DOCUMENT RESUME

ED 359 170 SP 034 610

AUTHOR Kennedy, Mary M.; And Others
TITLE A Study Package for Examining and Tracking Changes in Teachers' Knowledge. NCRTL Technical Series 93-1.
INSTITUTION National Center for Research on Teacher Learning, East Lansing, MI.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE Mar 93
NOTE 163p.
AVAILABLE FROM National Center for Research on Teacher Learning, 116 Erickson Hall, Michigan State University, East Lansing, MI 48824-1034.
PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC07 Plus Postage.
DESCRIPTORS *Data Collection; Educational Research; Elementary Secondary Education; *Evaluation Methods; Higher Education; Interviews; Lesson Observation Criteria; Longitudinal Studies; *Measurement Techniques; *Measures (Individuals); Questionnaires; Research Utilization; *Teacher Education Programs; *Teacher Evaluation; Teaching Skills
IDENTIFIERS Knowledge Base for Teaching; *Pedagogical Content Knowledge; Teacher Education and Learning To Teach Study

ABSTRACT

Between 1987 and 1991, the National Center for Research on Teacher Education engaged in the Teaching Education and Learning to Teach study, a longitudinal study of teachers as they participated in a variety of teacher education programs. The study sought to determine how teachers' knowledge, beliefs, and reasoning changed over time, and it explored the relationship between the content and format of teacher education and what teachers learn about teaching. Three data collection instruments--an interview, an observation guide, and a questionnaire--used in the study are presented in this package. This resource provides detailed explanations of data collection strategy; interviewer preparation; actual questions, problem sets, and implications of interview responses; and interpretation implications of data analysis. The study package offers a "do-it-yourself guide" for teacher education program planners and researchers for use in examining teacher learning within teacher education programs. The materials can be used to track changes in conceptual understanding of both preservice and inservice teachers and as feedback for curricular development in teacher education programs. (LL)

Technical Series 93-1

A Study Package for Examining and Tracking Changes in Teachers' Knowledge

Mary M. Kennedy, Deborah Loewenberg Ball,
and G. Williamson McDiarmid

National
Center for Research
on Teacher Learning

Sponsored by the United States Department of Education
Office of Education Research and Improvement

Technical Series 93-1

A STUDY PACKAGE FOR EXAMINING AND TRACKING CHANGES IN TEACHERS' KNOWLEDGE

Mary M. Kennedy, Deborah Loewenberg Ball,
and G. Williamson McDiarmid

Published by

The National Center for Research on Teacher Education
116 Erickson Hall
Michigan State University
East Lansing, Michigan 48824-1034

MARCH 1993

The work is sponsored in part by the National Center for Research on Teacher Education, College of Education, Michigan State University. The National Center for Research on Teacher Education is funded primarily by the Office of Educational Research and Improvement, United States Department of Education. The opinions expressed in this paper do not necessarily represent the position, policy, or endorsement of the Office or the Department.

NATIONAL CENTER FOR RESEARCH ON TEACHER LEARNING

The National Center for Research on Teacher Learning (NCRTL)[1] was founded at Michigan State University in 1985 with a grant from the Office of Educational Research and Improvement, United States Department of Education.

The NCRTL is committed to research that will contribute to the improvement of teacher education and teacher learning. To further its mission, the NCRTL special reports on contemporary issues in teacher education. For more information about the NCRTL or to be placed on its mailing list, please write to the Publication Clerk, National Center for Research on Teacher Learning, 116 Erickson Hall, Michigan State University, East Lansing, Michigan 48824-1034.

