

15. What determines the sequence of topics during the week of instruction?

16. How do you decide how much time to spend on topics during the week of instruction?

17. How important is it to link one lesson with the next lesson during the week?

1	2	3	4	5
not important		moderately important		very important

18. Please describe one example of how you attempt to link one lesson with the next.

19. Is weekly planning merely the collection of four to five daily lesson plans, or are there additional factors to consider which makes weekly planning <u>qualitatively different</u> than lesson planning?

[ ] Weekly planning is merely a collection of daily lesson plans. (If you check here, skip to <u>Part C</u>.)

[ ] Weekly planning is qualitatively different than lesson planning. (If you check here, please answer #20.)

20. What additonal factors do you need to take into account for weekly planning?

_____

_____

_____

PART C: LEARNING-UNIT PLANNING

We realize that some teachers may not do both weekly and learning-unit planning or that some teachers consider them to be synonymous.

To take this into consideration, please answer the next two questions.

21. Do you do learning-unit planning? [ ] Yes [ ] No

22. Is it different than your weekly planning? [ ] Yes [ ] No

If you answered "yes" to questions #21 and #22, please complete this section.
If you answered "no" to one or both questions, skip to Part D.

23. How long are your typical learning-units? Give the number of weeks

_____

24. When you begin to plan a learning-unit, where do you start (e.g., objectives, activities, textbook, topics)? Why do you start there?

_____

_____

_____

25. What determines the sequence of topics during the learning unit?

_____

_____

_____

26. How do you decide how much time to spend on topics during the learning-unit?

_____

_____

_____

27. How important is it to link one week with the next week within a learning-unit?

1	2	3	4	5
not important		moderately important		very important

28. Please describe one example of how you attempt to link one week with the next.

_____

_____

_____

29. Is learning-unit planning merely the collection of two to four weekly plans or are there additional factors to consider which makes learning-unit planning <u>qualitatively different</u> than weekly planning?

[ ] Learning-unit planning is merely a collection of weekly plans. (If you check here, skip to <u>Part D</u>.)

[ ] Learning-unit planning is qualitatively different than weekly planning. (If you check here, please answer #30.)

30. What additional factors do you need to take into account for learning-unit planning?

_____

_____

_____

PART D: LONG-TERM OR YEAR PLANNING For questions 31-33, consider how you plan for a course, term, or school year.

31. When you begin to plan for a course, term, or school year, where do you start (e.g., objectives, activities, textbook, topics)? Why do you start there?

32. What determines the sequence of topics during the course, term, or year?

33. How do you decide how much time to spend on topics during the course, term, or year?

IV. TEACHER CONCERNS

In the previous sections of this questionnaire, you have written down some of your planning practices. In this final section, we want to obtain a more "quantitative" type of data by having you rate a number of concerns that teachers often report when asked about their teaching.

For each of the concerns listed on the next page, please indicate how important the concern is to you during your typical planning of a lesson by putting a 1, 2, 3, or 4 in the blank. While it is likely to be the case that each of the concerns listed has been important to you at one time or another, we are interested in your typical lesson planning.

It may be helpful to try to think back about a recent lesson and remember the mental planning that went into the lesson as well as the notes your typically record in your planbook.

The list of teacher concerns is on the next page.

Think of your typical lesson planning and:

Mark (1) if the concern is usually of no importance
Mark (2) if the concern is usually of minor importance
Mark (3) if the concern is usually of moderate importance
Mark (4) if the concern is usually of major importance

1. ___ student's previous knowledge
2. ___ the cognitive skills to be learned
3. ___ the sequence of activities
4. ___ how the textbook will be used
5. ___ student's ability to learn
6. ___ the topics to be learned
7. ___ the grouping arrangement(s) for the lesson
8. ___ the use of the chalkboard
9. ___ student motivation for the lesson
10. ___ the relation of the topic to previously learned content
11. ___ the evaluation procedures to be used
12. ___ the availability of activities
13. ___ student's interest in the lesson activities
14. ___ the instructional objectives
15. ___ the directions for the lesson's activities and assignments
16. ___ the use of relevant examples
17. ___ the degree of student cooperation
18. ___ the difficulty of the content
19. ___ the time available for the lesson
20. ___ the math problems that are available
21. ___ students who may be discipline problems
22. ___ the sequence of content to be learned
23. ___ the use of a homework assignment
24. ___ the teaching suggestions in the teacher's edition of textbook

25. Which one of the above list would you consider the most important concern? Write the number here: _____

26. Which one of the above list would you consider the second most important concern? Write the number here: _____

27. Why are these two concerns so important?

_____

_____

_____

Appendix B

OBSERVERS MANUAL FOR THE INTERMEDIATE MATH STUDY

OBSERVERS MANUAL FOR THE INTERMEDIATE MATH STUDY

Robert Burns and Andrea Lash

This manual provides detailed methodological information for observers on the Intermediate Math Study, describing both instrumentation and data collection procedures. We cannot stress the importance of becoming completely familiar with the material in this manual. The success of the study depends, to a large extent, on all observers following the procedures spelled out in the following pages. This manual should provide a ready reference source for the observer and should accompany the observer during the collection of data.

The manual is organized into the six major sections outlined below.

Section I: Overview of the Study

Section II: Completing Narrative Reports

Section III: The Lesson Rating Instrument

Section IV: The Lesson Segments Summary Sheet

Section V: Your Perceptions of Today's Lesson

Section VI: Data Collection Procedures

We would like to acknowledge the consulting assistance of Dr. Susan Stodolsky in the development of some of the methodology described in this manual. Also, some of the description of segment types and delivery systems were adapted from Stodolsky, S. (1983), Classroom Activity Structures in the Fifth Grade. NIE Final Report. Of course, the authors accept full responsibility for any errors that may be contained herein.

SECTION I: OVERVIEW OF THE STUDY

The primary purpose of the Intermediate Math Study is to study teachers' planning and implementation of problem-solving instruction in middle school mathematics classes and provide a detailed description of that planning and delivery of instruction. The secondary purpose of the study is to explore the effects of the implemented instruction on students' ability to solve word problems.

This study is primarily descriptive in nature; we are going to collect extensive data sets on only nine teachers and their mathematics instruction. These data sets are organized into three major areas:

1. Teacher Conceptions and Planning. This data set consists of teacher responses to three sources: a teacher planning questionnaire, a structured interview with teachers about problem solving and their conceptions of problem-solving instruction, and a structured interview with teachers about their planning of a short unit on problem solving.

2. Teacher Implementation of Instruction. This data set consists primarily of narrative reports by observers of teaching during two separate periods of instruction: five consecutive days of "typical" instruction and six consecutive days of problem-solving instruction. In addition, several observer rating instruments and a short teacher rating instrument are completed daily.

3. Student Data. This data set consists of student aptitude test scores, pre- and posttest scores on problem-solving skills, posttest scores on a word problem test, and all homework and problem-solving worksheets completed during the observed instructional periods. In addition, student interviews will be conducted with representatives of high, middle, and low ability groups in each class.

Nine seventh-grade mathematics classes will be observed every day for five days (Monday - Friday) several weeks prior to problem-solving instruction to gather narrative data on teachers' "typical" instruction. Teachers will then be given a set of problem-solving materials (descriptions of problem-solving skills, exercises, problems in the skill areas) and asked to design a six-day unit on problem solving. Teachers will be interviewed about their conceptions of problem solving and the planning of their instruction.

The implementation of this unit will then be observed every day using the same observation methodology used during the observation of "typical" instruction. Student aptitude, pretest, worksheet, interview, and posttest data will also be collected. In addition, there

will be four control classes whose students are pre- and posttested only (no observational data will be collected); these control classes will be used to help assess the degree of student learning of the problem-solving skills.

Most observers will be involved in the collection of data on the second data set only--teacher implementation of instruction. This manual provides the background material and describes the procedures for collecting this data set only.

The next four sections describe each of four instruments that must be used each observation day. Three of the instruments, the Narrative Reports, the Lesson Rating Instrument, and the Lesson Segments Summary Sheet, are to be completed by the observer. The final instrument, Your Perceptions of Today's Lesson, is to be completed by the teacher immediately following the lesson. The final section of this manual summarizes data collection procedures.

SECTION II: COMPLETING NARRATIVE REPORTS

Introduction

The basic procedure for completing narrative reports is simple: while in classrooms, observers take narrative notes which they use after the class to write up a final narrative report of the lesson. The apparent simplicity of the basic procedure is deceptive however. There are really a number of important issues to consider if the narrative reports are to have any validity at all.

Why use narrative reports? It will be helpful to you to understand why we would want to use narrative reporting in the first place. After all, it would be much easier to use an "objective" coding scheme of teacher and student behavior, for example, to gather information about instruction in classrooms.

We can answer this question rather quickly. We think that having an observer in the classroom taking notes about instruction is the best way of really capturing the realities and subtle nuances of teaching in classrooms. Why we think this way needs a little more explanation and, as you will see, requires us to deal with two major problems.

The primary reason we think that first-hand descriptions are more valid is that observers can get a "feel" for what is actually happening in the classroom. While it is true that narrative accounts can be more subjective than other approaches to collecting classroom data because the accounts are "filtered" through the "eyes of the observer," it is also true that people can observe things that coding instruments cannot. Humans can use the many subtle cues that exist in classroom situations to help interpret the meaning of those situations, cues that do not "exist" for coding instruments.

For example, an observer could probably tell whether a negative comment to a student by a teacher was really a reprimand to the student which affected the entire class negatively or whether it was just part of the banter between a particular student and the teacher which passed without significance or impact on the rest of the class. And this interpretation could be reflected in what was written in the narrative notes. An observer using an "objective" coding scheme, on the other hand, would more than likely have to code the teacher's remark as "negative reprimand" or "punishment" or something similar because on the surface that was the teacher's comment. The point is that observers can often obtain more valid data because they are in a better position to understand the situation and the meaning of the situation to the participants.

Two potential problems. There are two potential problems with narrative reports however, and we must be careful to give them the

attention they deserve. One problem deals with the fact that the meaning of a classroom situation may not be all that obvious and simply having an observer in the classroom does not guarantee that the situation will be described as it really occurred. A second problem has to do with getting observers to focus on similar kinds of classroom events. In fact, if we are not careful in orienting all observers to the type of information we want, we run the risk of everyone writing down their own interpretations of what happened.

This point is so important that it will be useful to illustrate it with two examples. Consider the following two narrative accounts taken from different math lessons:

Example 1

> 11:35 T finally begins class after a long delay, telling students to get started on the board assignment. The T needs to give more problems because there are only 4 problems on the board and many students must have finished them already. There is too much noise for other students to work, but the T stays at her desk working on something. The T gets mad with some students and the noise level gets much better. They start going over the board problems which are too easy because everyone says that they got them correct. As they pass in their papers, they all look very bored.

Example 2

> 12:45 T at lectern, looking in text. Some students start walking around and T tells them to get back to their seats. T "On p. 204 we have a flow chart to help us sort things out. This is a novel idea. At top of the page see the number line, just a piece of it, x to the left and y to the right. In between is an improper fraction. Our task is to find what numbers represent x and y. What numbers are on either side, just below and just above 94/6? How do we do it? Look at the flow chart to help. We divide 6 into 94 and find we have 15 with a remainder of 4. What number is below 15--what whole number? We can see that x is going to be what whole number? What number will y be? What number is just under 15?" No answer from the class. T starts counting 1,2,3,4. T "What number comes before 15?" S answers 14. T "What number comes after 15?" S answers 16. T "So we can see that 15 2/3 is between what numbers? (Here the teacher must have realized he made a mistake so he immediately continued without waiting for an answer, which would have been wrong, given his example) T "Well, let's look at the other examples."

Can you see the difference between these two examples? In the first example, the narrative notes are riddled with interpretive and judgmental comments by the observer which reflect the observer's personal biases and concerns. In the second narrative, the observer

has described behaviorally what has happened and clearly denoted interpretive asides by parentheses. We want to avoid narratives like the first one and strive for narratives like the second one.

Learning how to write narrative notes that are behavioral in nature and that separate the behavioral descriptions from observer interpretations of that behavior is relatively easy to do. But the procedure of how to write the narrative is only part of the problem. The other part, and the one that is a little harder to describe, has to do with what to focus on during the observation of the lesson. Even if the two observers above were equally adept in writing behavioral accounts, it would do little good if they were not focusing on the same classroom events.

In this study, there are five different observers in nine different classrooms. We want to obtain as much consistency in focus among the five observers as possible. Otherwise, we will not be able to make comparisons between the different classrooms. The major obstacle is that classrooms are, at times, busy places where many things are going on and events are happening in rapid succession. What to note and what to ignore during these busy times are decisions which must be made quickly and on-the-spot. Fortunately, we are interested in some relatively specific activities (described later in this manual) which help observers focus on similar events and make these decisions easier.

Thus, a narrative report is a double-edged sword. On the one side, we get the benefit of having an observer in the classroom interpreting situations and making informed judgments about what is transpiring during instruction. At the same time however, we need to guard against what is called "observer bias"--personal biases entering the classroom descriptions and observers not focusing on the same events in the classroom.

We are willing to take the risk with the narrative reports, primarily because there has been a great deal of work with this technique which has demonstrated that the benefits far outweigh the drawbacks IF observers are careful, conscientious, and well-trained. You have been selected to be observers in this study, in part, because we believe you are careful and conscientious. This manual and the training you will receive will provide the framework to make you well-trained as well.

This section is organized into three major parts. The first part deals with suggestions for writing narrative notes which minimize observer bias. The second part presents a way of thinking about math classes and provides a framework for focusing on certain events during the classroom observation. The final part, then discusses the step-by-step procedure that all observers will follow in completing their narrative reports.

How to Write Narrative Notes

It is important that we do not let our personal biases and interpretations drastically alter the match between what really happens in the classroom and what we write down in our narrative notes. We want to strive to be as "objective" as possible. Of course, we cannot get away from the fact that the classrooms events will be "filtered" through the eyes of the observer and that some subjectivity will enter our descriptions no matter how careful we are.

Still, we want to minimize subjectivity as much as possible. There are four related suggestions to keep in mind which will help considerably in maintaining objectivity: (1) describe teacher and student actions behaviorally, (2) think of your narrative notes as a script which must be acted out, (3) maintain temporal continuity to actions, and (4) separate interpretations of behavior from descriptions of the behavior. Let's take a closer look at each of these.

Record Behavior

Classroom events should always be written in behavioral terms. This is not as easy as it may sound at first. It is very easy to use phrases like "T explains" or "T tries to determine," but these phrases are not acceptable. Consider these examples.

Example 1:

Non-behavioral: T explains where to put the exponent and the appropriate size of the exponent.

Behavioral: T writes on chalkboard $2 \times 2 \times 2 = 2^3$. T says "Two times 2 times 2 is the same as writing a two with a small three above it since there are three twos that need to be multiplied. The exponent should be smaller than the two and a little above it so we don't think it's really twenty-three.

Example 2:

Non-behavioral: When a student is wrong, teacher tries to determine source of error.

Behavioral: T asks "Who missed problem 13?" Two students raise their hands. T requests one student to give answer orally and student states "9 x 7". T says "Okay, but can 9 be divided further?" S immediately says, "Oh, yeah!"

Example 3:

Non-behavioral: Students get mad with one student who is standing in front of class.

Behavioral: T is writing seatwork problems on the front chalkboard. A student enters the class late and goes to the teacher at the chalkboard, blocking the view of the problems. Several students ask him to move and he doesn't respond to them. After about 20 seconds, four or five students yell loudly, "Move!"

Write Actable Accounts

An excellent way to periodically monitor how behavioral your narrative notes are is to ask mentally whether you could act out what happened from your narrative notes. If you can act out the situation, then your narrative notes are probably in good shape. If you can't, then you need to remember to record behavior.

Example:

Non-actable: The bell rings. T quiets class and starts work on today's assignment. The teacher begins to go over the textbook problems. A student is late and goes to his seat quietly. Lesson is progressing smoothly.

Actable: The bell rings. The T is at the front of the class, chatting with two students. "All right folks, the bell has rung. Let's begin. You know where you are supposed to be. Please open your books to page 220." The two students go to their seats. Students quiet down as they open their books. T walks down aisle to back of class as he says, "Problem #1, Tom, how many squares is that square box cut up into?" The student responds 16 immediately. A student enters class late, hands the teacher a late slip as they pass in the aisle, and sits down without interrupting the teacher at all.

Maintain Continuity

A third suggestion for writing good narrative notes is to maintain, as much as possible, the temporal continuity and flow of the lesson. All events occur in time. If we were videotaping a lesson, we would be able to capture this continuity easily. But we are not maintaining

a perfect continuous record when we write our narrative notes; rather, we will only note time every 5 minutes or so or when events and activities begin or end. For example, consider the following narrative record:

Example:

Discontinuous Record:

12:20 Bell rings for class change. T not in room.

12:27 T talks to two students in front of room.

12:30 T says, "Hope you understand the bathroom is locked up during 5th period. Okay, let's check roll."

There are several things to notice here. First, teacher "appears" out of nowhere talking to two students at 12:27. Second, it is unclear whether the teacher statement about the locked bathroom is directed to the whole class or the two students the teacher was talking to at 12:27. The action record is discontinuous. It is important to note that we are not suggesting that an exact record be kept; it is not physically possible to do this during most classroom lessons. We are only suggesting that attention to temporal continuity will eliminate many problems of interpretation. For example, a more continuous narrative of the above situation only requires a few more notes:

Example:

Continuous Record:

12:20 Bell rings for class change. T not in room.

12:24 T enters room and greets class. Most students are seated, talking quietly.

12:27 T talks to two students in front of room. Rest of class waiting.

12:30 The two students start walking out the door and the T says to them "Hope you understand the bathroom is locked up during 5th period. Okay, let's check roll."

Separate Descriptions of Behavior from Interpretations of Behavior

The final suggestion is to make sure that observer interpretations of behavior are kept separate from descriptions of the behavior. This suggestion is crucial for writing useful narrative accounts. Do not be afraid of putting interpretations into the narratives, but make sure they are indicated as such. We will all use parentheses for interpretative asides, as shown in the example below:

Example:

> 9:25 The lesson ends quickly and T says "OK, class, put away your books and get your homework out. We are going to correct it now." (This part of the lesson ended abruptly; some students did not appear to have grasped the concept yet; more time here may have been useful.)

What to Focus on During the Observation

In the previous section, we offered suggestions for dealing with one of the two major problems associated with observer bias, namely, eliminating personal biases and idiosyncracies from the narrative notes. In this section, we will take up the second major problem of observer bias: making sure all observers focus on the same kinds of events during the observation.

We will first discuss a way of thinking about math classrooms and the different parts of lessons that typically occur during instruction. Then we will use this framework to suggest the specific information and events that all observers should look for during their classroom observations.

A Way of Thinking About Math Classes

In completing our narrative reports, we will want an organizing framework to guide our descripton of the math lessons. The organizing framework we have selected is time: blocks or segments of time during the lesson that have a distinct purpose, focus, or pattern of activity. We will want to pay attention to the sequence and continuity of these segments of time, from the moment the class officially begins to the time it officially ends (the beginning and ending often signaled by the ringing of a bell). These blocks of time, when viewed together, give a math lesson a certain "structure." It is this structure that is important, and we will use it as a framework for our narrative reports.

There is a fairly standard structure (sequence of time segments) to a 7th-grade math lesson. This sequence of time segments is typically, although not always, made up of the following:

1. Opening Segments: This segment of lesson time begins with the official starting time of the class period and usually ends with some type of orienting statements by the teacher that today's lesson is about to begin. During this time, the teacher may be greeting students, taking care of late passes, taking roll, checking absence slips, and quieting class down; in general, procedural rituals.

During opening segments, no instruction is going on and students are typically waiting for directions (the teacher may however, have a standard routine of providing a few problems on the board that students are required to do during this time). The length of this segment varies considerably from teacher-to-teacher and even day-to-day; expect the opening segment to last from less than a minute to 10 minutes or more.

2. Directions Segments: This segment of lesson time is that part of the lesson where the teacher is preparing students for an upcoming assignment or activity. It is usually of short duration (less than 5 minutes). It might include giving instructions, suggesting materials to use, reminding students of how to do an assignment or activity, or presenting brief illustrations of how to do an assignment or problem. The distinguishing characteristic is the purpose; teachers are preparing students for an activity or assignment and there is little actual instruction occurring. This type of segment is usually carried out in a whole class grouping arrangement with a lecture or question and answer delivery system.

3. Instructional Segments: The major portion of a math lesson is taken up by periods of instruction where the primary focus of activities is academic in nature. Instructional segments take a number of different forms and can be categorized according to a number of different criteria. Here we will distinguish four different instructional segments according to the purpose of the segment: (a) development, (b) review, (c) practice, and (d) enrichment.

a. Development segment. The development period of instruction is that segment of time devoted to presenting and explaining new skills or procedures to students. The intent of the development segment is to introduce or expand on some new skill and is directed at developing student understanding. This type of segment is usually carried out in a whole class grouping arrangement with a recitation or discourse delivery system.

b. Review segment. The review period of instruction is that segment of time devoted to either one of two types of review: (1) correcting review and (2) refreshing review. Correcting review means review of homework problems and/or worksheet problems, where the intent is to correct any difficulties students might have with the problems. Refreshing review means review of a previously presented skill or procedure. This type of segment is typically carried out in a whole class grouping arrangement with a question and answer delivery system.

c. Practice segment. The practice period of instruction is that segment of time devoted to allowing students to practice, on their own, the skills or procedures that they were just taught or recently taught. Practice time allows students to achieve increased efficiency in performing a skill, or at later stages of practice, to polish a skill. This type of segment is typically carried out in an individual grouping arrangement with a textbook or worksheet delivery system.

d. Enrichment segment. The enrichment period of instruction is that segment of time devoted to allowing students to use or apply a newly learned concept or skill in a new or different format. This type of segment can be carried out in any format, but many times non-routine activities like games, math contests, programmed materials, and the like are used.

4. Testing Segment: This segment of lesson time is that part of the lesson where formal evaluation of student learning occurs with quizzes or tests.

Closing Segment: This segment of lesson time may or may not occur at the end of the lesson. If it does occur, it typically takes the form of either time to be filled, time for giving homework assignments or reminding students that homework assignments are due, or summarizing the lesson work that had been done that day. Many times the closing segment does not occur and seatwork gradually ends as students finish seatwork assignments and anticipate the official end of the period.

These segments of lesson time then, are some of the basic building blocks of math lessons and the particular sequence of segments which occur defines the "structure" of the lesson. And it is this structure remember, which we will use to think about and organize our narrative reports. For example, a typical structure of a math lesson might consist of the following four segments: (1) opening (4 minutes), (2) review of homework with a question and answer delivery system (16 minutes), (3) development of the concept of least common denominator with a recitation delivery system (15 minutes), and (4) practice with a worksheet delivery system (10 minutes). These four segments of time, illustrated in Figure 1, define the lesson's structure.

While we are interested in the different structures of math lessons that teachers use for their own right, there is another reason for spending time discussing them. The type of lesson segment will provide us cues about what to focus on and how much narrative detail to obtain during these various types of segments. During some segments, like a development segment, we will want to obtain very detailed information. During other segments, like a practice segment, we will not need as much detail in our narrative report. It is this issue to which we now turn.

Specific Events on Which to Focus

In thinking about focusing on certain classroom events during observation, it is useful to first consider two extremes or endpoints along a continuum which we might label "amount of information gathered." At one extreme might be a researcher who decides to set up a camera in the classroom and obtain a videotape (with audiotrack) of all classroom interaction from the very beginning of the lesson to the very end of the lesson. In this case, the researcher leaves the classroom observation with a great deal of what transpired during the lesson, albeit in the form of a videotape of the lesson.

At the other extreme might be a researcher interested in only one thing, say, how many "why questions" a teacher asks during a lesson. This researcher would ignore all classroom interaction except those episodes where a teacher asked such a question, and the only data this

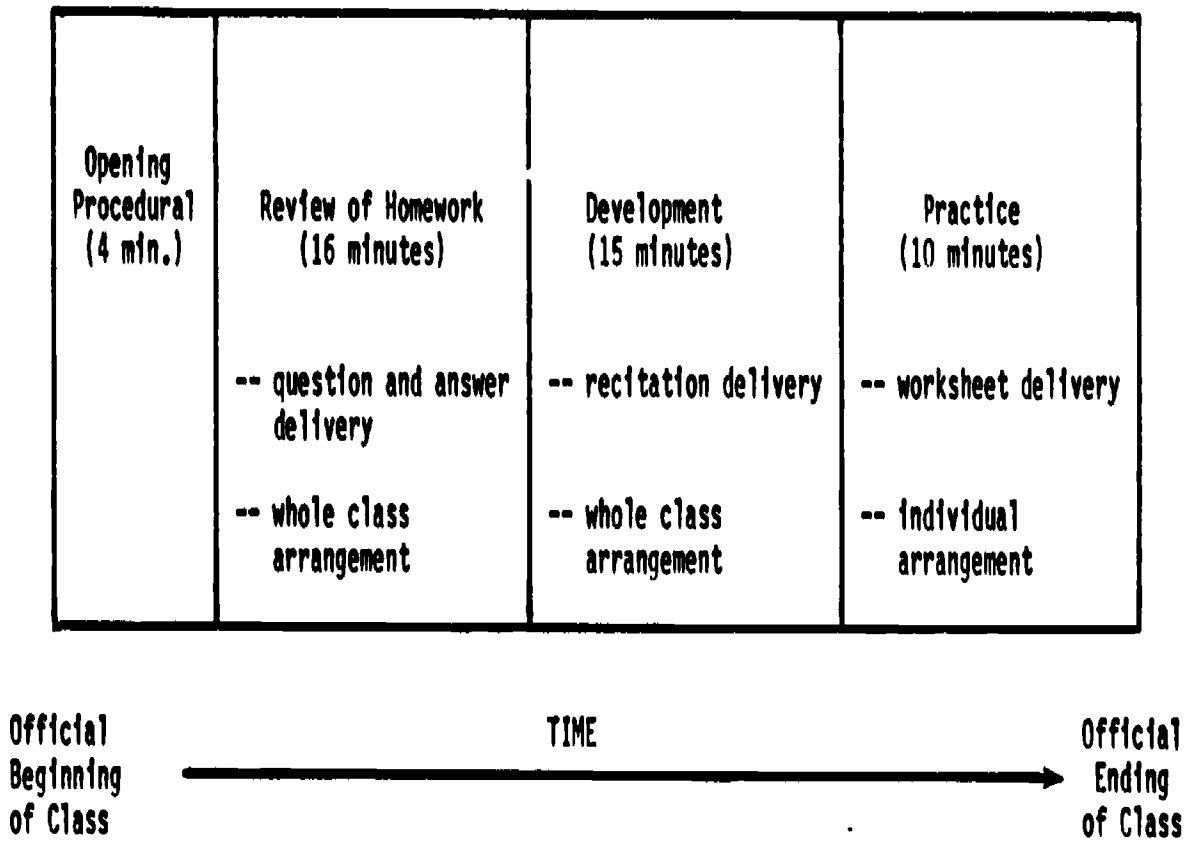


Figure 1

The Segment Structure of a Typical Math Class

researcher would produce from the classroom observation would be a tally of the number of "why questions" asked during the lesson.

It is easy to see that the "amount of information" obtained in these two studies is drastically different: in the first situation, we probably have too much data and in the second situation we probably have too little data. But the judgment about whether we have too much or too little really depends on our purpose as researchers. If all we are interested in is the number of "why questions," then the second situation fulfills our purpose adequately.

The reason we are spending time on what may seem like the obvious is that in education the obvious is usually important! And in the case of describing what it is that we want to focus on in our narrative notes, the purpose becomes critical. In part of our narrative notes, we want to obtain a great deal of information about what is going on in the classroom; in other parts, we only need to be concerned about some general descriptive information so that the reader knows what is happening and can maintain continuity from one time segment to the next.

In what follows, we describe the type of information we are interested in obtaining. These descriptions are organized accoding to the lesson segments discussed earlier (see pages II.8 - II.10).

1. Opening Segments:

   - Begin the narrative at the official starting time of the class period.
   - Provide a general description of what the teacher and students are doing during this period. Make note of any established routine the teacher may have for students to do during this period (e.g., a few board problems). Make note of any teacher statements regarding activities, homework assignments, or problems.
   - This opening segment usually ends with the teacher giving a verbal structuring cue that the lesson is officially under way. Record the time that the segment ends as well as the verbatim structuring cue, (e.g., T "All right, open your books to page 141. We are going to start with the problems at the top of the page.").

2. Directions Segments

   - Record the beginning time of the directions segment.
   - Provide a general description of what the teacher and students are doing during this period.
   - We are interested in all assignment problems, board problems, or homework problems that students are required to do. We

want to know the exact problems, not just that students had 5 homework problems to complete. Therefore, write down all problems that are written on the chalkboard or are given orally to students by the teacher, note every assignment that is given to the students (which problems, page numbers), and obtain a copy of all worksheets or workbook assignments that are passed out by the teacher.

- The directions that teachers give are important so try to get them verbatim. Student questions about their assignments are also important; try to get these verbatim also.

- Record ending time of the directions segment.

3. Instructional Segments

3a. Development Segment

- Record the beginning time of the development segment.

- Obtain as good a verbatim record of teacher talk as possible. Teacher "why" and "what" questions are important. Student talk is less crucial, but try to obtain verbatim record of student questions and student answers to teacher questions. Remember not to use the word "explains" to describe a teacher's instruction.

- Make particular note of teachers references to previous lessons, assignments, or subject matter content. These may be quite subtle, such as a teacher using phrases like "today we are going to do addition of mixed numbers again" or "remember when we did this?"

- Make note of use of examples with which to illustrate how or why a particular procedure, algorithm, or concept would be used.

- Record ending time of the development segment.

3b. Review Segment

- Record beginning time of the review segment.

- Make note of the concepts and/or problems that are being reviewed and how the review is taking place. Obtain verbatim records of teacher talk where there is explanation or instruction going on. Note any corrective feedback on the part of the teacher. If teacher is just giving answers to problems, it is not necessary to get verbatim notes unless there is instruction interspersed.

- Record ending time of the review segment.

3c. Practice Segment

- Record beginning time of the practice segment.
- Make note of the assignment given.
- There will be very little to record during these instructional segments. The typical instructional arrangement will be students working individually at their desks on some type of assignment with the teacher either circulating around the room offering periodic, individual help or maintaining intermittent vigilance over the class and answering questions or both. Therefore, continue to maintain continuity by noting teacher's actions and any significant events which occur or more than minor changes in noise level or atmosphere.
- The instructional events in which we are interested during practice segments are reminders, hints, or longer periods of explanation that the teacher might offer to the class. These often include suggestions or tips on the assignment students are working or the procedure that should be followed. Get verbatim accounts of these statements.
- Record ending time of practice segment.

3d. Enrichment Segment

- Record the beginning time of the enrichment segment.
- Provide a general description of the activity.
- Record the ending time of the enrichment segment.

4. Testing Segments

- Record beginning time of testing segment.
- Pay attention to the directions for taking the test and statements about how the test results will be graded.
- Record ending time of testing segment.

5. Closing Segments

- Record beginning time of closing segment, if it occurs.
- Note the content of the closing segment, e.g., whether it is a review of what was done during the lesson, whether it is a filler activity, etc.
- If it is instructional in content, obtain a verbatim record of teacher talk and student questions during this period.
- Record official ending time of class.

Writing the Narrative Reports

The procedure for completing the narrative reports consists of two phases: (1) an observation/audiotaping phase which occurs during the lesson, and (2) a write-up phase which occurs after the lesson. During the observation/audiotaping phase, the observer will take written notes of the ongoing classroom interaction and obtain an audiotaping of teacher-student verbal behavior. The audiotape will serve as a backup to the narrative notes written by the observer. During the write-up phase, the observer will write (or type) the narrative report by merging both the written notes and verbatim statements from the audiotape of certain portions of the lesson. This final narrative report, along with the observers' written notes and the audiotape, will comprise the primary source of data for this study.

The Observation/Audiotaping Phase

All narrative notes will be completed on the narrative note pads. (See the next two pages. Notice that a coversheet must also be completed.) These pads require the observer to make note of three separate pieces of information: (a) time, (b) narrative notes, and (c) chalkboard use. Each of these are described below.

Keeping track of time. During the lesson, you should periodically note what time it is to the nearest minute. However, there is no set pattern that you need to follow in recording time (e.g., recording time exactly every thirty seconds or exactly every two minutes), so do not become overly preoccupied with watching your clock.

Instead of having a set pattern of recording time, we will allow the events which unfold during the lesson to dictate when time is recorded. Thus, if nothing changes substantively during a 10 minute review segment, there would be no reason to record time every few minutes.

Even though the classroom events will dictate when time is noted, there are several general guidelines that should be followed and several distinct times that we would like you to record. These are described below.

- Always note the official beginning and ending of a class period.
- In general, note the time at least every five minutes. However, do not allow the noting of time to interfere with taking other more important notes about classroom instruction.
- Always try to note the beginning and ending times of classroom segments. We would like to be able to get the average length, for example, of all development segments or review segments. It will not help us to have the beginning time of a review segment only to find the next recorded time

Coversheet for Narrative Notes

Date: _____ Day of Week: M Tu W Th F

Teacher: _____ Observer: _____

Class/Period: _____ Period Begins: _____ Period Ends: _____

Number of Students:

Boys _____

Girls _____

Number of Adults:

Teachers _____

Other Adults _____ Specify: _____

_____

What is on the chalkboard to begin class:

Special Comments:

Teacher: _____ Observer: _____ Date: _____ Page __ of __

Time	Narrative Notes	Chalkboard Description

in the narrative notes to be half-way through the practice segment which followed. A good rule to follow then, is to note the time where there is a break in the action.

- The time of occurrence of any significant events should probably be noted if it does not interfere with other notetaking.

- It is alright to estimate the time if necessary, but try to keep such estimation to a minimum. An instance where it would be necessary to estimate time might be the onset of a particularly busy period where you were writing down verbatim teacher statements and you could not interrupt your writing flow to note the time. In this case, you might wait until you could stop and estimate the onset of the episode.

Completing the narrative notes. We have already said quite a bit about writing the narrative notes. Here we will briefly summarize the main points.

- Be sure to complete the cover sheet for the narrative of each lesson.

- In general, record what is going on: who, what, when, where.

- In general, take narrative notes continuously.

- Be sure to record behavior. It is all right to interpret situations, but first describe the situations in behavioral terms. Put all interpretations in parentheses.

- Be sure to maintain temporal continuity and the flow of classroom events.

- Pay attention to the "structure" of the lesson. This structure is of interest to us, and the structure provides cues about what to focus on during the lesson.

- We are most interested in problem-solving instruction, the problems that students complete, and the suggestions, hints, or tips the teacher might suggest to students about how to do problems. Pay attention for these episodes.

Keeping track of chalkboard use. Since considerable use of the chalkboard is made during math classes, it is necessary to note exactly what is on the board at the beginning of class and then to maintain a running record of what is written on the chalkboard during the lesson. There will be very few, if any, sentences written on the board (except perhaps word problems put up on the board). The large majority of chalkboard use will be math problems that the teacher

works out. Knowing what is written on the chalkboard will be extremely helpful in understanding many of the comments made by the teacher and the students.

There is really no trick to noting chalkboard use. Simply record in the space given on your narrative record what is written on the board as it unfolds during the lesson. A few tips and suggestions are given below:

- The reason for recording chalkboard use is to be able to match-up what is written on the board with the teacher talk that may be recorded verbatim. Use common sense. It will usually be the case that there is not much chance of any confusion occurring for the reader. Just make sure that the reader of your narrative record will have a good idea of what is on the chalkboard so that reference to the board is understandable.

- It will sometimes be necessary to make written notes about teacher gestures to information written on the chalkboard. For example, a teacher may be comparing the answers to two problems worked out on the chalkboard, simply pointing to the two problems and saying something like "Look at the difference between the answer to this one and that one. Why are they different?" If there was other information written on the board at the time, it may not be possible to figure out which two problems the teacher was discussing. So keep on the alert for this type of situation.

The Write-Up Phase

The second phase of writing the narrative report is the merger of the narrative notes and the audiotape in a formal narrative. This phase takes a considerable amount of time, mainly because you can listen to and transcribe only a short portion of audiotape at a time.

In theory, the narrative notes should be sufficiently complete to stand on their own; the audiotape should be viewed as supplementary. In practice, it does not always work this way because there is too much to write down at times. But we should always strive to make the narrative notes as self-sufficient as possible. About the time you start relying on the audiotape is the time the tape recorder will stop recording.

The audiotape is to be used to fill in places in the narrative notes where the observer may have missed something or was unable to write fast enough to keep up with the action. By merging the narrative notes and the audiotape, we should produce a full behavioral account of the lesson with a verbatim teacher and student record during periods of instruction.

The general procedure and suggestions for producing the final narrative report are given below. A brief example of in-class

narrative notes and a final narrative report for the same five minute period of time follows.

- Read over your narrative notes carefully. Mark places which are unclear or where more detailed information is necessary. Remember what it is that we are focusing on during different segments.

- Listen to short portions of the tape and take notes of additions, elaborations, or changes you need to make in the narrative notes. It may be helpful to do a five minute period at a time. If you have recorded five minute time intervals in your observation notes, this procedure allows an easy way to match corresponding segments when writing up the final narrative report.

- When you have finished listening to the tape, put your two sets of notes side-by-side. Read the two sets for each segment and plan how to integrate them. If necessary, add math problems under discussion by copying it from the textbook or worksheet. Write or type your final narrative report on the narrative note sheets. Do NOT throw away your original narrative notes; they are part of the data set!

- There are two occasions in particular to be on the alert for while you are taking your narrative notes. First, the audiotape will not record student talk very well (e.g., answers to teacher questions; student questions) unless the student speaks loudly or is in close proximity to the recorder. Second, the audiotape will not record teacher talk very well when the teacher is facing the chalkboard or has his or her back to the tape recorder. At these times, it will be necessary to write down teacher or student talk in the narrative notes if it is important to obtain. The audiotape will not record it.

- When there is a series of student answers to teacher questions, indicate whether the same student is responding or different students are responding by making interpretative asides (see example of merger on the following two pages).

- We will all use the following conventions for writing the final marrative report:

  -- T for teacher; S for student.
  -- Use dashes "-----" whenever a verbatim section you are transcribing is inaudible.
  -- Use dots ". . ." whenever a speaker is interrupted or cut-off.
  -- Quotation marks for verbatim records.
  -- Parentheses for interpretative asides.

Teacher: _____ Observer: _____ Date: _____ Page __ of __

Time	Narrative Notes	Chalkboard Description
11:50	T "Pay attention now. You have to change a mixed number into a improper fraction before you multiply. Is there anything to divide out? What is 11x15?" S answers 165. T "Divide 4. 4 into 16 is 4, 4 into 5 is one with one left over." T calls on S to change 2-3/5. Goes thru steps on board. S asks what to do if one number is whole # like 6 x 1-3/8. T "Any whole number can have a 1 put under it. It helps when you're multiplying a whole number by a fractional number. (Students are eager and alert; 5-6 hands go up at each teacher question; different students answering questions).	$5\frac{1}{2} \times 7\frac{1}{2} =$ $\frac{11}{2} \times \frac{15}{2} =$ $4\overline{)165}$ → $41\frac{1}{4}$ $2\frac{3}{5} \times 1\frac{2}{3} =$ $\frac{13}{8} \times \frac{8}{3} = \frac{13}{3} = 4\frac{1}{3}$ $3\overline{)13}$ → $4\frac{1}{3}$, remainder 12/1 $6 \times 1\frac{3}{8}$ $\frac{6^{3}}{1} \times \frac{11}{8_{4}} = \frac{33}{4} = 8\frac{1}{4}$
11:55		

Example of Narrative Notes

Teacher: _____ Observer: _____ Date: _____ Page __ of __

Time	Narrative Notes	Chalkboard Description
11:50	T "Pay attention now up here. That means all of you. Girls up here please. Yesterday, and most of you did very well, we multiplied fractions and we cancelled out and divided out. Now today we have to consider what happens if you have a mixed number. You remember we practiced changing a mixed number into an improper fraction. If you have something like this, 5 1/2 x 7 1/2, you have to change it to an improper fraction. Two times five is ten + one-half is 11/2. Same procedure for 7 1/2. In this problem, is there anything to divide out? No, the 2 won't go into the 15 or the 11. What is 11 x 15?" 165 (student answers). T "Over 4. Now I have to divide that into 165." T goes through division steps on board. When she is finished, stude start clapping. T "What's that for?" S You're a genius. T "Okay chang. chis one for me" (2 3/5). S says 13/5. T "Okay, what's this one? (1 2/3). S says 5/3. T "Okay, is there anything in this one that we can cancel out?" S 5. T "Okay, we cancel out the fives, multiply across, then divide." S Will you do that again? T "Which problem?" S 6 x 1 3/8. T "If you have 6, a whole number, times 1 3/8--any whole number can have a one put under it, so we know where the denominator is. You can divide 6 and 8 by 2, 3 times 11 = 33, 1 x 4 = 4 = 33/4 = 8 1/4. Any time you have a whole number and you're multiplying fractions, you can put a one under it." (During this period, different students are answering teacher questions. Students alert, eager, 5-6 hands go up at every question.)	$5\frac{1}{2} \times 7\frac{1}{2} =$ $\frac{11}{2} \times \frac{15}{2} =$ $4\overline{)165}$ $41\frac{1}{4}$ $2\frac{3}{5} \times 1\frac{2}{3} =$ $\frac{13}{5} \times \frac{5}{3} = \frac{13}{3} = 4\frac{1}{3}$ $3\overline{)13}$ $4\frac{1}{3}$ $\frac{12}{1}$ $6 \times 1\frac{3}{8}$ $\frac{6}{1} \times \frac{11}{8} = \frac{33}{4} = 8\frac{1}{4}$
11:55		

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Example of Final Narrative Report

SECTION III: THE LESSON RATING INSTRUMENT

The Lesson Rating Instrument is a high-inference rating scale which requires the observer to rate the lesson observed on nine different dimensions. High-inference means that you must use considerable judgment to complete the instrument. Rating scale means that you will rate the lesson along some scale, in this case a 5-point scale. This rating will be completed following <u>each</u> lesson.