Many papers published by the NCRTL are based on the Teacher Education and learning to Teach Study (TELT), a single multisite longitudinal study. The researchers who have contributed to this study are listed below:

Marianne Amarel
Deborah Loewenberg Ball
Joyce Cain
Sandra Callis
Barbara Camilleri
Anne Chang
David K. Cohen
Ada Beth Cutler
Sharon Feiman-Nemser
Mary L. Gomez
Samgeun K. Kwon
Magdalene Lampert
Parry Lanier
Glenda Lappan
Sarah McCarthey
James Mead
Susan Melnick
Monica Mitchell
Harold Morgan
James Mosenthal
Gary Natriello
Barbara Neufeld
Lynn Paine
Michelle Parker
Richard Prawat
Pamela Schram
Trish Stoddart
M. Teresa Tatto
Sandra Wilcox
Suzanne Wilson
Lauren Young
Kenneth M. Zeichner
Karen K. Zumwalt

[1]Formerly known as the National Center for Research on Teacher Education (1985-1990), the Center was renamed in 1991.

Abstract

Three data collection instruments—an interview, observation guide, and questionnaire—used in the National Center for Research on Teacher Education (NCRTE) Teaching Education and Learning to Teach (TELT) study are presented in this study package. This resource provides detailed explanations of data collection strategy; interviewer preparation; actual questions, problem sets, and implications of interview responses; and interpretation implications of data analysis. The study package offers a "do-it-yourself guide" for teacher education program planners and researchers for use in examining teacher learning within teacher education programs. The materials can be used to track changes in conceptual understanding of both preservice and inservice teachers and as feedback for curricular development in teacher education programs.

TABLE OF CONTENTS

INTRODUCTION

Between 1987 and 1991, the National Center for Research on Teacher Education engaged in a longitudinal study of teachers as they participated in a variety of teacher education programs. The idea was to see how these teachers' knowledge, beliefs, and reasoning about teaching changed over time as the teachers participated in these various programs. The data collection instruments proved to be very difficult to design: The range of skills and abilities teachers may need is far too vast to study and we needed a set of decision rules that could put reasonable boundaries around the study. A second problem we faced was that different programs had different goals, and we wanted to document changes teachers made toward these differing goals.

As the data collection instruments began to take shape, it became apparent that these instruments might be of value to other teacher education researchers or teacher educators who want to learn more about teacher learning in formal settings. To accommodate such interests, we developed this study guide. The document serves two purposes. First, it describes the rationale and procedures for the center's *Teacher Education and Learning to Teach* (TELT) Study, and in that sense provides a technical report for anyone interested in the TELT study. Second, it serves as a study guide for other researchers or teacher educators who are interested in conducting similar studies. In that sense we hope the ideas, arguments and interview and questionnaire items presented here can be drawn on or modified to suit a wide range of purposes.

The Teacher Education and Learning to Teach Study

As its title suggests, the TELT study was designed to explore the relationship between the content and format of teacher education, on one side, and what teachers learn about teaching, on the other. To that end, the center selected programs that differed along a number of important dimensions: They ranged from preservice to inservice and from university-based to classroom-based. Included in the study were a handful of traditional undergraduate teacher preparation programs, two alternative routes into teaching, a first-year induction program and two inservice programs. Even within these broad categories, the programs varied considerably. The two inservice programs concentrated on different subjects (one mathematics, the other writing), for instance, and the two alternative routes had quite different rationales—one aimed to recruit a higher calibre of candidates into teaching, the other aimed to solve a simple shortage

problem of getting teachers into inner-city classrooms. Among the preservice programs was an inner-city open-enrollment institution, a highly selective liberal arts college, a state university that evolved from a normal school, and two large research universities.

To track changes in program participants, we visited teachers or teacher candidates on repeated occasions, asking them roughly the same set of questions each time. The first visit occurred at the beginning of the program, the last after the teachers had completed their programs and had been teaching on their own for several months. The number of visits in between these two points depended on the nature and schedule of the program.

Given such a study design, the center's most difficult task was to design a set of data collection instruments that could be used to track teacher learning over time. Several important questions needed to be addressed:

1. What aspects of teaching should we study?
2. What aspects of teacher expertise should we document, and how can we document them?
3. Where and how should we seek evidence of connections between knowledge and practice?
4. What kind of teaching tasks are valid representations of teaching?
5. What criteria should we use to sample teachers' subject matter knowledge?
6. How should we pose questions about teachers' views of learner diversity?