As you might have guessed, the major problem in using a high-inference rating scale is having all observers rate similar lessons in the same way. In the best possible case, two (or more) observers in the same class would give identical ratings of the lesson--there would be consistency in rating across observers.

What might be less clear is that each rater must also rate in a consistent manner from one day to the next. That is, assuming that the same lesson could be observed on two different days by the same observer, we would want that observer to give identical ratings--there would be consistency in rating across days. This <u>does not mean</u> however, that all lessons should be rated the same. It simply means that <u>how</u> you rate should be consistent.

To help in obtaining rater consistency, descriptions of each of the 9 dimensions follow the rating form (see the following pages in this section). Read each description carefully. You are encouraged to refer to these descriptions each time you complete the instrument. A second set of the descriptions has been provided in your packet of instruments so you can complete the rating form without having this manual in your possession.

Teacher: _____
Date: _____
Observer: _____

Rating Form for The Lesson Rating Instrument

Check the one rating that is most appropriate for the class that you just observed. Try to think of each item individually as you make your rating; do not allow a rating on one item to influence the rating on other items. You should refer to the descriptions of each scale as you make the ratings.

1. Teacher orients students to learning

[ ] No orientation
[ ] Low orientation
[ ] Moderate orientation
[ ] High orientation
[ ] Very high orientation

2. Teacher's use of realistic and relevant examples

[ ] No use of realistic examples
[ ] Low use of realistic examples
[ ] Moderate use of realistic examples
[ ] High use of realistic examples
[ ] Very high use of realistic examples

3. Teacher's divergent orientation

[ ] Very low divergent orientation
[ ] Low divergent orientation
[ ] Moderate divergent orientation
[ ] High divergent orientation
[ ] Very high divergent orientation

4. Teacher's use of discovery techniques

[ ] No discovery techniques
[ ] Low discovery techniques
[ ] Moderate discovery techniques
[ ] High discovery techniques
[ ] Very high discovery techniques

5. Lesson challenge

[ ] Very low challenge
[ ] Low challenge
[ ] Moderate challenge
[ ] High challenge
[ ] Very high challenge

6. Lesson complexity

[ ] Very low lesson complexity
[ ] Low lesson complexity
[ ] Moderate lesson complexity
[ ] High lesson complexity
[ ] Very high lesson complexity

7. Activity flow and lesson pace

[ ] Very poor activity flow
[ ] Poor activity flow
[ ] Moderate activity flow
[ ] Good activity flow
[ ] Excellent activity flow

8. Lesson closure

[ ] No lesson closure
[ ] Low lesson closure
[ ] Moderate lesson closure
[ ] High lesson closure
[ ] Very high lesson closure

9. Classroom discipline techniques

[ ] Very low management
[ ] Low management
[ ] Moderate management
[ ] High management
[ ] Very high management

The Lesson Rating Instrument

1. Teacher orients students to learning

This dimension refers to the extent that a teacher orients students to what it is that they are going to learn or do during the lesson.

(1) No orientation

The students were not told what they were going to learn or do during the lesson or how the lesson related to other material they had learned previously; the lesson simply began with no apparent reason from the teacher. No objectives or outlines of the lesson were given, and no links between new and old material were made.

(2) Low orientation

Between (1) and (3).

(3) Moderate orientation

The students were told what they were going to do or learn, but orientation was brief, not particularly clear.

(4) High orientation

Between (3) and (5).

(5) Very high orientation

The students were told what they were going to learn or do in a very clear and understandable way. An outline was given, the teacher told the students what was expected of them to learn, or the teacher made an effort to provide an advance organizer to link old material with the new material of the lesson.

2. Teacher's use of realistic and relevant examples

This dimension refers to the teacher's use of examples, if and when appropriate, during the lesson. Realistic and relevant examples enable the student to understand a concept better because the examples are familiar to the student, relate to the student's real life experiences, and are less formal and "textbookish."

(1) No use of realistic examples

None of the examples used were realistic or relevant.

(2) Low use of realistic examples

Between (1) and (3).

(3) Moderate use of realistic examples

Some of the examples used were realistic and relevant.

(4) High use of realistic examples

Between (4) and (5).

(5) Very high use of realistic examples

The examples used were realistic and relevant.

3. Teacher's divergent orientation

This dimension refers to the extent that the teacher presents a convergent or a divergent orientation during the lesson. A convergent orientation is one in which there is an emphasis on the one best or correct solution to problems and the correct application of an algorithm. A divergent orientation is one in which the teacher emphasizes different approaches or strategies for solving problems and the understanding of the problem itself.

(1) Very low divergent orientation

The teacher's entire orientation to instruction was convergent in nature. The correct approach and the correct solution to problems were emphasized.

(2) Low divergent orientation

Between (1) and (3).

(3) Moderate divergent orientation

The teacher's orientation was partly convergent and partly divergent.

(4) High divergent orientation

Between (3) and (5).

(5) Very high divergent orientation

The teacher's entire orientation to instruction was divergent in nature. Different approaches and strategies for solving problems were emphasized as was the understanding of the problem.

4. Teacher's use of inquiry or discovery techniques

This dimension refers to the use of inquiry or discovery techniques during the lesson. Low inquiry refers to an emphasis on telling students information and telling them about concepts and algorithms. High inquiry refers to an emphasis on allowing students to figure out concepts for themselves by asking questions or structuring activities in a way that promotes discovery of the concept.

(1) No discovery techniques

No discovery techniques were used; the teacher spent the instructional time telling students about math facts or concepts.

(2) Low discovery techniques

Between (1) and (3).

(3) Moderate discovery techniques

Some discovery techniques were used, but only for a part of the lesson.

(4) High discovery techniques

Between (3) and (5).

(5) Very high discovery techniques

The entire lesson could be characterized as the teacher using discovery techniques; the teacher emphasized active student understanding of the concepts presented.

5. Lesson challenge

This dimension refers to the extent that the lesson presented provides a challenging and questioning environment to students. Low challenge occurs when the atmosphere in the classroom is one of sameness, routine, and there is an emphasis on low level thinking. High challenge occurs when the atmosphere is one of diversity and there is an emphasis on questions and assignments that force students to think and push their understanding beyond simple recall.

(1) Very low challenge

The atmosphere in the classroom was one of sameness and routine. Students were not challenged at all by the lesson's activities.

(2) Low challenge

Between (1) and (3).

(3) Moderate challenge

About half the lesson appeared to be challenging and about half the lesson was routine.

(4) High challenge

Between (3) and (5).

(5) Very high challenge

The atmosphere in the classroom was one of diversity and higher level cognitive orientation. Students were challenged by the lesson's activities.

6. Lesson complexity

This dimension refers to the informational and procedural complexity of the lesson. High lesson complexity refers to the teacher presenting a great deal of information or using activities that are procedurally complex. Low complexity refers to a lesson with little informational and/or procedural complexity.

(1) Very low lesson complexity

The teacher's presentation of information and/or the activities during the lesson were very simple and straightforward. There was very little possibility of confusion due to quantity of information.

(2) Low lesson complexity

Between (1) and (3).

(3) Moderate lesson complexity

The teacher's presentation or the activities during the lesson were moderately complex. There was some possibility for student confusion.

(4) High lesson complexity

Between (3) and (5).

(5) Very high lesson complexity

The teacher's presentation and/or the activities during the lesson were very complex. There was a good possibility for student confusion.

7. Teacher's maintenance of activity flow and lesson pace

This dimension refers to the extent that a teacher maintains an adequate flow and pace to the lesson and does not allow the lesson to drag out or bog down. Poor activity flow occurs when a teacher over-elaborates a problem, task or directions, gives too many examples, or spends too much time with a particular student. The result is student boredom or restlessness. Good activity flow occurs when a teacher keeps the pace of the lesson moving and does not allow intrusions into the lesson to become salient.

(1) Very poor activity flow

The entire lesson was very slow and plodding; many students were bored.

(2) Poor activity flow

Between (1) and (3).

(3) Moderate activity flow

The lesson flow was adequate about half the time but slowed down in places or during some activities.

(4) Good activity flow

Between (3) and (5).

(5) Excellent activity flow

The entire lesson flowed smoothly and at a pace that kept students involved and on-task.

8. Lesson closure

This dimension refers to whether a teacher brings the lesson to a psychological end by completing the lesson on time. Lesson closure may be indicated by a teacher summarizing what had been accomplished during the lesson or by simply making sure everyone had completed the assignment. Lack of lesson closure is indicated by the class ending before the lesson or activity was completed or by the teacher rushing to get the lesson completed before the end of class.

(1) No lesson closure

The class period ends before the lesson is completed; there is no summary or indication of what students have accomplished.

(2) Low lesson closure

Between (1) and (3).

(3) Moderate lesson closure

The lesson ends on time, but there is no teacher summary or conclusion. Seatwork activities end the lesson.

(4) High lesson closure

Between (3) and (5).

(5) Very high lesson closure

The teacher concludes the lesson by summarizing what was done during the lesson or by relating the material covered to other material.

9. Teacher's use of good classroom discipline techniques

This dimension refers to the extent that the teacher demonstrates good managerial skills during the lesson. Good managerial skills include nipping misbehaviors in the bud, disciplining the instigator of a disruption and not "innocent bystanders," and not "overreacting" to student misbehavior. Poor managerial skills include allowing misbehavior to go on too long so that the disruption increases in severity or spreads to other students, not disciplining the instigator, and being too severe or stern with a student.

(1) Very low management

The teacher managed the classroom very ineffectively. Too many disruptions were tolerated and the classroom was chaotic at times.

(2) Low management

Between (1) and (3).

(3) Moderate management

Occasionally the teacher was an effective manager; some display of good managerial skills. Sometimes however, the teacher managed ineffectively and allowed too many disruptions.

(4) High management

Between (3) and (5).

(5) Very high management

The teacher was an effective manager. The teacher conducted the lesson with minimal disruptions and dealt with those that occurred quickly and effectively.

SECTION IV: THE LESSON SEGMENTS SUMMARY SHEET

Introduction

The Lesson Segments Summary Sheet is a combination coding and summary sheet which requires the observer to summarize each of the lesson segments which occurred during the lesson observed (see the following pages). There are four different codings which must be made--segment name, delivery systems, grouping arrangements, and assignment pattern--and one set of summary notes concerning the actual assignment, if any, during the segment. Descriptions of each coding and how they are to be made are given below.

Segment Name

The segment names to be coded are those that were discussed in Section II (see pp. II.7 - II.10) under "A Way of Thinking About Math Classes." These segment names refer to the block of segments of lesson time that have a distinct purpose, focus, or pattern of activity. A brief description of each follows.

1. Opening Procedural. The opening procedural segment refers to the initial period of lesson time where the teacher is completing procedural duties. This segment may or may not occur, depending on routines set up by the teacher. No instruction occurs, but students may be reuqired to do academic work during this time.

2. Directions. Directions segments are typically very short and they typically occur before some type of seatwork activity. The teacher is giving directions or explanations about how to do an assignment or activity. There is very little, if any, instruction.

3. Development. Development segments are those periods of instructional time where new facts, skills, or procedures are presented to students. (To distinguish this segment from review, it may be necesary to ask the teacher about segment purpose following the lesson.)

4. Review. Review segments are those periods of instructional time where facts, skills, or procedures are being reviewed by the teacher. (To distinguish this segment from development, it may be necessary to ask the teacher about segment purpose following the lesson.)

5. Practice. Practice segments are those periods of instructional time where students are provided an opportunity to practice a new skill or procedure.

6. Enrichment. Enrichment segments are those periods of instructional time where students are provided the opportunity to expand on their skills and procedures through games, math contests, programmed materials, or other non-routine activities.

LESSON SEGMENTS SUMMARY SHEET

Teacher: _____ Observer: _____ Date: _____

Official Class Beginning Time: _____ Official Class Ending Time: _____

Segment # and Name	Segment Time	Delivery Systems Used (in sequence)	Grouping Arrangement	Assignment Pattern	Content and Actual Assignment (if any)
1	Begin: _____ End: _____				
2	Begin: _____ End: _____				
3	Begin: _____ End: _____				
4	Begin: _____ End: _____				
5	Begin: _____ End: _____				

e back of this sheet for comments or explanations as needed.

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Lesson Segment Codings

SEGMENT NAMES

1. Opening Procedural
2. Directions
3. Development
4. Review
5. Practice
6. Enrichment
7. Testing
8. Closing

DELIVERY SYSTEMS

1. Lecture
2. Demonstration
3. Discourse
4. Recitation
5. Discussion
6. Question/Answer
7. Oral practice/Drill
8. Film/TV/Audio-visual (specify)
9. Textbook/Workbook/Worksheet (specify)
10. Contest/Game/Computer/Lab/Project (specify)
11. Simultaneous (specify numbers in brackets, e.g., 10[3,8] for simultaneous use of recitation and textbook)

GROUPING ARRANGEMENT

1. Whole class
2. Sectioned
3. Individual
4. Tutorial (one-on-one)
5. Combination (Specify number in brackets, e.g., 5[2,3] for combination sectioned and individual grouping arrangement)

ASSIGMENT PATTERN

1. Uniform
2. Diverse
3. Individualized

7. Testing. Testing segments are those periods of time during which students are formally taking quizzes or tests.

8. Closing. Closing segments may or may not occur at the end of the lesson. If they do occur, the purpose may be instructional (e.g., a teacher summarizing a lesson), managerial (e.g., as a time filler or fun activity), or procedural (e.g., giving homework assignments).

Delivery Systems

A delivery system is the mode in which information is communicated to students and in which the learner gains access to that information. Delivery systems are commonly referred to as teaching methods--to how content is presented and delivered to students. A brief description of each follows.

1. Lecture. The teacher talks to students for some time about the skill, concept, or procedure that is being taught. While there may be an occasional student question, the teacher is clearly dominating the instruction and talking most of the time.

2. Demonstration. The teacher shows students how to do a problem or how to do an activity. Demonstration may involve extensive use of the chalkboard or some other object. The key features are that the teacher shows students something concrete and that which is being shown is the focal point of the lesson at that time.

3. Discourse. A discourse delivery system refers to relatively short teacher question-student answer exchanges, exchanges that are often relatively well paced (to maintain pace, the teacher often calls on students by name). The teacher often uses the student response as a springboard for the next question or presentation of the next piece of information. There is student input, but usually in the form of answering questions, not asking them, and the recitation is clearly directed and paced by the teacher.

4. Recitation. This delivery system is like discourse in that there are teacher questions and student answers, but the pace is not as fast and the teacher usually does not use the student answers as a springboard for the next short presentation or question (the teacher often directs the question to the whole class, in effect asking for volunteers). The teacher is likely to be using an overhead projector, the chalkboard, and/or a textbook to discuss problems or present information.

5. Discussion. Discussions are always led by the teacher, but the purpose is to get students to exchange opinions and ideas, not necessarily to focus on the right answer. There is not as much talk on the teacher's part as during a lecture or recitation, but the amount of talk really depends on how much the students participate.

6. Question/Answer. This delivery system usually occurs when a teacher leads students in correcting worksheets, homework problems, or tests. There are typically not many instructional explanations occurring, although the teacher will sometimes stop and do a problem on the chalkboard or point out something particular about a question or problem.

7. Oral Practice/Drill. Oral practice and drill refers to the teacher repetitiously leading students in reciting some basic facts with the intent of exercising a skill and not necessarily increasing understanding. This delivery system is more common in lower elementary grade levels.

8. Film/TV/AV. This delivery system refers to the use of films, TV, or filmstrips to present information to students. However, these mechanical devices must be used in a relatively continuous manner for this code to be used. A slide presentation, where each slide is used as a focal point for teacher lecture or recitation and the lecture or recitation dominates the instructional presentation should not be coded here.

9. Textbook/Workbook/Worksheet. This delivery system refers to when students are reading in or working on a textbook or worksheet, or are working problems written on the chalkboard. This activity almost always occurs when students are working individually at their tables or desks.

10. Contest/Game/Computer/Lab/Project. This code is a grabbag for a variety of infrequently used but not necessarily unimportant delivery systems. The titles are self-explanatory. These delivery systems are likely to last for some period of time and the nature of the particular delivery system will be clear from the narrative report.

11. Simultaneous Delivery Systems. This code should be used when more than one of the delivery systems are occurring at once. This is possible since some of the delivery systems are teacher directed and others are mechanical or object directed. For example, simultaneous delivery systems would be coded when a teacher was working with a group of six students and the rest of the class was working on a worksheet at their desks.

Grouping Arrangements

A grouping arrangement is simply the way in which the teacher configures students for instruction. It refers to how a teacher sets up and organizes students for instructional delivery. The range of possible grouping arrangements, in a class of 30 students for example, is from one group of 30 students (whole class) to 30 groups of 1-student each (individual).

There are three basic grouping arrangements--whole class, sectioned, and individual--each of which is briefly described below.

1. Whole class. A whole class grouping arangement is one where the teacher uses the class as the unit for instructional delivery. Also considered whole class is the situation where the unit of instruction is most of the class, but where there is some temporary side activity (e.g., a student or several students are working on make-up or enrichment activities while the teacher conducts a recitation with the rest of the class).

2. Sectioned. A sectioned grouping arrangement is one where the teacher organizes for instruction at least two distinct subgroups of any size. Although there are a wide number of possible sectioned grouping arrangements, in reality there are only a few commonly used ones. These depend on the assignment pattern (to be discussed shortly) and the delivery systems selected by the teacher. The common sectioned grouping arrangements are:

   a. students are divided into small groups for instructional reasons and given diverse (different) assignments,

   b. students are divided into small groups for activity purposes and given uniform or diverse assignments, and

   c. students are divided into two distinct groups, one a small group working with the teacher and the other composed of the remainder of the class in an individual grouping arrangement (see below).

3. Individual. An individual grouping arrangement is one where the teacher uses the individual as the unit of instruction. This is NOT necessarily "individualized instruction," which depends on how the assignments for students have been made. It is simply the case where students are expected to work alone.

4. Tutorial. A tutorial grouping arrangement is one where the teacher uses one individual as the unit of instructional delivery.

5. Combination. A combination grouping arrangement is one where two or more of the above arrangements are being used simultaneously.

Assignment Patterns

What complicates matters slightly is that teachers set up grouping arrangements for instructional reasons, and these reasons vary according to the assignment pattern decided upon by the teacher. There are three types of class assignment patterns--uniform, diverse, and individualized--and these can be combined in various ways with the grouping arrangement. A brief description of the three types of assignment patterns is given below.

1. Uniform. A uniform assignment pattern is one in which all students in the class are given the same assignment or are presented with the same information.

2. Diverse. A diverse assignment pattern is one in which students work on different assignments, but not every student has a unique assignment. This may occur if a teacher forms instructional groups and makes assignments based on group membership. It also occurs during free work periods.

3. Individualized. An individualized assignment pattern is one in which students are given assignments chosen for them on an individual basis. Typically a commercial package which includes text, worksheets, and tests drives the assignment pattern.

Content and Assignment

This final section is not a coding but a brief written summary of the content of instruction and assignment, if any, given to the students during the segment. Be specific. We want to know exact page numbers in the textbook or workbook and the exact problems that are assigned. Obtain a cpy of any worksheets and make note like "see attached worksheet on fractions." If there was no assignment, write "no assignment."

How to Complete the Summary Sheets

Complete the summary sheets during or following the writing of your final narrative report. We will leave the time of completion up to you; choose a procedure with which you feel comfortable. You may want to make marks during your narrative note taking to indicate some of the information required here. We will discuss this during observer training.

SECTION V: YOUR PERCEPTIONS OF TODAY'S LESSON

Your Perceptions of Today's Lesson is a short teacher questionnaire that should be completed by the teacher immediately following the lesson. It should only take about one minute to complete. If the teacher is too busy to complete the questionnaire, leave it with the teacher and request that it be completed as soon as possible while the lesson is still fresh in the teacher's mind.

Your Perceptions of Today's Lesson

We want your impression of how well the lesson went today. Please answer the questions on this page (both sides) as soon as possible after the lesson is completed, preferably before the next class begins.

Circle only one response for each question.

1. What proportion of the students do you estimate had difficulty learning your lesson objective today?

   a. none of the students had difficulty
   b. only a few
   c. about one-fourth
   d. about one-half
   e. about three-fourths
   f. almost all
   g. all of the students had difficulty

2. What proportion of the students do you estimate were invclved in your lesson assignments today?

   a. none of the students were involved
   b. only a few
   c. about one-fourth
   d. about one-half
   e. about three-fourths
   f. almost all
   g. all of the students were involved

3. What proportion of the students do you estimate cooperated well in your lesson activities today?

   a. none of the students cooperated
   b. only a few
   c. about one-fourth
   d. about one-half
   e. about three-fourths
   f. almost all
   g. all of the students cooperated

4. Compared to what I had planned, today's lesson went

   a. exactly as planned.
   b. slight different than planned.
   c. moderately different than planned.
   d. very different than planned.

Over. . .

5. Considering the lesson overall, please rate how well you think the lesson went today?

   a. very good
   b. good
   c. fair
   d. poor

   If you selected (a) or (b), please answer number 6 only.
   If you selected (c) or (d), please answer number 7 only.