Answering these questions entailed much more than simply choosing among available alternatives. No clear alternatives were available. Our task, therefore, was to choose an aspect of teaching on which we would focus, develop a conceptually-defensible model of the knowledge, skills, or dispositions that contributed to that aspect of teaching, and develop a framework for data collection instruments that would tap the kind of knowledge or skills we had earlier identified. The data collection instruments we display in this study guide, then, are more than merely a collection of interesting questions one can ask teachers. They are the product of a thinking that warrants examination even apart from the particular data collection devices it ultimately yielded. Below we discuss our thinking on each of the central questions listed above.

1. What aspects of teaching should we study?

There are many ways of construing the phenomenon we call "teaching." Some people envision teachers as representatives of academic disciplines, and assume their primary influence on students derives from their enthusiasm and knowledge of their subjects. Others think of teachers largely as alternative parents and assume their primary influence on students derives from their moral character and the type of role model they present. Still others envision teachers as members of the larger community, thinking that their influence on students comes not merely from what occurs within schools, but from what occurs when teachers meet with parents in homes, at church, or on other occasions. Still others envision teachers as technicians, implementing district curricula and managing students as they proceed through their lessons, so that their primary influence on students derives from their ability to efficiently manage classroom activities. Finally, many envision teachers as professionals who work with colleagues in the development of curricula, school programs and policies.

Each of these aspects of teaching contains some truth, yet each is too narrow to adequately represent teaching, for teaching can be all of these things. Still, a research project such as we set out to do cannot possibly measure the full range of teacher knowledge, skills, or dispositions relevant to all of these aspects of teaching. We clearly needed to take a position on the phenomenon of "teaching."

We did not adopt any of the perspectives described above, but instead fashioned our own. We wanted to recognize two important points: first, whatever responsibilities teachers may have in their communities or in their schools, the bulk of their responsibilities occurs within their own classrooms. Thus, the most critical aspects of teaching must reside there. Second, we recognize that the phenomenon of teaching entails both subject matter and students, and that any description that recognizes only one of these cannot adequately portray teaching. We therefore focused our investigation on *teaching academic subjects to diverse learners.* in so doing, we implicitly chose not to gather data on teachers' knowledge about, or skill in, talking with parents, negotiating with administrators, working on school committees or with PTA associations, or even managing classrooms.

Choosing to concentrate on this aspect of teaching enabled us at once to delimit the scope of our study considerably while still leaving it open enough to capture the range of knowledge teachers might be learning in the diverse programs we studied. But even this focus left too broad a range of things we could investigate. There are many school subjects, for instance, and teachers may need to know different things about each. And teachers need to be prepared to

teach many kinds and combinations of learners. It might be possible to limit the study to one subject so that we would study, say, learning to teach mathematics, or learning to teach history, but such an approach would not allow us to see whether different subjects placed different demands on teachers. It seemed important to include at least two subjects, so that the differences and similarities between them could be examined. It also seemed important not to include more than two, in the interest of narrowing the study's scope.

We ultimately chose to concentrate specifically on teaching mathematics and writing to diverse learners. These two subjects had several advantages to us. Both are considered core subjects—indeed, they constitute two of the three Rs. Both are taught throughout the K-12 curriculum, and so are relevant to both elementary and secondary teachers. Both also involve learning to do something as well as learning about something. In that sense, they can be construed either as "tool" subjects or as disciplines. Finally, these two subjects are usually considered to entail quite different kinds of ability. Mathematics is considered a hard subject, writing a soft subject; Mathematics objective; writing subjective; Mathematics logical, writing creative. While we doubt the truth of these polarities, they are nevertheless part of the received wisdom about these subjects, and therefore render them more interesting as contrasts than other combinations of subjects might yield.

It did not make sense to follow a similar route for examining what teachers learn about diverse learners. That is, it did not make sense to focus the study on two particular kinds of learners. But it did seem to us that some issues regarding diverse learners were more salient than others. One such issue was diversity per se; that is, what do teachers know or learn about how to handle heterogeneity within their own classrooms? While it may be true that particular kinds of learners make particular demands of teachers, it is also true that virtually every teacher must respond simultaneously to many kinds of students. Boys and girls, quick and slow, quiet and noisy, theists and atheists, all reside within each classroom. The second important issue on the learner side of the equation is the treatment of particular groups of students who have traditionally not been well served by our schools—poor children and children of color. Given the changing demographic makeup of our student populations, and the stable demographic makeup of our teaching population, this issue of student diversity seemed important to address.