COMPLETE ONLY ONE OF THE FOLLOWING:

6. I think the main reason why today's lesson was successful was because

   a. the lesson content was at the right level of difficulty.
   b. there were few student discipline problems.
   c. the teaching methods used were appropriate.
   d. the lesson activities maintained the attention of students.
   e. the pace of the lesson did not slow down too much.
   f. the students achieved the purpose of the lesson.

7. I think the main reason why today's lesson was not particularly successful was because

   a. the lesson content was too difficult.
   b. the lesson content was too easy.
   c. there were too many student discipline problems.
   d. the teaching methods used were inappropriate.
   e. the lesson activities did not maintain student attention.
   f. the lesson pace slowed and dragged on.
   g. the students did not achieve the purpose of the lesson.

SECTION VI: DATA COLLECTION PROCEDURES

The procedure for completing data collection consists of four steps:

1. Enter the school and set-up in the classroom
2. Take narrative notes and audiotape the lesson
3. Complete the post-lesson instruments
4. Write the final narrative record

Here are some general procedures and suggestions about collecting the narrative data in your assigned classrooms. Most of the suggestions can be summarized quite simply: be organized and be prepared to go from the time you enter the school.

- Make sure you have all the necessary materials for your day's observation before you leave for school. It is wise to keep extra copies of materials for emergencies.

- You will be collecting a large amount of data as the week progresses. Be sure to clearly label all materials with the date and the teacher's name and file accordingly.

- Be ready to enter your class before the class period is ready to begin. We want to start the narrative record at the official starting time of the class. Check with your teachers and see what they think. They may be willing to allow you to set up during the last few minutes of the immediately preceeding class.

- Locate yourself to the side or the back of the classroom where you are unobtrusive as possible but still have a good view of classroom activities. Do not forget that being able to hear the teacher and students is as important as seeing their interaction.

- Set up the tape recorder close enough to where you are sitting so that you can monitor it. Remember that the tape recorder is going to be sensitive to sounds and noises close to it so avoid locations that may have too much background noise. The tape recording is extremely important; be sure to check and double-check that the recorder is working properly.

- We are using 90-minute tapes. Record one lesson on each side. Do not put two different teachers on the same tape. This means that if you are observing two different teachers in a day, you need to use two different tapes. Label each side of every tape with date, teacher's name, and observer name.

- Avoid interacting with students and the teacher during the actual math class. Minimize your presence as much as possible. However, the teacher will more than likely introduce you to the class, so be prepared. If asked to say anything, simply say you are interested in how schools work and leave it at that. (Make note of it in your narrative.)

- Do not allow teachers to read the notes that you will be taking during the study. Politely explain to the teachers that to discuss the notes would jeopardize the research effort. If teachers persist in asking questions about the study or about how they are doing, assure them that you will be glad to answer all questions at the end of the study.

- Never offer evaluative comments about students or the teacher's performance, even if the teacher says it is alright to do so. Remain as neutral as possible.

Here is a checklist for daily data collection:

_____ Cover page to Narrative Notes

_____ Narrative Notes

_____ Rating Form for the Lesson Rating Instrument

_____ The Lesson Segments Summary Sheet

_____ Your Perceptions of Today's Lesson

_____ Final Narrative Report

_____ Audiotape

Appendix C

INTERVIEW EXCERPTS BY TEACHER

Section 1: Interview Excerpts on Problem-Solving Views

Section 2: Interview Excerpts on Planning Process

Section 3: Interview Excerpts on Plans for Problem-Solving Unit

Section 4: Interview Excerpts on Post Problem-Solving Unit Views

Interview Excerpts on Problem Solving Views

TEACHER 1

How Textbook Handles Problem Solving

Well in a way they do, as far as problem solving, they intermix word problems quite well. At the end of every section they'll have some percentage problems or some problems to do with geometry in word problem form. So I do appreciate that. They're not always in a big lump in the back of the book. They are related to a particular math topic, which is nice. (5; 1-7)

Well the ones [word problems] that are there I think are fairly good. They try to relate them to everyday life. While they include them at the end of every chapter, there's not enough of them. I would like to see more, because that's where the student does the worst type of work. They always freeze up on them and they don't know how to approach or attack the problem, and I think the more they have the easier it becomes. (5; 19-26)

Drill and Practice

Oh, Sure it is.
ANY SPECIFIC REASON?
Well I think it's especially important for the lower level students because they need to be able to gain some expertise and a little speed, because they are taking tests and the tests are required of them. And I think they build confidence. The quicker they can work a problem the better they feel about it and they're more willing to tackle other things. Too often at the higher level, we spend too much time doing computations and we should be doing more enrichment. If they have those skills down already, I think the better students resent having to spend a lot of time doing multiplication and division and not learning anything new....it would be nice to be able to present the drill and practice in maybe some different format once in a while--and that's not always easy to do--so that the lower level achievers don't get bored too. It is repetitious and I think they too resent it even though they need the practice. (6-7, 16-11)

Difficulties with Word Problems

Well one is because I think they are relying on two skills and sometimes, especially at an early age, they're not terribly proficient in either one--reading or math--and then the combination of the two skills, having to decipher what is relevant in the problem is probably the biggest hangup. There are more numbers than necessary, they often don't know what to eliminate and use in their calculations. Oftentimes the way the problem is worded may be misleading to them or it may not be the way that they would say the problem. So they can't really decipher what the problem is asking them to do. (8; 1-12)

Importance of Problem Solving

I think a lot more than we're giving it right now. I would say between 60% and 75% because at this point I think most of them have got the computation skills, and they need to apply them. (11; 1-4)

Define Problem Solving

That's a difficult one. I know what it is in my mind. It's taking a situation and determining the facts in the situation, analyzing what needs to determine if there's a problem in the situation--there may not be--determine what information is missing in order to answer that problem and how you're going to supply that information. In math it often revolves around certain basic math skills to determine if you're going to multiply, divide, add, whatever, and be able to supply a solution. (12; 6-15)

Major Roadblocks in Teaching Problem Solving

The availability of enough problems, the actual type of problem that teaches a particular skill and relates it well. Another one of our major problems is the lack of time to the students, but those are things that are not going to go away very quickly I don't see. (17; 20-24)

Solution vs. Understanding

The understanding of them. I would much prefer that they understand what they're supposed to do than actually doing the math part. If they can set up a formula or an equation, then they can take out their computer or their calculator and do the actual calculations. (20; 23-28)

Showing vs. Understanding

I would like to be able to do more of the latter, to have them understand how to do it alone, but I probably--because it's easier and quicker--show them how it should be done. And that's a hard skill just to teach them to know intuitively how to go about doing things. The brighter students I think want to know how it works. If you throw something out to them and you say okay, this is the way it is, they're going to say oh yeah, why? And you have to be prepared to tell them why. The slower students often just want the basics. "How am I going to do this? What's my grade going to be?" I think the basic interest in math, the curiosity about it oftentimes isn't there. For a student who doesn't do well, math is often not a challenge, it's more of a drag oftentimes, something they have to do. But the bright ones are really interested in why. (21-22; 21-10)

Other

In the text we're using, I think sometimes the directions are inadequate and they're misleading. The words are misleading, and they also don't give enough examples. So I don't rely very much on the book giving directions. I give the directions 3 or 4 times, giving different examples, because if I had to go by the book, they give one example and they assume that covers all the bases, and then they'll have a stream of very long, difficult problems at the bottom page and the students are going, "Hey,

wait a second, this isn't quite what I thought it was, or does it work the same way even though this is a little bit different? (4; 12-23)

...I don't see math as being very activity oriented--up and moving around type of activities that they can do in an offhanded manner. They've got to think about it and be logical. (7; 22-25)

Yes, because that is time consuming. Those problems take so much longer for the student to be able to go through and do. They can maybe do 16 in a period if they're lucky, whereas if it's just computation they can do 30 or 40. So they do take more time and so I want to make sure they are ready to reach that point. (15; 7-12)

I think at this age they're getting thoroughly bored with doing the same type of thing they've been doing for the last eight years and some of them really need to branch out and try problems in other areas, such as the logical problem you just showed me. I think that they would be much more interested and stimulated than how many apples can you buy at such and such a price? They've reached the max on that, a lot of them have, especially those that understand the concepts already. (24; 5-13)

Interview Excerpts on Problem Solving Views

TEACHER 2

How Textbook Handles Problem Solving

It doesn't. (5; 14)

Drill and Practice

Yes. I think so. I believe it's important because mathematics is a building kind of subject, and I believe students ought to know all of the facts because they don't really have time to stop and think what's 9 times 6. They need to know just by saying it. So for that reason I believe drill is very important. But again, when you get to a honors level or a high level of math class, the students have mastered all those things so it isn't important to bore them with things that they've already mastered, and I don't.
OKAY, THAT KIND OF MOVES INTO THE NEXT SEGMENT. CAN STUDENTS GET BY WITH LESS DRILL AND PRACTICE?
I think so.
ON ANY ACADEMIC LEVEL?
No, not on any academic level. I would say when the student is in honors class, high level math class, they may not need any drill and I'll probably not give them any. With my honors classes I give them problems on basic skills in with their other materials, but I don't take time out to teach them how to add or subtract and divide, because by virtue of the fact that they are in a high level class, they are well aware of their skills. Now when I'm teaching, if I find that part of their knowledge is limited, then I'll backtrack. Of course I encourage the student too. "You are in an honors class." One of the things that happens in an honors class is that the material is fast paced, and you should know all of these basic skills. So if you are low in this area, on your own you want to do some practice and bring yourself up.
DO YOU THINK THE STUDENTS CAN GET BY WITH LESS SEATWORK, PAPER AND PENCIL WORK?
Well, overall, no. But I don't know what you mean by less. My students work every single day. There are fun days where I might do the transparencies and then there are days when I might say if you're really quiet and good I'll give you _____. But I believe in order for them to learn the subject and to master the subject they have to be taught it and they have to work at it. (7-8; 8-20)

Difficulties with Word Problems

I believe it [problem solving] has not been given the amount of attention that it deserves probably in elementary school, and by the time they've reached middle school and it has not been given a lot of attention, I believe that the language is a problem for students. Because sometimes the language in a mathematical problem may mean something else than a reading situation of a novel or in English. For instance "of" in mathematics means times, "is" means equals, so I think I would put that aside

as one major problem, along with the fact that they've just not been given enough attention....That I believe number one would be the language and then the next thing I believe they would have to be taught is how to pull out the information, how to restate the problem so that it's in terms that they can understand, so that it's in terms of something that they can relate to that happened to them. Not necessarily a personal thing, but being able to restate the problem so that it's clearer, knowing when to take out unnecessary information, and also being able to figure out what information is necessary and what does the author want. (8-9; 24-6)

Important of Problem Solving

Just as important as computational skills, as important as any of the things in that, because it's all around us. (11; 4-5)

Define Problem Solving

Oh, here it is. Problem solving is the process of applying previously acquired knowledge to new and unfamiliar situations. How about that? THAT'S VERY GOOD.
I wrote it down. I thought that was pretty good. And I think from that is why I say that problem solving is everything, because it's previously learning how to look at a problem, restating it in familiar words or familiar terms and applying it to something new. (12; 5-13)

Major Roadblocks in Teaching Problem Solving

Keeping them interested. Keeping the problems interesting. (17; 7-8)

Solution vs. Understanding

I would say the understanding of it. (20; 28)

Showing vs. Understanding

I do a little of both, and they get a little upset sometimes because I'll just put the problem on the board and say that's it, I won't explain anything. And after about five or ten minutes they're moaning and groaning, and the next thing I'll have them come up and then we move the whole class along and talk about each problem. About 90 percent of them will get about 3/4 of the work correct because they're just using what they know and applying it and finding out what the author wants. (21; 17-25)

Other

I agree that the instructions [in the textbook] are limited and quite often the instructions really mind-boggle the students. I believe that there is more than one way to teach a concept and sometimes the books will have only one method, and I like to have the students think on their own and not just come up with the correct answer. I'm really a stickler about the formulas and being certain that all steps to the formulas are there because I think it's important to know--you need to know--that they know the process and what it actually means because a calculator can give them the correct answer, but that doesn't always mean that they know the

process. I believe that if they know the process then they can apply it to different mathematical situations. (4-5; 15-1)

Well students in general would rather not work on it [problem solving] because somehow they see it as a threat. First they have to interpret it, then they have to figure out just what the author is looking for, and most students would rather do things that come easily. (10; 21-25)

Interview Excerpts on Problem Solving Views

TEACHER 3

How Textbook Handles Problem Solving

They don't do problem solving. They get some word problems and occasionally after a skill, they'll give a few word problems that involved a skill. The kids know that that's still what they have to do, so all the teaching of clues and stuff is done by me--key words and key terms that help them recognize these word problems; like "of" means times,"is" means equals and that type of stuff. Otherwise the book never even touches on any type of technique for solving the problems, but then their problems are often different from their examples. If they're going to teach word problems, they should give an example for each one and explain how they came up with it instead of saying, "Here's a word problem, here's what we did, here's the answer, now you do it." (6; 1-14)

Drill and Practice

Oh yeah, I think so, because you know, practice makes perfect. It's just like anything else.
DO YOU THINK STUDENTS COULD GET BY ON LESS DRILL AND PRACTICE IN A TYPICAL MATH CLASS?
Some students can. I would say the majority of them need that reinforcement.
DO YOU THINK THEY COULD GET BY WITH LESS SEATWORK ACTIVITIES?
Well the only thing is, then they need to do it at home. I think if you can keep your classroom quiet enough and comfortable enough to where there is really some work being done in the classroom, then that takes the place of the work that they maybe would have to do at home. (8-9; 19-3)

Difficulties with Word Problems

You know, if you know your arithmetic skills, that's one thing, but to be able to analyze and to decipher, extract things or things that aren't 3 x 2, it takes a different skill, and I think that a lot of people might have the skill but they are having trouble developing it because they're not being presented with the right ways to go about doing that, and I think that's a skill I need to work on...Right. Because heck, they've been doing these arithmetic things every year now you know, at least my kids. Some of them still have trouble, but I think overall the problem is setting it up, definitely. (9-10; 19-25)

Importance of Problem Solving

Very important, and they don't realize it at this age. They're constantly asking why do I have to know this? If all you're doing is multiplying, I know that. But the fact of the matter is, when do you multiply? And they don't understand that that's important. That's the key to mathematics as far as I'm concerned....If you want math to work for you, you have to be a problem solver. (13; 1-11)

Define Problem Solving

Well, by problem solving, that just means that you give them something to do and they have to figure out how to do it. Is that right? It doesn't necessarily have to be a word problem, but it can be something where they have to devise a method for solving. That's how I would define it. THAT'S FINE. WHAT KINDS OF SKILLS ARE INVOLVED IN PROBLEM SOLVING? Oh, I see. I think you have to have reading skills in that you have to be able to read a sentence or read whatever it is and be able to comprehend what it is they're saying. So it would be a strong reading skill. But I don't think that you have to be a strong reader, I think that's an important skill to have but I think you can overcome it by being taught a method for recognizing ways to solve problems in math like key terms that represent things mathematically. (13-14; 24-12)

Major Roadblocks in Teaching Problem Solving

Probably my own lack of knowledge on a lot of the more advanced techniques to teach these skills. You know I can look at the stuff and say "Okay, I know that, that means to multiply," but then how do you tell the kids to recognize that two weeks later on a test? You know, it seems hard for me to teach this type of skill, maybe because everybody's at a different level or everybody doesn't perceive the same way....Maybe more material, or at least my willingness to go and get that material. I'm sure it's available. I just... you know, you sort of avoid the uncomfortable. The things that you really aren't the strongest on you hope they'll get it along the way. You know I would say for middle school kids, I teach quite a bit of problem solving, but I know that at the high school level--and I was trained to be a high school teacher-that there's a lot of things about advanced problem solving skills that I really need to get some info on. It doesn't seem real hard at this age level. You can say well this is how you do it, but I don't know if they're getting it. (17; 2-27)

Solution vs. Understanding

Well a lot of times, because it's really not clear as to how to decipher the process that you should do on the word problem, and more or less if it's teaching the skill of multiplication, then all the word problems are multiplication, what you end up doing is just teaching the solutions, right? I mean they know it's just going to be that you add them all up or something, so you end up doing that because that's the way it's presented a lot of times. (19-20; 23-2)

Showing vs. Understanding

Well I try to give them Point A and say, 'Okay, this is how we would do it in this example. And let's not just say that all of them are going to be multiplication but when we see the word 'of' next week, we're going to know that that means times. So I guess I try to do some others. (20; 8-13)

Other

I've found that it has to be cut and dried, it has to be structured for them, and they have to feel comfortable, because when they feel comfortable, and it's not something new and it's something they know, then usually you have more success with them. (3; 17-21)

A lot of them just want the answer. They don't care about the process, and that's what upsets me a lot of times, because I make them, like if we were supposed to solve for the variable $3x = 6$. Well anybody could say 2. But then when you get to $1x + 7/2 = 32/4$, find x, it becomes a little bit different. It becomes a process rather than just a plugging in of the number. So I try to instill that in them, and if you start out with these examples, they say "Well why can't we just give you the answer?" So they're always looking for just answers most of the time. Why not? If that's what they're graded on, why shouldn't they look for that? (5; 11-22)

Well their maturation level is pretty low, and they're all going through all these bizarre changes, and they don't remember what they learned the day before. It's enough to drive you crazy. (11; 21-24)

Interview Excerpts on Problem Solving Views

TEACHER 4

How Textbook Handles Problem Solving

Well, I don't think it really handles it. There are some problems attached that would correspond from time to time to a lesson on division of fractions or multiplying fractions, but there's really no stress or emphasis on solving problems. (2-3; 26-2)

Drill and Practice

Yes.
WHY?
Because you repeat over and over and over the same things. We're rehearsing for the SATs this week, you know, and even through they understand things they haven't done it because so many new concepts have come through after something and then you have to jar them back and get them thinking about it again, and I think just that continuous repetition just drills it right into their heads.
DO YOU THINK THEY COULD GET BY WITH LESS DRILL AND PRACTICE?
No, I feel an element of always a shortage of time. We need time for me to explain things, we need time to go over the homework, have them ask questions, drill. I mean there's a lot of things that are going on and you just run out of time to do them. Then going back towards the tests you have to cover this, this, this, and this; you don't have time to dwell on one thing for too long, but I do think somewhere down the road they can use more drill. They do forget. It's not exactly like forgetting because once you remind them it comes back to them, but it's kind of just slipped from their consciousness for the moment. (6-7; 21-20)

Difficulties with Word Problems

Because they have to think, and I'm not so sure they know how to really think. I think thinking is a creative process and no one ever teaches creativity. We seem to hit the drill and that's maybe what we emphasize in math, but I'm not sure that, you know like word problems are part of just everything. They have to be able to think and distinguish and group things and make assumptions, and it would be the same in social studies or in something else. If you ask them why do you supposed something happened, it's hard for them to come out with something that is their idea. (9; 7-17)

I think it's the figuring out what is asked for. If there's extra information there and they have to sort through, dig out, it's hard for them to be the initiator and say yes, this is important, this I can forget. The thinking process I think is the worst. I think the vocabulary in some cases is a problem but that's not the major problem I don't think....I can't believe like they would miss things like, we've worked on this "A car goes 60 miles an hour. We went for 3 hours. How far did the car go?" They still can't understand that, not that many people. And it seems to

me obvious, and I don't know how I can clarify that to them. I intuitively know that and they don't intuitively know that. That's where I run into difficulty. (9; 2-19)

Importance of Problem Solving

Very important. Because I believe in teaching thinking, and I think that's what they need to be able to do. (11; 9-10)

Define Problem Solving

Analytical skills, organizational skills. In math it would include reading skills, computational skills. (12; 21-22)

Major Roadblocks in Teaching Problem Solving

I've never been taught how to teach it....They were talking [in a reading class] about teaching word problems and one of the things was read and reread and re-reread and solve the problem and reread it again to see if your answer corresponds. That's about the only significant thing which makes sense that I've been taught about how to handle word problems. I really don't know, when a kid doesn't understand it and I know intuitively that you divide or you divide and then you multiply that answer times something else, I don't really know how to explain it to them or how I know that that's what you do. Do you understand what I mean? I know it intuitively, and if they don't understand it intuitively then I don't know how to teach it to them. (16; 3-21)

Solutions vs. Understanding

Hard to say. I mean I can't say that's what I do, because I really don't do much of anything. It's mental and I really don't know the proper way, and I told you when they don't understand I just go crazy, because I don't know how to tell them in a logical way, because all they keep saying is "I don't get it, I don't understand, how did you know to do such and such?" After you teach them a few words like less and more and a few giveaways, there are still things tht sometimes they don't understand. (20; 13-21)

Showing vs. Understanding

Showing them....I don't know. it's just there's so much frustration the other way. I don't know. Maybe it's because I have children at home, but when they go home and go to do their homework, and they feel their teacher hasn't explained it to them, there's just this total frustration. "I don't understand what to do. I'm not going to do it." And they kind of give up, where if you go over it with them, I think they have a shot at at least trying to work it out and maybe it will come back to them in between what you say and what they can pick up from what the book says and from the examples in the book--piece it all together--they have a shot at getting that work done--a better shot at getting the work done than if they just try to do it on their own. (22; 5-21)