Thus, when the TELT study defines its focus on learning to teach academic subjects to diverse learners, it refers specifically to mathematics and writing, and it refers specifically to teaching these subjects in heterogeneous classrooms and/or to traditionally less well-served

populations of students. Having established all of this, we may now ask, what should we expect teachers to be learning that will enable them to accomplish these tasks?

2. What aspects of teacher expertise should we document, and how can we document these things?

Just as there have always been different perspectives on the nature of teaching, there have always been different perspectives on what contributes to good teaching. One perspective emphasizes the knowledge demands, another the skill demands. Still others emphasize dispositions, beliefs, or values. The problem of defining teacher expertise was not simplified by defining one aspect of teaching to focus on. For teachers have not only knowledge about their subject and their students; they also have attitudes toward both, and skills related to teaching particular subjects to particular students. Though teaching has been the subject of scholarly attention for centuries, there is very little empirical knowledge about the relative contributions of these different aspects of expertise to teaching. All seem equally important.

Yet recognizing all of these introduces an unusual sort of data collection problem, for each aspect of expertise requires its own method of documentation. We can learn about teachers' skills by observing their teaching, for instance, but cannot very well learn what they know or believe. On the other side, if we used paper-and-pencil instruments to measure teachers' knowledge and beliefs, how could we know whether these bits of knowledge or beliefs had any bearing on practice? If we were to be true to our understanding of teaching as influenced by all of these things—knowledge, skills, dispositions, beliefs, etc., then we needed a method of data collection that could tap all of these things. We could not limit data collection to one format.

The data collection system ultimately developed for the TELT study entailed three major data-collection formats. One, a questionnaire, was limited to multiple-choice questions and questions asking for degree of agreement on Lickert scales. The questionnaire allowed us to gather data on knowledge, attitudes and beliefs, and to gather these data in a standardized way from all study participants. Our second instrument, an observation guide, was used whenever teachers were in classrooms as student teachers, as novices in alternative routes or induction programs, or as experienced teachers. The observation guide enables us to document actual teaching practices. The observation guide is accompanied by pre-observation and post-observation interviews that enabled us to learn the teachers' reasons for the practices we observed. Although we provided our observers with guidelines for observing and documenting

their observations, and standardized questions for the pre- and post-observation interviews, the contents of these observations were n y variable, for we could not control what a teacher necessarily happened to be teaching on the particular day we visit.

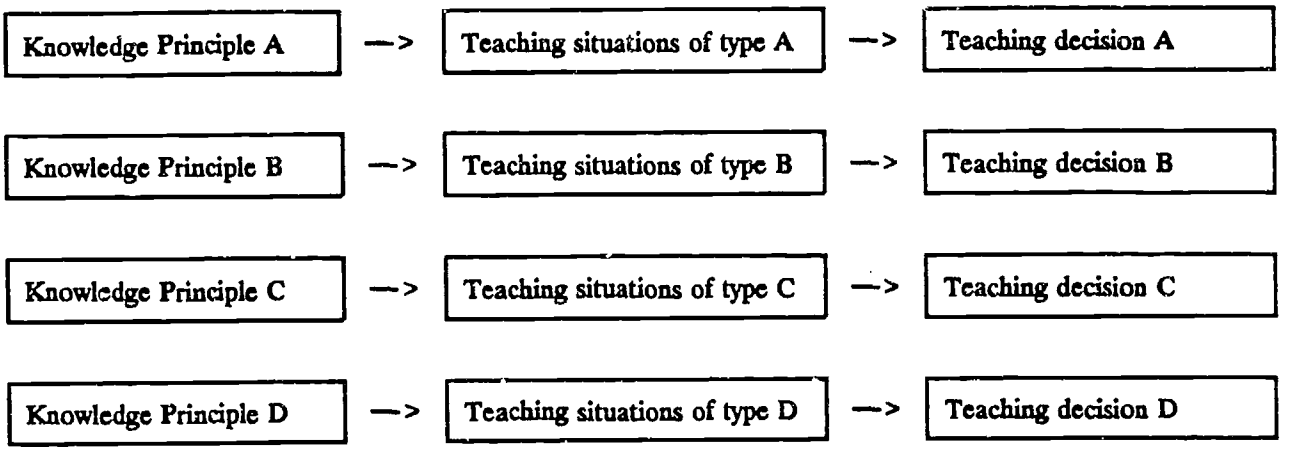
Finally, we devised an interview. The interview provided teachers with hypothetical teaching situations and asked them how they would respond to these. Since the situations were standardized, the interview had some of the advantages of the questionnaire. Since the responses were open-ended, though, it also had some of the advantages of the observation guide. Moreover, since the interview couched virtually all questions in the context of teaching situations, it offered an opportunity to see how the various aspects of expertise—knowledge, beliefs, attitudes—about teaching, learning, and subject matter, were drawn on to make teaching decisions.

Each of these three instruments was designed to address the focal points of our study: The questionnaire and interview are organized around the two main subjects, mathematics and writing, and each contains questions designed specifically to learn what teachers think about student heterogeneity and about students from particular cultural backgrounds. The observation guide directs researchers to observe the teaching of one or both of these two subjects, and to take special note of how teacher attend to different students in the classroom—to note, for instance, whether children get called on at random and whether there seems to be a pattern.

The bulk of this study guide is devoted to a detailed rendition of the specific contents of these instruments, with some discussion of the rationale for particular items. Since the interview posed a special burden, in that it represents an attempt to learn about the connections between various aspects of expertise and particular teaching decisions, we devote a special section to it here.

3. Where and how should we seek evidence of connections between exercise and practice?

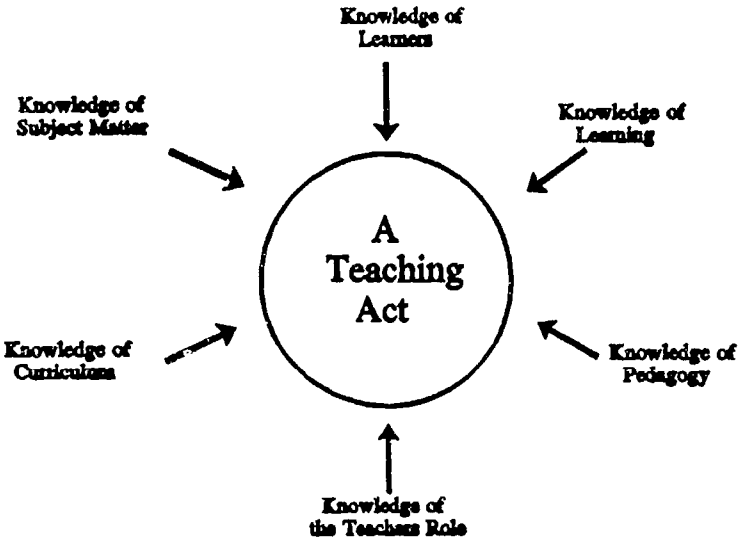
One of the most difficult tasks for researchers of teacher knowledge and teacher learning has been developing a reasonable model of the relationship between (a) knowledge about various aspects of teaching and (b) decisions about teaching in particular situations. At one extreme are those who expect teachers to apply specific rules, or research findings, directly to their teaching practices. Such a model sees teaching decisions following directly from a formally-derived knowledge base. This model might be portrayed as follows:



and so forth.

Critics of this model point out that it allows teachers few degrees of freedom, and that real decisions depend on the particular student(s) involved, the time of the year, the subject, and so forth. Indeed, at the other extreme is a model of teaching that is so situation-specific that teachers cannot possibly benefit from any general propositions. According to this view, there is no defensible content for teacher education, no purpose for research on teaching, no justifiable content on which teachers can be *assessed* for purposes of licensing or promoting them. Instead, teacher knowledge must necessarily evolve idiosyncratically, as each teacher learns to "read" instructional situations and develops a set of ad-hoc methods for responding to them.