Other

I do do a lot of talking, either because it's not explained well or they haven't had the background or whatever. It just seems easier if I can go over it on the board and show them three or four examples of problems. (1a-2; 27-3)

The word problems are a real drag. It drags on and on and on and on, and you just feel like you'e going nowhere with it. (10; 20-22)

IS THERE A REASON WHY THEY'RE [problem-solving skills] NOT TAUGHT?
Yeah, probably it's easier discipline-wise when you have a diverse group to sit everybody down at the same table or at their desk and do the same page at the same time in the same way. It's easy to check, it's quiet, it's orderly, systematic for the teacher, and teaching creativity or teaching things like that takes a lot of one to one or them talking to somebody about it, and it might not be orderly. Sometimes we opt for orderly kinds of things.
SO THERE'S CLASSROOM MANAGEMENT ISSUES IN THE BACK OF YOUR HEAD?
Yeah, that's why we tend to drill and drill and drill. It's probably a lot easier than going over these things and having kids scream at you all the time, "I don't understand it", and sit there because they don't understand it and poke their neighbor and that kind of stuff. (12-13; 25-15)

...it's so logical to me and it's so logical to the people that understand, but it isn't logical to those who don't understand, and I don't know how to...beyond saying "Well, look, you do this and then you multiply that times 7" or whatever. but I don't understand why they can't understand that in the first place, unless they get nervous about it. I think there's a certain amount of anxiety with word problems. (21; 6-13)

They will give up. Not all of them, but I'm saying, you know why we're doing this is because there are so many people that really can't do these word problems and their frustration--they can't handle it. They won't read it three times. They'll just say, "No, I don't understand it." (23; 19-23)

Interview Excerpts on Problem Solving Views

TEACHER 5

How Textbook Handles Problem Solving

The book we have right now is really lean on word material. It does give a good explanation to the problems, then it goes right on into practice. Some of the others we've had would give the kids questions, provocative questions that they would have to answer which led to the concept, made them think about what they were doing more than what we've got here. So I do have to do a lot of explaining and use my background to say this is what this means and this is what the objective is, or how do you use it, where does it fit in, what's the use of this type of thing, how are we going to use it? (6; 9-19)

Okay, now on the seventh grade one, all the things we've covered so far this year there aren't a lot of problem solving materials, so we really haven't done a lot of problem solving and like I say, I've got some things that I would pull out later on and do what we're going to do on problem solving and really give them...maybe spend two weeks or whatever is necessary. But they would be handouts, but they would be problem solving materials. (8; 11-18)

Drill and Practice

Yes.
WHY DO YOU SAY THAT?
Well, from my experience, a lot of kids--I think most people perhaps overall--you can listen to an explanation and you can observe examples and then you can understand and they make sense. I have kids say, "Well I know that, and "Oh, we did that before," but then you give them something to do, they're not that familiar with it that they can go through it independently and work those things out. That happens all the time. We'll have a kid say, "Oh, we had that in the sixth grade." So then you say, "Okay, good. John, how about this? How would you solve this kind of problem? "I don't know." See they haven't had enough practice--I think the practice would be the only thing where they would develop a skill where they would have the recall. I know if I don't do things myself I'm really not going to learn it. It's just like observing a piece of art work, you, how do you do something with your hands? It's very conceivable but then to do it yourself is another thing, and I don't think there's much difference in mathematics. (10; 1-21)

Difficulties with Word Problems

Because they have to filter out--they have to make a decision. They have to filter out facts and they just haven't had enough experience at repetitious...I think you have to get back into the repetition that a child or anybody else; you've got to see this type of thing enough before you catch onto it. You know, they'll read something, the problem, and they'll say oh, do you add, subtract or do your multiply or divide or do both?

And I don't know how else despite challenge and repetition would they get enough experience to be self confident to make their own decision. (11; 8-20)

Well you see this book there's not a lot of reading to do in the general trend of the thing. Like I've got a list of vocabulary words I've been going to give them--math words that I feel it's the best time for them to learn what they are and what they mean, and I haven't gone into that with them yet, but I've got the list up there on that table. But they don't know a lot of vocabulary words, and of course this is where they--like I always tell them, if you don't know what the word means, then you can't do it because you're not thinking properly on whatever the topic is. The nomenclature, you know, the structure of the...whether it's dividend or divisor and all these things. Most of the kids don't know that stuff unless you drill them on it. (12; 9-22)

Importance of Problem Solving

Well I don't think all the arithmetic they do and techniques that they do are worth too much to them if they can't use them in problem solving. (15; 5-7)

Define Problem Solving

Well problem solving would be where information is presented and some facts are presented and then the question of how to extract a particular problem situation out of that for a specific answer, and draw out from certain verbiage a desired amount of information to answer a specific need.
OKAY. ARE THERE CERTAIN SKILLS THAT THE KIDS HAVE?
Yes. Well I don't know if they have them. Some kids would probably have them intuitively, but there are steps that can be used that I think you need to go over with them you like what kind of information is in here? What's the question? What material do you need to solve the question? What material don't you need to answer the question? And what do you do with the information that's there? (15-16; 24-9)

They need to know how to look at it, what's important and what's not important, how to simplify it down--which is all problems solving is--and simplify it down to something that's understandable. But they need some little techniques. (16; 12-16)

Major Roadblocks in Teaching Problem Solving

Okay, when they're in a word problem situation I find that maybe ten percent are pretty capable of going through it on their own and getting what they need to know in tackling the problem and solving it appropriately, but the majority of them you really need to go around. They need to be reassured. They'll want to find out am I doing this right? Is this right? So you have to say yes, you're doing it right, in most cases. It depends on the number of steps too in the problem. If it's a number of steps, a lot of them will want to be reassured each step of the way. If they know they're doing two steps or three steps they'll want to know if the first step is okay--which is fine because if they got wrong information, there's not much point in going on to the second step and the third

step with them because I always try to make them do their things independently, but I also realize that anything you do, even testing--every time I give a test I find out it's still a teaching situation practically unless you want to be just cold turkey about it and say you flunk or you pass. Well that's pretty hard to do--say you flunk, you pass. So I find out that it's growth, and that's the only way they're going to get it is to go around and pursue it and help them as they go along. And of course eventually you're going to say well, here's five or ten problems, let's see what you can do with them, at the end. But there's a long period of really trial and error in it. I think the word problem solving is really the most difficult thing for them, and I think they need more of it. (21-22; 3-6)

Solution vs. Understanding

The understanding, I think." (31; 7)

Showing vs. Understanding

I try to give them a real good explanation on the board usually and show the ramifications. (32; 4-5)

Other

DO THESE KIDS WANT TO KNOW WHY SOMETHING WORKS, OR DO THEY WANT TO GET MORE THAN JUST HOW DO YOU DO IT?
Good question. I always thought that was really important and I still do. I always try to show the kids why--we're doing formulas in the eighth grade, and I try to show them why does the formula work? Why will it give you an accurate answer? And what a formula is, it's consistent, it never changes. You follow it because it follows a rule or a concept that is never-changing. Therefore it works for you all the time if you know what it says, like multiply, divide, and so on. So we've been doing these area formulas--triangle, parallelogram, rectangle, circles. Yesterday I went through the circle because hardly any of them, anybody looks at pir^2 and really knows where it came from and what it means. So that's always been one that I try to prove my point. I always felt better when I was going through school if I knew. The teacher said do this, this is how it works, go ahead and do it. Well most kids can learn those things by rote or just by remembering step by step. Fine, you get the answer, but I always wanted to know how come you get the answer and why does that give you the answer? So that's why I try. But there aren't too many kids--there are some that are interested in why it works, but the majority aren't I don't think, not from my experience. Most of them really aren't. But I always thought they would be more interested in why it worked. (19-20; 17-15)

If they don't have the skill, then they're not going to be able to solve the problem. A kid that's lost in his arithmetic isn't going to get anything out of a problem solving situation I don't think. (34; 19-22)

Well my reason for that is a lot of kids still think that they have to get the exact number for one thing. If you don't get the exact number, you haven't got it correct. And if you get into problem solving, you really have to focus

on two things. Does the kid understand how to solve the problem, which is really the main thing--even if he made an arithmetic mistake in his computation, I would still give him problem solving credit. If he comes up with 2.26 instead of 2.25 or something like that and if it was a good problem, and he had to do the thinking and really doing some evaluation with the information and got to that point, I think he did a good job. You have to consider all that. (34-35; 25-9)

Interview Excerpts on Problem Solving Views

TEACHER 6

How Textbook Handles Problem Solving

I don't like that textbook that we're using at all. (5; 18)

Drill and Practice

Very.
HOW COME?
Kids in middle schools especially need repetition in order to be able to absorb and understand what they're doing. You may give them one problem and then another problem with just different numbers in it and they won't see that it's the same thing.
WHY IS THAT?
I don't know. I don't know if there's a learning blockage or something when you're at this age group, if you just don't want to learn or if they just can't see far enough to realize that they're doing the same thing. I don't really know why. (5-6; 27-11)

Difficulties with Word Problems

I think there's a negative attitude about word problems. I think kids think "Ooh, a word problem" and then they just tighten up, even though the word problems very often will just follow the basic math that they've already done. Also, a lot of times their reading levels are so low that they just can't do the word problems. They may do very well on math computations, but when it comes to being able to actually read and understand what is being asked in a word problem, they have trouble doing it because they can't read that well--a lot of kids. (7; 3-14)

Importance of Problem Solving

I think it [problem solving] should be emphasized a lot more than it is now because I think most of their math applications when they get out of school will be somehow dealing with word problems or something to do with word problems. They're not just going to be given a problem and told, "Work this out," they're going to have to apply it to their every day lives, which is basically a word problem. (9; 16-22)

Define Problem Solving

I think so. When I teach, or try to teach problem solving, one of the things that we work on is like a vocabulary of key words that relate; for instance, in a percentage problem "of" would be times, "is" would mean equals, and we go over words that are key words that will give them clues to working. (10; 7-12)

Major Roadblocks in Teaching Problem Solving

Well, just basically that there just isn't that much stuff out there, and some of the stuff that is out there like I said is just difficult for them to read. Their reading levels aren't that good, and number one you can't find a lot of problems. Finding the problems. I have lots of workbooks, and I'll be in all those workbooks, I can't find that many word problems. They're just not available. The problems themselves are not available unless I write them up or dig them out of someplace. (12; 17-22)

Solution vs. Understanding

I try to do the understanding of word problems. (18; 25)

Showing vs. Understanding

I do more on showing and explaining and then allowing them to do it on their own if it's not just...you do one thing--they're not two separate things. A lot of times it just helps if you do a problem on the board. The problem may be in the book, all done step by step; but unless you do it on the board and show it to them step by step they won't get it. And then once they've seen it done, they can usually do it on their own. Does that make sense? (19; 7-15)

Other

For one thing, I don't think a lot of times...the kids don't really understand. You have to really bring it down below their level to get them to understand, because if you speak on what essentially their reading level should be, they won't all get it. You have to get down really low and explain things very basically and simply to them, and the areas on the sides of the book don't always do that. (5; 9-16)

I think they should be able to understand what they are doing--in other words, how to basically add and subtract or where to put a decimal in a problem, because if they don't understand the basics of anything, they'll never be able to put anything in the right order from a word problem. (11; 5-10)

...they won't remember how to do things. They don't remember from day to day where to put the decimal point, even in honors math class, so it's hard enough to teach them one thing one day and use that thing to apply to the next day without taking something and putting it at the end of the year and saying, "Do you remember when we did this?", and they say no. (15; 2-8)

I think partly, and I think partly because it doesn't apply directly to them except for the grade that they get that day. I think if something affects them directly they learn how to do it. (15; 13-16)

I don't know if something affected them directly--the same thing--the direct effect. If it hurts me now or does something to me now, I'll learn it, but if this is something I have to know a year or two years from now I can always do something else about it or ask somebody. That seems to be the attitude, and I don't know what to do about it. (17; 1-7)

Kids this age I think are extremely immature and are not responsible enough to themselves to very often do the work or even try to do the work. They need somebody still to tell them, "This is what you will do." (20; 9-11)

Interview Excerpts on Problem Solving Views

TEACHER 7

How Textbook Handles Problem Solving

I found it [in the textbook] to be clear and concise and I also found that when they give the exercises they don't throw in something that wasn't in the example. So it's example, problems, example, problems throughout the textbook. It handles it okay. You still need the teacher to further explain it and to really point out verbal clues, especially when you get some low readers in here. Then you have to go over it and point out clues. It's okay, but I also choose to do it after I've really handled the skill. I do it last. I go over skills first and then I go back and do problem solving when they're more mature. (3-4; 16-15)

Drill and Practice

Yes.
WHY?
Because you are training the mind to do something new; and your mind responds to repetition.
SO CAN STUDENTS GET BY WITH LESS DRILL AND PRACTICE?
No, and I used to think so. I used to give the odds and evens and I don't any more.
COULD THEY GET BY WITH LESS SEATWORK?
I'd say no, not in mathematics.

Difficulties with Word Problems

No, it's not really vocabulary. It's just that suddenly we've got words in math, sort of like a real life situation, and they tend to be resistant toward it....Computing the answer isn't the problem if they position everything right. If it took several operations and things to do, then they have problems.. Figuring out where to put it. That's why I found that maturity helped, and that's why I do it in the spring instead of as we go through the textbook, because I was finding that they weren't mature enough and that maturity made a big difference, especially when you had a series of problems and you're just adding and multiplying. (6-7; 22-12)

Importance of Problem Solving

I think we should blend it in like it is now--teach a skill and then use it. (8; 13-14)

Define Problem Solving

As far as I'm concerned, problem solving is any time you're going after an answer....Well as far as actual skills, they have to not only be able to organize information, they have to be able to write. For instance, if they can't write the information in the proper sequence clearly, then

they can't make the proper changes to solve the problem. So you have to insist that they write correctly. For instance, I don't allow slant lines in fractions because it's very difficult to add and subtract fractions if you don't have horizontal lines. So they have to have mastered certain skills of being neat and orderly and organized otherwise they can't solve that problem. In other words mathematics is not a place to be creative. I say this is not an art class, don't decorate with decimal points. They're not decoration. I say decimal points have a purpose and a place and a value. (8-9; 22-18)

Major Roadblocks in Teaching Problem Solving

Probably reading through the problem, that's the hardest part....Getting students to read through to the end and then deciding what you times or what you take away and what you're looking for. (13; 19-24)

Solution vs. Understanding

I find middle school kids become very restless, and their attention span is somewhat short. So if you go into a whole lot of analytical things--I mean a good example is when you teach them to multiply fractions. You could spend three days discussing why a reciprocal. They're much happier if you just say, "Turn it over and multiply." They will whine and cry and say they don't want to cross divide things. You mean do we have to? Well, it's easier. Getting that point across takes a lot of time.
WHERE DO YOU THINK THEY'VE LEARNED TO BE THAT LAZY?
I don't know. I think part of it's just their maturity level. They're just not quite ready for that higher understanding. They'll want to know how to do something but they don't keep at me, "Well why is it done this way?" They really don't. (17-18; 17-4)

Showing vs. Understanding

No, I don't do a whole lot of inquiry... I'm a dictator all the way through the math class. I show them, they do it.
SO IT WOULD BE MORE ON SHOWING AT THIS POINT?
Yeah, because when I do that I find like sometimes I'll put something up there and say let's go after this and solve this. You get your sharp ones right up there with you and boy you sure lose the other ones. (19; 4-12)

Other

I think mathematics is a place to teach habits--how to go after an answer.... Following directions is extremely important, okay? Because you have to follow a set of rules and when I get further in the book I'll say here's the rule, here's the game. This is the rule and this is the negative number, now any time you have two negative numbers it's always a positive, if you're multiplying. So quite often I'll write the rule. I'll say this is the rule, here's the game. I'll actually write "rule" and "game" on the board, and theyll go after it. (10; 4-16)

The attention span is not that great. For instance I never talk more than 7 or 8 minutes. I don't stand up there all period and do math problems for the kids because they're just not that interested. They want to be left

alone. Well, I condition them. Okay, I'm responsible for that. I condition them to this kind of behavior. They seem to want to be left alone and try the problems out themselves and not spend all period doing that kind of thing. (12; 18-26)

I don't think it's the long explanations that they're that interested in. They don't seem to be. They in some cases want to get through their work and then they have an extra credit project going on in here at all times and sort of want to go to do that. I mean how long can you talk about fractions and that kind of thing? (20; 9-14)

They love to know where the fences are so they know where to put their feet and how far, and then they'll try to climb over and see how far they can get. They know what's expected of them, it's very clear. You know, math is clean and orderly and if you don't follow the rules and laws in mathematics you're not going to get there. Yeah, when you get into algebra you get some type of creative approach, you can start a problem in a certain place or whatever, but when you're in the seventh grade, you don't really have a whole lot of choices in these kinds of problems and what you're looking for. (27; 8-18)

Interview Excerpts on Problem Solving Views

TEACHER 8

How Textbook Handles Problem Solving

I think there should be more word problems than just the computational type problems like we're used to seeing as an extra aside. I mean there should be more word problems. It should be just the reverse or at least more even. Like there should be maybe 12 problems of regular type problems like this and then 12 word problems, so you can give them even on both sections, and they would start putting them together. (11; 7-15)

Drill and Practice

Oh yeah, definitely.
WHY DO YOU THINK SO?
Well it keeps them sharp or attuned to what they need to be aware of all the time. Well, drill and practice would mean in what sense?
SEATWORK ACTIVITIES, WORKING THROUGH FRACTION PROBLEMS OR WHATEVER.
Well if you didn't give them say 12 or 20 problems to work for homework, then they're not going to get enough exposure to the different types of problems that they could be faced with. And if you don't give them problems that are like in a quiz form, where they have to sit down and do five problems right now for a grade, then they don't understand how to solve problems under pressure and get the same answers.
SO DO YOU THINK THEY COULD GET BY WITH LESS DRILL AND PRACTICE, OR NOT?
No, not at this level. They already want to do as little as possible. You don't want to give them less.
COULD THEY GET BY WITH LESS SEATWORK?
Well seatwork is the same as homework. Depending on the amount of time that you have left in the class is how much seatwork they're actually going to accomplish. If there's five or ten minutes left and they've got 20 problems, they're not really going to work feverishly until the bell rings, so they can have less to do when they get home because a lot of times their parents want them to bring homework home. They don't want them to do it at school, because they want to see the homework. There's so often the case where the parents get the response from the kid that "Oh, I've already done the homework," and yet they're getting a D in the class. Well if they do too much seatwork, they're just going to just slop out the answers real quick because they're working between the time I finish the presentation of tomorrow's homework until the bell rings. It might be ten minutes, they've got to do 15 problems. If they try to get 15 problems done in ten minutes, they're just wasting their time. So I think you have to define the seatwork activity as being something that if they sit and just work as many problems as they can comfortably, then that's effective. (12-13; 10-23)

Difficulties with Word Problems

The vocabulary. All you have to do is talk to any social studies or English teacher probably to get those answers. Word problems are based in a sentence structure and sometimes the terminology or the vocabulary words that they use in the word problem itself may not be familiar to the student. I think they can read the problems. I think they have problems in understanding--well that might be comprehension I guess--understanding what they've read and how to put those numbers together to answer the question. (13-14; 19-21)

Importance of Problem Solving

Well, it should be of utmost importance. (15; 24)

Define Problem Solving

Well I think of problem solving as being a problem that's written in sentence form. And as that's the case, I think they're all about the same. (15; 19-21)

I would think though that what they have is a problem understanding what words indicate different types of operations. There is a chapter in this book that does hints on vocabulary words, and this one here they'll start off by drawing two more than a number, where the word "more than" is indicating addition or "less than" a number is indicating subtraction....What they have to do is understand how to take the information from the problem and put it into that algebraic form. That's the major problem. And the way you have to do that is you have to get them associated with what words mean, like "is" means equals; that that equation has to have a total amount of something at the end. (17; 2-17)

Major Roadblocks in Teaching Problem Solving

Well, having more materials available to me in a more concise form so that I can distribute them to the students and have enough material to keep them occupied and interested for a 4-6 day stretch....I think all of us when we were taking math classes had problems with word problems--just learning how to set the problems up, given the information from the problem--sort of like little tricks of the trade on key word associations and things of that sort would be really nice to know and to pass on to the students as well. (23; 7-19)

And right now they do need more work on problem solving so that they're not afraid of a word problem. Some kids will just tense up and go--I'd rather not even hassle with it, because the majority of the textbook is so--it thrives on the computational part and has very little word problem structure to it. So when they get to it it's like something...you know, these kids aren't stupid, they can understand it. If there's only that many word problems dealing with this entire chapter then how important could that be to the chapter? (25; 15-24)

Solution vs. Understanding

I think I would give them credit for understanding how to get the problems up as much as I would getting the final answer. (26; 8-10)

Showing vs. Understanding

I think I'd focus on how to do mathematics. Showing them how to do it.... Because first of all they have to know how to solve the problem before they can be shown something new. You don't want to get too far ahead. You don't want to put the cart before the horse kind of an idea. If they feel comfortable in how to solve the problem, then along the way you can develop the creativeness in the mathematics program down the road. But first they do need to understand how to solve them. (26-27; 28-11)

Other

...but I think there's an overabundance of problems like this where it doesn't take any imagination to understand how to work them out; once they understand how to do one problem, they can do as many problems as you give them. But there's not enough of these problems...
THE WORD PROBLEMS THERE?
Right. There's not enough word problems that are associated to these types of problems here to make it work. So I do feel they have to have computational problems to understand how to solve them, but it doesn't take--like you asked me are there enough problems in the book--well there's 30. How many more problems like that do you need to give a student before he understands how it's done? I mean if you give them 15 of these or all of them if you like, it becomes redundant after awhile. If they understand the process of it, then you don't need to give them another 60 tomorrow because you don't want to burn them out on the idea. You want to keep them interested in the topic. (18; 6-25)

And where is the emphasis being placed here? There's no word problems till you get to the last page in the chapter. They should have some of these in every one of the sections so that when you get to this page, it's not like "Oh my god, we've got to do these today?" This page is like a slap in the face, because they've been cruising along for so long here without any real concern for word problems and then all of a sudden there's one whole page or two pages of full word problems. They're scaring off the talent is what they're doing. (19; 7-16)

...they don't concentrate on what they're doing sometimes. A lot of times some students think that once we get done with fractions, that's the last they'll ever see of fractions and they're on to something new tomorrow. But as they gradually dig through this book with the help of myself emphasizing that, we do come upon fractions other places in the textbook or ideas that they needed to understand; if they understood how to subtract fractions here then the problems they're going to be faced with on page 249 may become easier for them. But they don't understand that all of this is relevant throughout the entire book. They think each chapter is a short story, and as soon as the short story is over with, we're going to read a new short story with a different concept. (28-29; 16-2)

In fact they've got enough computational problems in here. We just need more word problems in order to emphasize why they need to do these computational problems. The computational problems should just be the homework on understanding how to do word problems. It should just be the refresher course on how to do the word problems. (29-30; 27-5)

Interview Excerpts on Problem Solving Views

TEACHER 9

How Textbook Handles Problem Solving

It seems awful dull. It doesn't have enough instruction, as I said. It doesn't have enough meaningful practice and hardly any problem solving. You just get a smattering here and there of problem solving, which as I'm thinking now is that more and more that's the way it's going to go. I'm trying to think of next year how I'm going to run my class, and I don't see how I'm going to use the text and then work in problem solving. It's more of a hindrance to me than a help. It seems like I'm going to be making a lot of material, which is kind of a pain because of time, my time....I've done it in the past, and then kids tear it up, so it's very unrewarding to do that. It's probably one reason why we spend so much time in the book....So then you just flop back and say "Open the book to this page and go for it." (3-4; 20-16)

Drill and Practice

Yes.
HOW COME?
Well, if you can get them to do the thing once, then with a little bit of practice, you can set it in their mind a little bit better.
CAN THEY GET BY WITH LESS DRILL AND PRACTICE?
I don't know.

Difficulties with Word Problems

I don't think they can take the time to read and understand--reading comprehension of what the question is.
SO YOU THINK THEY HAVE TROUBLE WITH THE VOCABULARY OR THE READING COMPREHENSION?
The comprehension. I think what we do is we train them to look at a book, and we say, "Here's the homework," and if it's all nicely laid out in algorithms, they'll do them. If you give them a word problem, they don't know how to put the algorithm together....They can read the problem. They can read the words. Then they stop, and they can't put what they read, take it and put it on a piece of paper in the form of a problem that makes sense every time. (5-6; 24-16)

Importance of Problem Solving

I think it should be very important. More so than it is now....You think they're doing all right, then you give them a bunch of problems and they're just lost. (7; 9-14)

Define Problem Solving

I would define it as being able to take a problem, whether written or however you might see it, and be able to functionally put together a solution that works.

ARE THERE MAJOR STEPS THAT YOU WOULD GO THROUGH IN THE PROBLEM SOLVING?
Oh I'd say yeah. First define the problem, and then discover which arithmetic operations you're going to have to do, and then do them. (7-8; 24-3)

Major Roadblocks in Teaching Problem Solving

Okay, time. I don't give it enough I don't think, and the inability of the students to move ahead.
WHAT WOULD BE THE NUMBER ONE THING THAT WOULD IMPROVE YOUR ABILITY TO TEACH PROBLEM SOLVING?
I think I'd have to change my whole style and just start working with problem solving, rather than working with computation. And I'm kind of in a mind to do that, but I'm not sure which way to go, and I'm not sure if I'm prepared to pay the price that it's going to take.
WHAT KIND OF PRICE ARE YOU TALKING ABOUT?
Well I'm going to have to do a lot of research to figure out what it is. Since the textbook is not going to be any help, it's going to be an awful lot of teacher made material. It's going to be time every day on pre-planning. This summer I'm going to have to start trying to get materials and reorganize my thoughts. I've been doing this for so long the same way, it's going to be very hard to change, a very uncomfortable feeling. (10-11; 10-1)

Solution vs. Understanding

I think my focus is on accurate solutions to the problem rather than...I don't know, I try to make them understand how the thing goes. I don't know. I want the right answer, so I'd probably have to say I focus on trying to get the right answer. (13; 11-15)

Showing vs. Understanding

I probably show them how to do it. I try to get them to understand, but typically I probably show them.
IS THERE A REASON WHY YOU WOULD SAY THAT?
Probably impatience.
DO YOU THINK THEY MAY NEED IT?
Need what?
NEED TO BE TOLD MORE HOW TO DO THE MATHEMATICS, RATHER THAN FIGURE IT OUT ON THEIR OWN?
I think so, yeah. I would like to think that if I show them three or four times and then turn them loose, they have good examples to follow. What I try to focus on is trying to have them look at examples and be smart enough to go back and put in the new numbers for the problems so it will work. (13-14; 20-5)

Other

It frustrates me to see them just turn off on a problem like that, where it could be fun, and then you can try to talk about okay, you're going to do it the long way, can you think of a short way to do this that might not be so much work? When you try that now, I think they're so used to either the way I've taught them or the way they've been taught, that they

don't want to listen to that. They don't have time for that. They're not used to it.
THEY JUST WANT TO GET THE PROBLEMS COMPLETED?
Yeah, "Give me the homework, Mr. [Teacher 9] I know what it's going to be. It's a page of dittos I know. I want to do it now, I don't want to do it t: ight." (15-16; 22-6)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 1

Time Spent Planning

6-7 hours

Steps in Planning

Group Planning
(1) Looked at four objectives
(2) Gathered materials
(3) Pooled resources as group and made decisions; added keywords
(4) Chose problems

Lesson Organization

Well, first of all, you have to organize everything around the system that's here between taking role and things coming at seventh period announcing the end of school. You have to figure out how you're going to have the most organized, least interruptive class to where they can all work as a unit and not be interrupted constantly. So you try to figure out different methods, and that's one of the things we thought of is either using the overhead or having a problem on the blackboard so as soon as they come in, they have something to capture their interest while you can take role and get things organized as quickly as possible. (10; 4-14)

Easiest Part

Actually I think determining your goals, what skills you wanted to teach was fairly easy, It's knowing how to go about that that's not necessarily the easy part. (12; 23-27)

Hardest Part

Coming up with the problems for the tables and diagrams. I found that there were very few problems that unless they were already in a table or diagram, you could come up with that. (12; 17-21)

Difference From Normal Planning

I'm trying to think of what it was. I guess I was probably more specific in my mind just exactly what I wanted to do. Usually when I plan a lesson I have objectives and goals, but this time I was out of necessity much more specific, and my time allocation had to be much more precise....Probably a little bit harder in that I think word problems generally are harder to come up with and present in a manner that's interesting for kids. (13; 10-18)

Absence of Textbook

I had multiple textbooks to use. I went through a whole slew of them to try to come up with the type of problems I want, and it's amazing how few of them had them. (13; 25-27)

Homework Policy

Probably if there isn't a textbook it will be a xerox sheet of paper and it would not be a lot of word problems because I find that when students have too many word problems, they don't do them. They would much rather work out just the straight math problems and will do 20 or 30 of those, but 10 word problems is more for a homework assignment. (16; 21-27)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 2

Time Spent Planning

5 hours

Steps in Planning

Group Planning
(1) Looked at four objectives
(2) Gathered materials
(3) Pooled resources as group and made decisions; added keywords
(4) Chose problems

Lesson Organization

I think we're pretty much going to teach it the way we normally teach our lessons--introduce it, practice, discussion, boardwork, transparencies, and then get the students worksheets....The normal flow of teaching. We don't plan to do anything different because we felt that by being part of this group that we needed to be certain of our teaching and curriculum, teaching styles and teaching methods. We would try to stick with those as opposed to trying to come in with something new. (7; 17-26)

Easiest Part

Deciding how many days we were going to spend. (10; 17)

Hardest Part

Sticking to just these four, making certain that we zeroed in on these four skills and not extend it to other skills that are involved with problem solving. (9; 25-27)

Difference From Normal Planning

Not different at all. (11;10)

Absence of Textbook

It didn't bother me at all because I don't usually rely on a textbook. I like textbooks but I believe that they hold you too closely to just certain things. (11; 16-18)

Homework

Well, the homework is given in the class, and then it's due the next day at the beginning of the class, and then we go over the materials and evaluate and discuss it and see where the problems were....But they do have ample time in the classroom to work on them. (15; 17-27)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 3

Time Spent Planning

4-5 hours

Steps in Planning

Group Planning
(1) Looked at four objectives
(2) Gathered materials
(3) Pooled resources as group and made decisions; added keywords
(4) Chose problems

Lesson Organization

Yes, but I didn't think about that before I planned the lesson because I figured however I wanted to present the lesson would make a difference as to how I had them do what and when. For instance, on one of the days, we're going to start our reviewing and then get some more on that skill. But I didn't do that until I found out that I had enough information on that skill to spend a few days on it. So I sort of structured my lesson plans around the material that I had, so I really didn't preconceive on this day I have to start out reviewing. (4; 15-24)

Easiest Part

Probably writing it all down once you've figured it all out. (5; 15)

Hardest Part

Probably assimilating everything into order and also choosing what exactly is going to--how you're going to present the skill--then sorting through the different information to determine how useful it was or whatever. (5; 20-23)

Difference From Normal Planning

Usually my regular instruction is somewhat centered around text objectives, and I didn't have a text. I had four points with which to make my own text. (6; 24-26)

Absence of Textbook

Well, in the regular text, if I'm teaching addition and subtraction of integers, there's set rules and the book explains the rules. Any supplementary material is going to explain the rule the same way, so if you need that information you can get it. Here it was the concepts were a

bit more abstract....So you had to sift through a lot of stuff before you made sure that you were teaching exactly the skill that you wanted to teach. (7; 5-20)

Homework Policy

I try to avoid giving a lot of homework, because I basically don't want a lot of materials taken out of the room but I won't hesitate to assign homework if I feel they need to complete something. So most of the days they'll do a lot of the work in class and then maybe two of the days they'll take stuff home with them. (13-14; 27-5)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 4

No lesson plans were completed. The following excerpts indicate some of the difficulties this teacher experienced during planning.

It's all mumbled in my mind. I cannot sort through it at all. I'm trying to sort through an idea for problems. I talked to [Teacher 7] on the phone last night. She said she's just going through and adding problems one day and subtracting problems another, multiplying problems and so forth. I feel that's okay, that's one way of doing it, but then they just say no, that if you're doing straight adding--like today we're doing adding and it's not a word problem any more. So I'd like to try and mix it up so that they do have to think. (3; 5-14)

OK. Now I'm having a hard time putting it down like in an outline form. It just is really hard for me to do. I want to also do the diagramming and I want to go through here and find things. So that's one lesson I want to cover. I want to talk for one lesson on vocabulary and then just keep on drilling on these two parts. When I was reading in here [the teacher's workbook] about the approaches to word problems--I want to go through like the common sense approach. Does it make sense? Thinking about it. But it's so hard to keep their attention long enough to get some fine points in. (4; 6-16)

So, I don't know. I'm at a loss. There are certain things I want to cover, and then part of the time I just feel I'm giving them word problems for practice. (6; 6-8)

For some reason--I don't know if it's a mental block or there's just overwhelming materials--and I have to sift through it to find exactly what I have to do. I'm having a real difficult time getting it together.
DO YOU THINK THERE'S ANYTHING THAT WOULD HAVE MADE YOUR PLANNING EASIER, ANYTHING IN PARTICULAR?
Well, it's just so vague. I mean like these are the objectives to cover and you can use any materials you want any way you want to use them, which is a lot. Then you feel like you have to sift through and kind of come up with some organized plan. There's just so much to word problems. There's just a lot of stuff you can cover. (7; 14-25)

All I can say is I'm having the toughest time ever. It's not like I haven't thought about it. I mean I sat there till 11 last night and I really don't know what I'm going to do from one day to the next. (9; 15-18)

...I decided last night that I was going to have to tell you guys that we don't have an overall lesson plan because I have to do it intuitively. I guess that is what I'm going to do. I'm just going to wing it and see how it goes from one day to the next. (10-11; 28-4)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 5

Time Spend Planning

12 hours

Steps in Planning

(1) Looked at four objectives
(2) Found problems

Lesson Organization

No, I don't think I'm going to change the way I teach. That's why I gave this preliminary work because I thought--I didn't know what was really in the spectrum. I'm just going to give them these work problems from day to day and see how they can handle them. (8; 4-8)

Easiest Part

Copying the problems. (9; 13)

Hardest Part

Finding the time. I don't think it's difficult for me to plan the unit. I think the toughest part in doing any of these things, unless you're really--if you were a new teacher and only had a year or two--I think it's going to be more difficult. But you know I have kind of an overall picture of what I think we're driving at, so the difficult part is merely organizing myself to get it down in concrete form.... (8-9; 26-6)

Difference From Normal Planning

I didn't go about it any different than I would have ordinarily. (12; 18-19)

Absence of Textbook

It's easier to have a good textbook with good problem solving stuff in it because it's together. (13; 21-22)

Homework Policy

Usually if they don't finish a lesson in class they have to take it home and finish it to have it ready for tomorrow. (17; 3-5)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 6

Time Spent Planning

2 hours

Steps in Planning

(1) Examined workshop information
(2) Added keywords
(3) Chose problem

Lesson Organization

To start with the simplest thing and go to the things that were more complicated....The only thing I might do--and I've done this before, too, in class, so it's not really changing things--is on the non-routine word problems I made the kids work together. And I've done that before, like on geometry and things like that, I've made them work in groups before. But other than that nothing is different. (4; 6-14)

Easiest Part

I don't think that the whole thing particularly difficult so I can't really say... (5; 27-28)

Hardest Part

I can't think of anything that was particularly easy or particularly hard either way. It was just a routine thing that could be done. (5-6; 27-6)

Difference From Normal Planning

It really wasn't any different. (6; 28)

Absence of Textbook

That really didn't bother me at all because at the beginning of the year I didn't have a textbook....So this was really relatively easy because all the information was in one place. So it didn't really bother me at all. (7; 11-18)

Homework Policy

Homework will be anything that they do not finish in class. They will be given class time to do their work, and if they don't finish it it will be assigned as homework. That's the same thing as my regular class. (11; 8-11)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 7

Time Spent Planning

1 hour

Steps in Planning

So I sat down at my dining room table and I said to myself that this task is going to take me exactly one hour because I had to paint the house. So I sat down and did it in one hour instead of procrastinating about it. I sat down, took the information...And I thought now this is what I'm expected to cover in six days and I should be able to do it leaving one day for review. And I wanted to do that Michael Jackson thing, and that incorporates so many skills. I thought it would be a great way to finish up the unit. (3; 17-21)

Lesson Organization

Well I knew they had to have a classroom explanation and they had to have a daily assignment with a worksheet. So that was pretty much it. I knew there was going to be two things going on. (2; 3-6)

Easiest Part
Hardest Part

I'm so used to planning lessons after 10 years of teaching that I don't think this is particularly difficult and I don't think you asked a whole lot of me. You could have asked a lot more. You could have asked me to specifically write and state objectives each day and you didn't which was real nice of you guys because that's a lot of work. Because there would a lot of work after teaching for ten years to put this into educational language and spell that many words right. I teach math. (4; 14-22)

Difference From Normal Planning

Just a little bit. I wouldn't have been so concerned about say fitting into six days necessarily. I would have been more concerned about simply starting it and going until it was finished knowing where I was going next, okay? (5; 5-9)

Absence of Textbook

No, because I used my Addison-Wesley they've got in here. You said that was okay. So I kept the book. They're going to like this. You know what they're really going to like? I thought about this when I planned it. They're going to like it that I'm going to stay right on page 32. 'I want you to look at problems 2, then 4, then 6,' and not do the whole page. (6; 5-9)

Homework Policy

Yeah, I'll have it Tuesday but I would say more because I don't think in a 42-minute period they're going to finish some of these problems. So that will be their responsibility. (11; 4-7)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 8

Time Spent Planning

9-12 hours

Steps in Planning

(1) Collected all materials on word problems
(2) Examined objectives & pulled all materials related to objectives
(3) Decided on the number of problems

Lesson Organization

It will be pretty much the same. The first lesson will start off with ideas on problem-solving guidelines, on what to look for in problems, and that will be presented as an introduction to this particular unit. Then we'll just take the problems as they come....No, it will be exactly the same except we won't be using the textbook. (5-6, 21-2)

Easiest Part

Probably just running them off....The planning could have been much more difficult had I not had some resources other than what you offered to fall back on. (7; 8-13)

Hardest Part

Deciding what problems to use for each unit, given the materials that I had. I wanted to make the problems as interesting but still as difficult to try to get them to think about the problems if possible. Trying to establish a 3-page or 25 problem maximum for each day's lesson. (6; 10-14)

Difference From Normal Planning

Well, in the regular instruction you would have a textbook that would basically answer all the questions for you in essence and you would just present that material from the textbook and the kids would have a textbook to work from. (7-8; 27-4)

Absence of Textbook

I could have used the textbook and I did have pages identified that if I wanted to use the textbook that would also have reinforced what they were doing. But I just decided it would be fun not to have a textbook. I could tell the kids it's going to be a completely different unit for them only, so I decided to leave the textbook out on my own. (8-9; 25-4)

Homework Policy

That there is homework every day over the material that has been presented. There will be new material presented at the beginning of the day, and by the end of the day homework will be given over that material. (13; 9-12)

Interview Excerpts and Summaries on the Planning Process
for the Problem-Solving Unit

TEACHER 9

Time Spent Planning

4 hours

Steps in Planning

(1) Identified the four objectives
(2) Identified the understanding and solution stages
(3) Decided one day per objective
(4) Gathered materials

Lesson Organization

Probably I'll try to do that, try to make sure they understand the homework on the previous lesson, anything that was assigned. I almost do this as a routine, then present the new material and practice it. I've just kind of gotten into that routine, I suppose. (7; 1-5)

I know exactly what I'm going to do. I can look at my plan book and it just days page, page, page. But I know the objectives I have in mind and everything I have for that period. (9; 21-24)

Easiest Part

The easiest part, probably once I got started gathering the materials and just thinking and mentally going over day by day what I would do. See, I didn't write down everything. This is one of the things I have trouble with, my substitutes may have trouble with. I've got a lot of thought in this--I've got it all planned-and it doesn't say much, it's just a sketchy outline. (9; 9-15)

I know exactly what I'm going to do. I can look at my planbook and it just says, page, page, page. But I know the objectives I have in mind and everything I have for that period. (9; 21-24)

Hardest Part

Trying to satisfy what you wanted without getting a phony lesson. (8; 25-26)

Difference From Normal Planning

It wasn't really that much except I tried to make it fit within criteria that I might not have thought of. (10; 12-13)

Absence of Textbook

It didn't. (10; 19)

Homework Policy

Yes. Generally I don't assign specific homework. Sometimes I will give classwork--homework--but most of the time it's a combination. We try to get started on it and then take it home and finish it. (13; 4-7)

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 1

Overview

Well I think for the introduction purposes on the first day all four will be mentioned, but then on Day 1 and 2, I will be concerned primarily with being able to discriminate between relevant and irrelevant information and to throw in the concept--they've heard it already, it's nothing new--is the key words. They go to bed at night mumbling those words. Then on Days 3 and 4 we'll be concerned primarily with problems where you have fore-knowledge of the information--certain things to be able to solve the problem--information that isn't in the problem--feet and yards, inches, that kind of thing. Then also putting your problem in diagram or table form would be in those two days. And I still have a hard time with that one. That's the only one that really worries me. And the last two days would be on two-step problems. (14-15; 20-7)

Day 1

They had the key words that we were using and also that they would have enough irrelevant material, not just somebody's age or something to make it seem like it was really irrelevant but that there was a chance the student might misinterpret it. (21; 15-19)

I want the fractions and decimals as my main point of interest. (21; 10-11)

Day 2

And I've got a list of problems that should require them to make diagrams, and I would like to have them, as long as they're going to do the diagram, they ought to know how to do it nicely. I think that would be important. I would like to have them again use fractions and decimals as much as possible to gain experience so I anticipate picking a lot of problems with fractions and decimals both for identifying information that's not in the problem and also for the diagram or table. (22; 15-23)

I think the table and diagram part are the hardest for students to visualize--how to begin to set up a table, where everything goes on that table--how to allocate space in a geometrical design to look nice and to be representative of the information I'm trying to get across. And I think students have a hard time doing that. (23; 20-25)

Days 3 and 4

If I felt that they were really into that ["the information to solve the problem that's not in the problem statement" Skill 1], then I would postpone even bringing up this other one about a table or a diagram [Skill 4], so I felt that if they were going really well in this that I would leave them alone and let them pursue it. The tables and the diagram may not come till the next day. (25; 6-11)

I like the one about the hand shaking. 'If you have to shake hands with four people, how many times will you actually end up shaking hands?' (25-26; 27-3)

Day 5

Two-step problems....It would be an introduction day starting with simple problems, things that I'm sure that they would have no problem doing. (26; 19-25)

Day 6

I think what I would do is I would start out with one of your harder problems. I'd like to start out with one of the harder problems and work most of the day with those. It would be more of a challenge throughout the whole period. And then maybe try to tie in all of these other areas; have problems that are two-step that you can make a graph out of. Have a problem that's a two-step that also has some relevant information or information that it's assumed you know already and try to interweave all of that together....Then as the final thing, I would like to have maybe a little bit of a counting budget type thing where you have a lot of different things that all sum up to one thing--a balance sheet or something--that show multiple steps and what you can do with it, and then even to graph it. That would be the homework. (29; 6-26)

Tying the Lessons Together

And trying to find problems that transfer from one day to the next. If I finish picking out my problems, I would perhaps try to end the day with one, and then pick up the next day with one that was similar to it but maybe had an additional idea thrown in that would start to introduce the new topic area. (16; 11-16)

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 2

Overview

We're going to spend two days on this one--relevant and irrelevant information [Skill 2]. And on tables, diagrams, and information necessary [Skills 4 and 1] we're going to spend two days, and then two days on the two-step problems [Skill 3]. (13; 5-10)

Day 1

I will be doing the objective on relevant and irrelevant numerical information....I will also be giving them some--I will introduce the lesson with transparencies and talk about key words, what to look for in the sentence, depending on where the words are placed....I imagine it would take probably 10, 15 minutes at the most. And then we'll go into talking about the first skill [Skill 2]. I will be doing activity 4 on the first skill, which is 'The Biggest Star in Pop Music.' (21; 3-16)

Day 2

On Day 2 I will stay on one [Skill 2]....On that day I expect to give them these sheets with the answers and have them show me the process that was used to arrive at the correct answer. Because, as I mentioned earlier, I'm really concerned a lot about them knowing the steps. For instance, this is a fraction and they're going to have to add or subtract or multiply or divide. I will see that they know exactly how to add the fraction as well as understand the problem, and be able to decide what part of this problem is irrelevant, what is it I don't need, and I will be able to determine that by looking at the figures that they've chosen to work the problems. (23; 9-23)

Day 3 (Note that day 3 and day 4 are different from the teacher's lesson plans)

Skills 2 and 3 [Skills 4 and 1] will be presented on the third and fourth days....I will probably do 2 [Skill 4] on one day and start 3 [Skill 1] on that same day and then on the next day, review 2 and review 3 and complete 3. (26; 3-8)

Day 4

...I'm going to allow them some time on that day to start thinking about their problem that I want them to write. (29; 23-25)

Number 3 [Skill 1]. They'll be doing the review of 2 [Skill 4] and completing 3, and then they have these problems to complete. This I will send home, have them take with them as homework because I am sure that I will ask them to write their own word problems, and as I said, I'm doing it at the end of 3 because I believe after they've gone over the three

concepts or three skills, that they should be able to write a word problem, and then this will be taken home. (30-31; 22-2)

Days 5 and 6

Alright, on 5 I'm going to spend the last two days on the fourth [Skill 3] and that's the multi-step. (31; 11-12)

Because these are multi-step but I'm going to use this little tic-tac-toe because I think prior to this there has not been a lot of things that have been super, super fun where the kids will look at a tic-tac-toe game, they are learning the skill, they'll look at the game as something fun. (32; 7-16)

Tying the Lessons Together

Yes, with the problems that we chose....Well, one of the things I'm going to do is have the students write their own problems, all of the students, and then we're going to put them together and give them back to the students to work out. So we felt that could be one way of tying all the material together. And that's about it I think. (15; 2-8)

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 3

Overview

Some are going to be mixed. The relevant and irrelevant information [Skill 2] is going to be introduced on the first day, and I'll find some easier problems with that. Then when they come back, we're going to review that skill and we're going to go farther with it. So that will have two days. The reason I did that was because not only is it important but I have plenty of information on it. You know, that had something to do with it. Plus it's a useful skill. Then I plan to test them a little bit on that skill to give them a sort of recapitulation type deal, so that they can draw conclusions from it. Then we'll look ahead at representing diagrams and tables [Skill 4]. There's enough activities on that and that is very useful, especially later on in more complicated word problems--to drop things out and to separate facts--it helps you see. So I'm spending two days on that, and the rest are one day skills. (8; 2-17)

Day 1

Mainly key words and introduce relevant versus irrelevant and a possible activity....I'll assign these problems here probably. That's why I said assign problems [in lesson plan], but I don't know how many I'm going to find, because I don't know about the time. You know, you have to go with the flow. If we don't have as much time I won't assign as many problems. (13; 2-13)

Day 2

We're going to review relevant and irrelevant and then do problems. (13; 20-21)

Day 3

Represent with a diagram, information with a table or diagram....We'll probably check the work that they did the previous day because there is no way we're going to have time to check it all. So we'll check the work and we'll start this new skill and do a couple of activities to introduce the skill. Then I'm going to give them problems 1-5 that we wrote ourselves, and they're right here. And they have to draw tables and diagrams for those five problems and hopefully that can all be done in class. (15; 1-15)

Day 4

Using a table. There's a bunch of tables and it shows them how to put things in columns and sort of organize statistical information from a word problem. (16; 17-19)

Yeah, we'll pretty much work through all this together, and then there won't be really any homework. That'll take the whole day. (17; 2-4)

Day 5

Missing info, identifying information to solve the problem that is not in the problem statement....Yeah, there's 11 problems. (18; 12-19)

Day 6

Identifying the intermediate step in a two-step problem. (19; 22)

Then we have some problems in Tic-Tac-Toe....The other teacher gave them to me. And in talking with her about why she chose those, they were simple enough so that they can say okay, yes I do have to go on and do another step. It wasn't like they had to sort of decipher it on their own. They were taken through all the steps. It's more of a game too, it makes it more fun. I thought that would be a good way to end it. That would be Day 6 with more of a fun game type skill. (20; 2-14)

Tying the Lessons Together

They should flow together, mainly if you review the points that you did the day before and then go on to--for instance--the key words are going to be found throughout all of them, so that's a constant review of that skill. (9; 23-26)

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 4

No Plans

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 5

For the interview, the teacher had the first four days of handouts--the handout headings are given in parentheses for each day. The final two worksheet titles were: Day 5 (Word Problems That Contain Irrelevant Information) and Day 6 (Multiple Step Problems That Contain Irrelevant Numerical Information).

Overview

No, I didn't mix them [the skills] up. I thought about that, but I thought these are seventh graders again. I thought I'd just leave them in an escalating form and go from simple to difficult. I thought when they got through, when they get through with that [Days 1 thru 4], I might follow it up--just to take a look and see--and give them some that mixes up all kinds of things. But these are just going to go through. Well, I think if this is a learning situation you might as well just keep in a pure form and go through each one. At least maybe they can see the pattern, and if the pattern sticks in their mind, then they can apply it later on. But I think if I mix all that stuff up, I think they would have a little more difficulty. I don't think they could do as much. (14; 7-19)

Day 1 (Relevant Numerical Information)

Relevant numerical information. (18; 7)

We're going to have 15 problem-solving word problems. (18; 12)

This is going to be straight seatwork, where they have to sit down and read. Like I've been telling them, they've got to develop their reading ability and read three or four times until they understand it, then plan your solution. (18; 14-17)

I read them [the problems] and thought that I'd pick some that were easy and some that I thought were a little more difficult. So I thought they wouldn't be stereotyped as to difficulty. They should vary a little bit. (19; 3-6)

Day 2 (Problem Solving)

Lesson number 2 is still in the same category only the first lesson was probably add and subtract whole numbers and fractions and problem solving, and I see the fractions are kept fairly simple so that they're not getting involved with denominators and things like twelfths and one-fourths or 36ths and things like that. (20-21; 25-3)

They'll be similar [lessons 1 and 2] except that they'll be doing multiplying and dividing I think. I took one day for adding and subtracting. The next day will be multiplying and dividing whole numbers and simple fractions. (21; 7-10)

Well, simple arithmetic so they could concentrate on the words and thinking about how to go about solving the problem rather than getting bogged down in arithmetic or something. (21; 15-18)

Day 3 (Problem Solving-Multiple Step)

Lesson number 3. These are multiple step, so most of them are two steps I think. So they're multiple steps but they start with simple arithmetic, whole numbers, like I've got about four problems with whole numbers and then they have about six problems with some fractions. (21-22; 24-1)

There's a little bit with money in here or something, but again, if they're going to concentrate on problem-solving ability, then we've got to keep some of the arithmetic simple. You can lose what you're trying to accomplish if you get bogged down in the arithmetic. (22; 16-21)

Day 4 (Word Problems with Irrelevant Information)

Okay, this is a follow-up on that. Oh, this is word problems with irrelevant information. So there's usually a statement in each one of these that has some fact or data that's associated with what they're talking about but not necessary in working out the problem. (23; 9-13)

Days 5 and 6

See now I haven't got 5 or 6 made up, so in 5 and 6 I'm going to orient around using a graph or a table like number 2 says and number 3 [Skills 4 and 1]. (24; 21-23)

Tying the Lessons Together

No, nothing special, except that they would escalate in sort of the way they've been going through the year....They go to the whole numbers, to the fractions, with the add and subtract first and then the multiply and then the multiply and divide. (15-16; 26-14)

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 6

Overview

OK, generally I start it off with things that I thought were easy, that would be kind of a review. I started off with addition and subtraction and then addition and subtraction of fractions and then multiplication and division, multiplication and division of fractions. I thought that was a logical progression. Then I went into stuff that had irrelevant information, stuff that they had to sort out. Then I was going to do non-routine word problems but then I got this other thing on consumer math and I thought maybe instead of non-routine word problems which maybe they wouldn't use I would put some stuff in from consumer math, but I haven't had a chance to do that. (1; 8-19)

Day 1-Day 6

Okay, those are just going to be things that we're going to go over as we go on. They're right here, these four [the four skills]. This is what I was talking about in addition to vocabulary. These four things would be used in everything that we do in addition to vocabulary, because I think vocabulary was omitted from this. So I thought that was important. But we are going to use, well separating relevant numerical information [Skill 2] would be something that we wouldn't do until Monday the 14th of May [Day 5]. Then representing the information in the problem through a table or diagram [Skill 4] could apply somewhere in here, maybe even in the addition or something. Then identifying information necessary to solve the problem that is not in the problem [Skill 1], that would probably be relevant and irrelevant on that one. And then identifying the intermediate step in a two-step problem [Skill 3] would be maybe in the first day because I think there were two-step problems in addition and subtraction. And vocabulary would be throughout. (3-4; 12-1).

Okay, 'Separating relevant numerical information from irrelevant numerical information contained in the problem statement' [Skill 2]. Okay, what I thought I would do would be that on the 14th [Day 5] and that would be irrelevant information, and we would go over some problems and we would decide what had to be done and then I would have the class tell me what wasn't necessary in order to do the problems....'Representing the information in the problem statement through a table or diagram' [Skill 4]. That was something I thought we could do in the first one or two days, maybe the first three or four days and just do a diagram or a table for them to give them an idea about how to do it and maybe require them to do one or two problems doing that, and then 'Identify information necessary to solve a problem that is not in the problem' [Skill 1]. There are some problems that I chose that are like that, specifically to satisfy this one. And that would be throughout I think. And 'Identify the intermediate step in a two-step problem' [Skill 3], that's on the 9th [Day 2] and the 11th [Day 4] I think that we're going to start working on that. (7-8; 23-17).

Tying the Lessons Together

You mean with each daily progression? Yes, that's partly what the vocabulary does. It ties the lessons together, and it's also in the order of progression so that once they've gone through the addition, subtraction, multiplication and division of whole numbers and fractions, they are using things that are relevant and thus they get into things that use all of those together, and they have things in there that are irrelevant. And again, the non-routine problems are another progression. (10-11; 21-2)

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 7

Overview

Each day as I go through this they're going to be told 'I want you to look for important information.' I can't really have them circle in the book but I can have them point and circle it on the worksheet. Then I'm going to say to them 'I want you now to put this into mathematical terms.' Throughout the year I always talk about mathematical terms, making a mathematical sentence: '3 + 2 is __'. Then draw pictures if needed. I've always encouraged kids to draw pictures. Then I want them to solve it and I think it's very important that they label. I don't allow them just to give me numbers floating around....Then I want them, at the end--this is very important I think--is go back and see if it makes sense. (8; 6-22)

Day 1

I would say addition. (14; 1-3)

Day 2

Subtraction--whole number and fractions (16; 16)

Day 3

The third day we've got multiplication. (16; 27)

...this class has worked very little outside their textbooks so they're going to be more secure with a textbook. So that's why I want them to see the textbook, go through these, and then be given a sheet that has the same kind of thing. If I throw something else at them they start whining and crying and I can't do anything. (17; 6-13)

Day 4

This one for some reason covers extra. I know, because we have decimals in here too. Whole numbers and decimals and fractions, so that's why. (17; 22-26)

Oh yeah, I expect them to be able to handle all of them [Whole Numbers, Fractions, Decimals] because we've covered units and units of these things. (18; 4-5)

Day 5

Okay, so Day 5 is multi-step. (18;7)

Day 6

And the last one was the review. Because I felt that the Michael Jackson thing sort of used everything. And another thing possible here is if I've gone through and discovered that they're really weak on certain things, I may go over something else that day. (18; 9-13)

So the reason I chose that [a non-routine problem] at the end to do it because I'm assuming as you that they're going to have success all the way through and they'll be willing to try something like that. If I introduced that on the first day, they'll get frustrated. I know we think kids like puzzles and they like to solve things but I don't find that they really do. They also don't like to be in a state of confusion.... Yes, because then they'll feel good about the unit, and they'll think they have succeeded. But they should succeed at this because we've covered all these operations and all these things carefully throughout the year. (20; 3-16)

Well, for instance, The Biggest Star in Pop Music [Michael Jackson Problem], they've never had something like that where they have to read the whole thing. I have a few low readers in the room, not a whole lot. I have high interest there but they're very immature at times: "What do I have to do now?" For instance, when we were finding the area of a circle, they're taking pi and squaring it. Because it took three steps they were just falling to pieces because they want to do one task and have an answer. So that's another thing I'm going to have to be teaching them--that it takes several steps to get your answer. (21; 5-15)

Tying the Lessons Together

There isn't a separation in mathematics other than probably verbal, but I don't really see a separation even though I'm going to use different operations. The reason to use different operations each day is for familiarity of them, really. That you're going to add--ok, today we're going to add whole numbers or fractions--and they're going to be comfortable. They like a secure environment. It's partially my fault. (10; 12-19)

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 8

For the interview, the teacher had a single page outline. This outline is given in parentheses for each day.

Overview

One [Skill 2] is covered the first and third days, two [Skill 4] throughout the whole unit, number 3 [Skill 1] is covered the second day and 4 [Skill 3] is covered the fourth day....This is the unit, but there is all this opportunity to add additional information, and that's what my plans are. And that's when I'll develop the non-routine type problems, probably the fourth or fifth day, or even the sixth day. Give them a couple of non-routine problems and have them think it through. So they're going to get everything that you have, but this is how the unit is going to begin. This is the framework, the foundation of the unit, and then I'll just add things to it as I feel necessary. (23; 4-21)

Day 1 (Solving general word problems by using facts given)

Solving general word problems, problems with relevant facts given. (16; 16-17)

...I chose them [problems] so I would have at least 25 problems per day out of three pages. (17; 20-23)

Day 2 (Identifying and solving when applicable problems that may not have enough information to solve a problem)

Well I think one of your objectives is to identify--your understanding stage or something like that--is to identify problems that have irrelevant information in them. This particular assignment is to help them see that not always is everything in the problem [Skill 1]. They need something else to solve the problem which I hopefully will be able to get them to sense or to read more explicitly, more accurately. (20; 13-19)

Day 3 (Solving problems that have both relevant and irrelevant information)

Well this one again, where the first one was identifying problems, lesson 2 was identifying problems that did not have all the facts needed to solve the problem. So the first lesson was identifying information not in the problem that you can solve. The second day is finding all the needed facts from the problems. So obviously here again there is irrelevant information and they have to be aware of that, and I've also used some of your questions in order to fill out this assignment....you'll notice that I put four on one page, and it should go well. This lesson is more an objective one. [Skill 2] (21; 13-24)

Day 4 (Identifying the intermediate step in a two-step problem. What must be answered before the problem can be solved.)

Now lesson 4 is identifying two-step problems [Skill 3] which means that they have to do more than one step using information given in the problem. This may be a little more difficult but I think once we get the rhythm going for it and the explanation and everything is identified, I think it will go fairly well. (22; 10-15)

Day 5 (Learn to check answers to see if they make sense)

Lesson 5 is 'does the answer make sense?' This is one in the understanding stage. (22; 21-22)

Day 6 (Review of word problems)

Lesson number 6 is--like I say--just a combination of everything. That is, this one we're doing some problems with a lot of fractions and multiplication and things of that sort. We're taking information from a graph or from a chart and utilizing it in the problem. Now throughout this whole assignment I will be giving them other problems to do which will relate to objective 2 or 3, the one that describes diagrams, how to diagram problems.' (23; 11-18)

Tying the Lessons Together

Well, I tried to do that while I was putting these together. All the worksheets are related to the same topic for each day hopefully. (12; 11-13)

Interview Excerpts on Plans for the Problem-Solving Unit

TEACHER 9

For the interview, the teacher had a single sheet with the first four days linked to the four objectives. This outline is given in parentheses for each day.

Overview

I'm going to do one each day and then the last two days I'm going to mix them. (11; 4-5)

I just wanted to get these four in and had the six days, so I figured, OK, we'll get in and then we'll break it down in the last two and practice picking these out and using them. (12; 6-9)

They're not open in a sense [the last 2 days]. I just plan on that day after I see how things are going. Like with these first four days I'll be strict with that just in fairness to get all these objectives out. Then whatever feeling I had after the second or third day then I'll begin to fill in the fifth and sixth days, which I think needs to be done. (16; 22-27)

Day 1 (Separate relevant from irrelevant)

First I thought about what we were going to do and I chose my focus here which was going to be separating the relevant from the irrelevant. I put down as a little ex[illegible] a 'choosing the correct operations.' You didn't do that....Yeah, I just wanted to focus on they were going to have to remember to do these operations and how to think about them and key words and so forth that are going to make you do one thing or another. (14-15; 25-19)

It's going to be discussion, seatwork, then homework. That's probably going to be typical of all four of these. (17; 21-22)

Day 2 (Represent information on a table or diagram)

I picked these [the worksheets] because they seemed to be things that could be drawn by the kids and diagrammed. I'll probably hide the answers on at least two of them. But they're problems I picked because they're physical types of things they can draw or diagram. [Skill 2] (20-21; 25-2)

Day 3 (Identifying missing information)

Finding missing facts [Skill 1] (22; 4)

Day 4 (Find the second step in two-step problems)

Two-step problems [Skill 3] (23; 27)

Days 5 and 6

They would be mixed. There would be activities, a little bit of seat-work activities. If they're doing well we'll try to figure out some kind of, you know, break it up so they're not just sitting there. (25; 4-7)

I haven't really focused on that lesson yet. Typically you said do what you would do. I have left the last two days kind of open, semi-open. (16; 3-6)

I know what I'm going to do but I don't know exactly what I'm going to do in a sense. If we're weak on one then I'll focus on that. Or if it's not going like I want it to then this will give me a little bit of time in there to adjust and get different material. (16; 6-10)

Tying the Lessons Together

The last two days. The whole thing is going to go as a whole. I'm going to explain to them the first day what our objective is--to cover these four. So it will be tied in that sense. It is all problem solving. And then the last two days they'll all be inter-tied. (12; 12-16)

Post Interview Excerpts

TEACHER 1

Did Unit Go As Planned

No, I think it went much slower than I had planned....I felt like I had to go over it more on a problem by problem basis rather than just an idea or different concepts and we didn't cover nearly as much as I wanted to.
WHEN DID YOU DECIDE TO SLOW DOWN?
Day two. Day one I decided that we were going too fast for some kids.
TOO MUCH MATERIAL?
Too much material and they wanted to bring in too many different aspects in the amount of time we had, and I didn't want to have to rush through it because I thought the basic concepts were important anyway and there was no point in presenting it if I was going to slop through it.
WHY DO YOU THINK THAT WAS THE CASE.
Good question. I remember I told you this before and now I can't think what I said. A lot of the ideas were new to some of them, the idea of word sentences and there seems to be a gap in the type of problem, easy to hard and I think we need to sort of fill in that gap a little bit more--easy to more difficult problems--so they'll understand a little bit better; not make a nice big jump and expect them all to follow. We had to go back and discuss the problems in a more individualized basis. (1-2; 1-10)

Major Difficulty

Coming up with problems that suited our concept that we wanted to teach.
SO IT WAS HARD FINDING PROBLEMS?
Yes, hard finding them and it was hard making them up-time consuming. (2; 6-10)

Necessary Time

Too little, about half as much as is needed....I think twelve days would be nice. Then you wouldn't be rushed and you wouldn't lose any kids. We've done this for a few of them but I figure you'd have a better understanding if we had about twelve days. (2; 20-26)

Difference From Regular Instruction

Yeah, I felt like I was pushing papers too much, giving too many handouts. I don't like that concept of "here's a paper, do it" and shove it under their nose. I like to be able to present a few problems and then have them try to work them around instead of having to read things and they don't understand it, then it's hard to get around to each and every one of them instead of going over it as a group and trying to iron out the questions before they go home. I don't think we have that opportunity for instruction when we're pushing to do our sheets. (3; 8-17)

Students' Reaction

I think basically some of them enjoyed it. I think it was sort of a challenge for some of them, especially the harder problems, such as Baby Huey. Things like that they enjoyed getting into because it's different from what we've done before. And the graphs and the tables. I don't know if you had time to look through many of those but I think they enjoyed those.
DO YOU THINK THEY LEARNED WHAT YOU INTENDED THEM TO LEARN?
I think some of them did. I'm curious to see the results. I think a lot of them picked up some ideas that they hadn't thought of before, especially the key word type thing although we've been over it, actually picking it out and circling it I have done, but I think a whole unit on it maybe emphasized it a little bit more. To them it seemed like it was emphasized more. We didn't really get into two-step problems. I think more of what a word problem is is more intricate and the ones they had the hardest time solving were two step problems and we really didn't touch on that. (5-6; 7-2)

Advice to Teachers

Have lots of problems, lots of different types of problems and if you have time at the end try to integrate all those different concepts into several problems that the kids can use--as many different concepts as possible to solve one problem. (7; 15-19)

Post Interview Excerpts

TEACHER 2

Did Unit Go As Planned

Yes, I think so. (1; 5)

Major Difficulty

I felt the problem solving skills that we were asked to teach were skills that should have been taught only after students knew other kinds of basic kinds of problem solving, and I found that the students did not know the basic concepts. So I had to start with that, go through it quickly and then try to make certain _____ that the research wanted as well as constantly going over the basic things. (1; 16-23)

Necessary Time

It was too little time I felt. It was too little time for introduction, discussion, teach words and review words, and all four of those are important, so I would teach _____ to students. (2; 4-7)

Difference From Regular Instruction

No. I use pretty much the same strategies for introducing something new, picking up something old and relating it, showing them how it's needed in order to do something new, and I did pretty much of the same style as far as the pattern. It was about the same. (7; 1-5)

Students' Reaction

At first they weren't too excited about it, and I don't think they ended up too excited about it, but I think they ended up understanding it better. (7; 7-9)

Advice to Teachers

I think probably intensive workshops on teaching and learning problem solving prior to going into an area if they are unfamiliar with it, if they are not very motivated to work on their own to find out a lot of information about it. And I think working in a workshop setting with other educators would be supremely helpful. (7; 20-25)

Post Interview Excerpts

TEACHER 3

Did Unit Go As Planned

It's hard to say if it went as planned, because it's the first time I had done it. I wasn't really sure exactly what to expect but I think it went a lot different than I thought it was going to go.
IN WHAT WAYS DID IT GO DIFFERENTLY?
Well, I didn't realize how much of a problem there would be with the materials themselves. I forget to take into account the seventh graders and the use of the folders for the papers. I didn't staple the papers together in order because the staple would not have held, and I had quite a few papers, so I gave them a paper clip. Well, then you run into all these problems with papers out of order, people can't find the right page. They don't have the self discipline to keep themselves organized, and that became somewhat of a problem and a distraction. What else was different? Well I wasn't careful enough in selecting some of the problems that I gave the kids and I ended up pulling a sheet that I was asking them to give the unnecessary information and there was none. That gets a little frustrating when things start adding up on you, you know. You think oh, desperation. And then you have students absent that miss what you have taught and you have to go on with the skills because you're on a time--you know. You only have six days and you're supposed to follow your lesson plan and so that became frustrating--what do you do with those students that miss? I remember one day there was a field trip and I only had half of them here and that discouraged me so we kind of got a really bad start. Things seemed to turn out toward the end a little better....I think I need to go through my unit too and write more explicit directions about what it is I'm doing so that when students are absent then I don't have to re-explain the whole thing. For instance on those problems that I said, "Okay, write the unnecessary information, then solve." Well that wasn't written on the top. I explained the directions to the people that were there and said, "This is what I want you to do" and I showed them how to do No. 1 and No. 2. We did the first two together. But then I'll tell you you have all these people come in tomorrow, "What do we do?" You have to say, "Well write the unnecessary information." "Well what's that?" They weren't here for the lecture. So it really became sort of a stressful situation, trying to reteach and answer questions and stuff; whereas if they had a textbook that outlined it all for them and taught them, then they could just follow the directions. (1-3; 6-7)

Major Difficulty

The major difficulty...Probably some of the things I've already mentioned. The materials themselves were not adequately I don't think organized to where that wasn't a distraction. For instance clipping-maybe I shouldn't have handed it all out to them at once which I did. But I don't know, that would have been a hassle trying to hand things out every single day. Major problems--absences and having to follow a rigid guideline probably.

SO THE PAPER WORK AND THE ORGANIZATION OF THE PAPERWORK?
Was a distraction, but I don't think it was the major problem. The major problem was the strict schedule, not being able to go back and reinforce things, not being able to take the time to make sure that all the students did all the problems and that they were indeed learning the skill. It was like, you know, I was out of time and what do you do? Unfortunately I wasn't able to go back. In a way I'm glad I didn't go back. Had I gone back, the latter part of the unit wouldn't have gone as well as they ended up doing, because it would have distracted from the time spent on them....Right, and sometimes I as a teacher take things for granted that the students have common sense to realize you know, keep the papers in order. I said clip the papers that you've already done so that you know where you are. That became confusing. Some were in different places. So it was pretty stressful there for the first couple of days, but they got used to it and I loosened up a little bit too. It's like teaching something for the first time. No fun. (3-4; 10-13)

Necessary Time

I think the time is adequate, but given the time of the year and the amount of extra things going, no, I could have used more time....Maybe a couple of days. Spent more time on those graphs and tables, even though I alotted two days for them. The first day was an introduction because of those other problems being so long and people being gone, I didn't have enough time to do that so it kind of was a domino effect. So a couple of more days probably--given this schedule, maybe a regular schedule--maybe one day would have been adequate. (4-5; 20-5)

Difference From Regular Instruction

Yeah. Less work taken home and stuff, which made them have to come to class and then finish what they didn't finish the day before and then sometimes for some of the students that took too long and I was saying okay, it's time to quit because if we don't quit we won't get the new skill. So there were some adjustments. (5; 15-20)

Students' Reaction

At first I think their reaction was "This isn't so hard," and "I can see these" and it was the key words and all that. Then I noticed somewhat of a trend after that, "Oh, this again?" But I don't think they minded it. I don't think the material was too difficult for them. I think they understand the use of each one of the things. I'm not sure how well they will use it in the future, whether they will say, "Oh, I should set up a table for this." I think they realize that you can set up tables, but I'm not convinced that they feel that it's something that they will use later unless they're reminded that hey, this is applicable to setting up a table, or this is a key word. (7; 6-18)

Advice to Teachers

Well make sure you're organized I guess. Make sure the level of difficulty is not too hard for the kids--the easier the better. They may moan and say "Oh this is easy, but deep down they like easy, because easy leads

to learning harder stuff, and I think wit[illegible] problems the easier the better, but then don't be afraid to branc[illegible] from the easy into some more difficult applications where they hav[illegible] draw conclusions: if this means this, then this must mean this. You [illegible], like those multistep things. I think if anything I would revamp the lesson that I've done because now I know what works and what needs to be more explained, what worksheets need to be handed out to all of them to have it to turn in to write on the sheets. So that was a problem sometimes too. I would have preferred that they just had their own handouts on it instead of not writing on the handouts. (8-9; 26-14)

Post Interview Excerpts

TEACHER 4

Did Unit Go As Planned

No, I really didn't have any preconceived idea of what it was going to go like. I think they're getting more excited about it now. They're maybe seeing patterns, ways to solve them that I didn't really anticipate in the beg inning. (1; 6-10)

Major Difficulty

So I was beginning to look over the material I think and see some patterns. Remember, I told you I couldn't see myself with word problems. That's why I was having a problem. It was so much in the beginning, and I couldn't seem to organize it. Then I just kind of picked some themes and ratio was one that I thought could be covered fairly easily. It really solves a lot of word problems. Then two-step and important information or not important information. (2; 20-28)

Necessary Time

No, I think we were really just getting into it now. There's so many more directions to do, but I think their anxiety over word problems has lessened. I'm not sure it's their anxiety or my anxiety, or maybe it's both, it's lessened and we can talk about the problems and not just have this "oh my god, a word problem, what are we going to do?", "I hate 'em, I'm not going to do 'em," which was what you were dealing with before this block of time. (5; 21-28)

I don't know. I wouldn't want to make it any longer than maybe two weeks, 12 days, maybe 10-12 days. But again it's like one of those kinds of things that I don't know until I get there how it's going, and I haven't done it before so I don't know, but I think we at least need five to seven more days. (6; 17-22)

Difference From Regular Instruction

No, not significantly, except for the drawing which was something they don't usually do in class. (7; 25-26)

Students' Reaction

I think positively. I think there was not a great reluctance to do the problems. I didn't hear a lot of whining. (9; 9-10)

Advice to Teachers

To get more materials. Don't count just on the book. It isn't nearly sufficient. It doesn't really handle it, it just gives a word problem. You're not really getting into ways to solve it and maybe there's more

than one way to solve it. It seems that with the textbook you're just concerned with getting the right answer and you're not really talking about the method you're using. I just think that maybe we all need more materials and maybe some workshops where we can talk about these and exchange ideas about what works. (12-13; 23-7)

Post Interview Excerpts

TEACHER 5

Did Unit Go As Planned

It did go pretty much as planned. If we'd had a little more time per day we could have probably made a little different approach, which may have helped them go through some of that a little easier; you know, a little more explanation and stuff for each type of problem like we did in the last few days. But in the first couple I didn't think they really needed any because they had had that type of stuff for at least a couple of years from the fifth grade on--adding, subtracting, little word problems--so I thought we could see what they did on their own on that. And then it's like we see what they run into and then take it from there. So I could tell there were difficulties that they would run into, so I tried to give them a little more explanation each day like we did with them today in particular. (1; 6-22)

Major Difficulty

The main problem would be not--well, it was a decision making thing for them. You know, deciding what to do with all these word problems, trying to foresee where they were going to have the most difficulty. So I think you just have to let that happen and then recognize and do something about it....Oh, I was aware that when we were selecting the problems, that you probably would have wanted to do more in production to all that stuff, more board work, examples; let them see things, let them think about it, and let them do the actual paper work. But if they don't do enough of them, I don't think you gain much either. Like you can do a lot of verbal work and put examples on the board together, which I think is important, but if they don't get enough practice after that, they don't really gain too much either, although they might understand exactly what you're doing when you're going through a problem and putting it on the board, and everybody--even if it was 100% understood--they've got to do so much practice. (4-5; 12-6)

Necessary Time

I think it could have used more time overall. When we first went over this, we had six days and I felt each of those was a work session for the kids, and so maybe I could have done it differently--gave them fewer problems like six, seven problems, and do two or three in discussions and then give them six instead of ten--things like that. And you might get a different result, I don't know....I think about four more days. I think about ten days would have been better. (3; 14-24)

Difference From Regular Instruction

No, I would have been doing some of this problem solving anyway, because like I said, these particular books don't have enough of that. (5-6; 28-2)

Students' Reaction

About like they did everything else we do. Their reaction wasn't much different than what we do ordinarily when we work out of the book or give them a handout sheet, whatever, and this bunch has been about just like you see them. (10-11; 26-1)

Advice to Teachers

...but like most teachers they don't have time to do a lot of that on their own so they're going to go out and collect what they can from all the materials that they have on hand and select some from that. So the point would be that if there was material that we could get so you wouldn't have to do all that work, where you could just go to a workbook with good word problems for the seventh grade or each grade--I thi ' that's what we really need being that we don't have it in our part lar text. (9-10; 28-9)

Post Interview Excerpts

TEACHER 6

Did Unit Go As Planned

Yes, it did basically. It was basically as I planned it. There were a few things that I changed as we went along. The first lessons were too easy, so I had to add stuff sometimes right in the middle of a class. Like I had to put a problem up on the board because everybody would have done it in ten minutes or fifteen minutes and it would have been too soon. (1; 6-12)

Major Difficulty

Difficulty...well, it was difficult...I assumed that the kids remembered stuff that we had done before and that they could apply these things to the word problems and the problem solving, and they didn't remember how to do the things that we had done before, so we probably should have had a review before we did the problem solving. (2; 8-14)

Necessary Time

I don't think there was really enough time....I think one thing about this study is that it would have been better if it were earlier in the year. It was a bad time of year for me and maybe for the kids because it's the end of the year. I had tests to give before and after and everything and it was just not a good time, and I think that if I had had a little more time to think about it and organize it maybe it would have been enough time. I felt rushed the week before, just really rushed. I had intended to take some time and rethink everything after I had made the lesson plans, because I usually do that anyway with all of my lesson plans. I make them up and then when I have a chance I go over them and make sure that everything's what I think it should be or see if it's progressing properly. I don't think it would have hurt to have more time, regardless of the time of year. Maybe two or three more days. (4-5; 11-1)

Difference From Regular Instruction

No, basically the class was done in the same way. They have a little bit of instruction and then they're given their assignment and they had time to work on it in class and what they didn't finish they took home. I do it that way because then they have a problem and they can still ask me. Because even though they say yes, we understand it, when they finally start to do it it's "I didn't understand." (5-6; 28-7)

Students' Reaction

Some of them, even though I told them it was going to be run just like a regular class, they didn't believe that they were going to have, that I was going to give them grades and when I did say, "yes I am taking these grades," they reacted with disbelief so I think some of them were goofing

off a little bit, but I think overall, especially the last one, they really enjoyed it. They enjoyed working with those non-regular...those unusual ones. They really enjoyed those yesterday especially. And they told me that as I went around. "Hey this is really fun, this is neat." (6-7; 18-1)

Advice to Teachers

I can't think of any advice. (9; 10)

Post Interview Excerpts

TEACHER 7

Did Unit Go As Planned

Very much so.

Major Difficulty

I was a little disappointed in the results. They'd sit there and they'd go yeah, yeah and I'd say put the papers back, and they weren't that good. 50% or 70%. So I realize that in watching the kids and actually having them do it themselves on paper is a different thing because some of the kids who went to the board to do them and did an excellent job didn't do that well on paper. (1; 20-26)

Necessary Time

In most cases it was perfect. I would never have spent more than six days on it anyway. One thing that could have happened to me that I didn't allow for is I could have had an interruption in there, and actually today there is an interruption. If I had walked in that room and had half the class gone I wouldn't teach a lesson that day. I would put them into extra credit or something else....Yeah. It's nice this time of year to do something different. One of the reasons I think throughout the building some of the kids quit is the teachers refuse to plan lessons that are just a little bit different and that's what you need to do, otherwise they just sort of drop out. They need something just a little bit different to do. That's why I save measurements usually till the end. Then I let them do some drawings with the measurements. We measure the room, measure the side of the school. (4-5; 23-15)

Difference From Regular Instruction

Definitely. I found I was talking more. I looked at the clock and half an hour or twenty minutes would go by. Of course I had the kids coming to the board because I thought it was important for them to be able to take the information, put it into mathematical terms, do the calculation and put it back in there. Now I realize writing on the board was going this way and they don't normally do it, but I wanted them to set something up so they knew what they were looking for. (2-3; 21-1)

Students' Reaction

They liked it. They told me that many times.
WHY DO YOU THINK THEY LIKED IT?
Maybe because it was different. The worksheets and the activities on the board, I don't normally do that and they like that. I don't like the kids writing on the board but I did it this time. (5; 20-26)

Advice to Teachers

I don't know. The best thing you do at any moment in any classroom is whenever there's a high interest rate, is to stop and do a calculation if you've got a kid with a paper route or something. There are moments and you have moments even in the math time. (7; 10-14)

Post Interview Excerpts

TEACHER 8

Did Unit Go As Planned

I'd say it went pretty much as planned, yes....The only changes that occurred is that as we got to the fourth and fifth days I had too many problems. I think the number of problems that I had decided on in the beginning worked well, but as we got to the more difficult problems on the fourth and fifth day, there wasn't enough time to go over each problem as in depth as it needed to be done. So I had to hit some and maybe leave out a page in order to accomplish everything that I wanted to do for that particular period. I think that was the only problem I found. (1; 3-14)

Major Difficulty

Probably--which wasn't my difficulty--was that there were absences for the students, and since we're dealing with a time line here, they were given the necessary makeup work but it was after the fact. I mean they may or may not accomplish all the problems, because when all of a sudden instead of having 25 problems to do they've got 50 problems to do in one day. So I think that was probably the only difficulty is that I had more absences than I thought I would have. (1; 17-25)

Necessary Time

I thought given the six days was kind of short. I would want it to be a little bit longer and maybe--the way I would have handled it--maybe two worksheets instead of three, and have a little longer period so it's not so--I mean a little longer--instead of having six days, having 10 or 12 days. But this seemed to be a little too tight. You're packing in an awful lot. You're proposing four objectives in six days. I think that's a little too much for some kids. (2; 19-27)

Difference From Regular Instruction

No, I have the same approach for both of them. It's just different types of problems.
DID THE PROBLEMS CAUSE YOU TO CHANGE YOUR STYLE IN ANY WAY?
No, I used the blackboard just as much as I would any other time.
DID YOU TALK JUST AS MUCH AS YOU WOULD ANY OTHER TIME?
I probably talked more, although the nice thing about the word problem solving was that for the first page, I'd have the students read the problem, whereas in a regular assignment in the textbook, all you have to do is give me the answer because four times nine doesn't need to be read. You just tell me it's 36. But with word problems, it was kind of nice to have them read the problem. There was something to read, and it gave them experience and it helped spread out the activities for the class so that everyone had a chance to participate whether they had been absent the day before or not. They could still at least read a problem. It kind of keeps everybody going. (3-4; 15-5)

Students' Reaction

I thought really well. I had a couple of students that didn't have the assignments. Well I had four students that didn't have two assignments and four students that didn't have one assignment for the five days. In most cases it really went well. There was always good participation for most all the problems. There was always someone who had an answer. There wasn't a point where it bogged down where it was a wasted day or something was just lost that day. I think the material that was chosen by hit or miss was appropriate for their level. Actually it's appropriate for any level. If we're talking about how long it takes you to solve the problems or solve the entire three pages, it might be different for an eighth grader as opposed to a seventh grader, but I think all the problems are good for any grade level. A lot of students really kind of enjoyed it I thought. I mean they were always--on some problems where there was a diagram that had to be thought about they really kind of got into it. I mean of these problems where you're dealing with how much area does the house occupy on a lot and things like that, it really went pretty well more than I figured it would. (4-5; 13-7)

Advice to Teachers

I think the primary thing is to have the materials. Most people don't teach things because they don't have materials. Your materials helped and being a teacher having three years' experience, knowing where to look, helped me also. So now that I have them all together it will be fairly easy for me to continue this process of teaching this problem solving unit. I think primarily just rounding up resource materials is the key to it. (6; 7-14)

Post Interview Excerpts

TEACHER 9

Did Unit Go As Planned

I thought I needed more time. If I look at it now, as I planned it it was, but I think I would change it if I was going to do it again. I would intersperse it with the actual arithmetic. Like we came across the idea of using fractions yesterday to try to do that. It was obvious they had forgotten that, so I would have like to stop maybe for a day or two and reinforce that. It appeared then that six days was going to turn out to be way too short. Or maybe on the other hand problem solving ought to be an ongoing kind of thing that after you think you've taught it then you present problems that would use those kinds of skills and see if they know how to relate back....The first four days were pretty much as planned and the last two days they went--I wanted to go back to the two-place problems and I didn't get to those at all. I thought we would yesterday. Then they got so involved with the other things that we ran out of time, and I felt really squeezed. (1; 3-24)

Major Difficulty

The things that I saw was that they just couldn't get that abstract idea of problem solving. So I didn't have time to go back and try to relate the algorithm to a problem. I felt frustrated by that. (2; 6-9)

Necessary Time

Too little....What I would do, I think I would change everything. I would try to teach arithmetic and then try to intersperse problem solving with that and then again maybe toward this part of the year have a problem solving and review that. I think it's going to change my idea about what's going to happen. I'm going to try to get more problem solving. (3; 5-13)

Difference From Regular Instruction

No, I tried to teach the same....Well I used almost exclusively ditto sheets which normally I'd use the textbook and ditto sheets. (3; 22-25)

Students' Reaction

I don't know. As I said, the first four days I thought they were pretty enthusiastic about it. I would think that most of them felt pretty good and a couple of them kind of got a little apprehensive about it after that. But generally--overall--they like it. (4; 9-13)

Advice to Teachers

Allow a lot of time. (4; 27)