Neither of these views seemed adequate. What we wanted was a way to recognize that teaching decisions are context-sensitive, but that they also are based on broader principles. Instead of either of the two models described above, we envisioned a relationship between knowledge and practice such that teaching decisions are informed by broad principles and beliefs, but these broad principles do not offer invariable rules for practice. Instead, the teacher brings together knowledge from several domains to interpret situations and to choose courses of action. Our model looks something like this:



Thus, in teaching, some decisions might be more influenced by the teachers' subject matter concerns while others might be more influenced by concerns about the learners, yet to some extent, knowledge in all these domains is relevant to all decisions.

We should also point out that teachers may hold several forms of expertise—knowledge, values, beliefs, dispositions, skills, etc.—in each domain. A teacher may know a great deal about a subject but dislike it, or may know very little about students from a particular cultural background but have strong commitments to assuring that all students learn. Teachers may have strong values regarding their own role as teachers, perceiving themselves to be authority figures, or mentors, or guides. Thus, teachers draw on all of these domains of knowledge as well as on all these forms of expertise when they make decisions about how to handle various teaching situations.

This model of teaching expertise, and of how it contributes to teaching practice, has a number of conceptual advantages over either of the first two models for research on teacher learning. In contrast to the first model, for instance, this model recognizes that teaching situations are multidimensional and rarely governed by a single principle. On the other hand, in contrast to the second model, this model does not abandon the notion that there are relevant bodies of knowledge and values on which teachers should depend. Yet this model also recognizes that teachers will make instructional decisions, regardless of what knowledge or

beliefs they have available to them. That is, if they know little about the curriculum but a lot about the learning, they will probably base their decision on their understanding of learning. If they know a lot about the subject matter but little about the learners, they will probably base their decision on their knowledge of the subject. Or if they perceive learners to be more important than subject matter, regardless of what they know about each, they may base their decision on what they understand about learners.

This model, then, recognizes that virtually every decision will be based on an interaction among many domains. And it tacitly argues that these bodies of knowledge are likely to improve teaching. It enables us to define the range of substantive ideas that we might expect to influence teaching decision, and to trace the extent of each influence. For instance, if we ask a teacher how and why she might handle a particular teaching situation, we can dissect her answer to see whether and how subject matter considerations influenced her decision, whether and how learner diversity influenced her answer, and so on. In this way, we hope our research can not only contribute to knowledge about how teachers learn, but also to knowledge about how they make pedagogical decisions.

But the model still leaves open the question of how one documents teacher knowledge, and in particular how one documents *changes* in teacher knowledge, beliefs, and values, using such a model. Our strategy was to present standardized situations to our teachers and teacher candidates, asking them on repeated occasions to tell us how they would handle these situations and why. We take changes in their responses over time to reflect things they have learned during the intervals. The next questions we had to address, then, were what kinds of teaching situations we should pose, and what particular substantive issues should we incorporate into these situations.

4. What kinds of teaching tasks are valid representations of teaching?

Ever since Charters' and Waples' study in the 1930s, researchers and teacher educators have tried to define teachers' work in a way that could contribute to a curriculum for teacher education. Often these efforts yield taxonomies of teachers' tasks. There are many ways in which such efforts can go awry. Teaching tasks can become so numerous and so fine grained that they lose significance; they can be defined as if they existed independent of each other or of any teaching purpose, and they can be defined as if the tasks themselves had no connection to knowledge, beliefs or values. Though our interest was not in contributing to a teacher education curriculum, it was no less daunting, for we wanted the hypothetical situations we

posed in our interview to be (a) relevant to teaching academic subjects to diverse learners, (b) representative of the kind of real situations teachers must face, and (c) structured in a way that would enable us to dissect the variety of ideas that contributed to our respondents' instructional decisions.

At a relatively broad level, the problems and tasks we presented to our teachers and teacher candidates do build on some of the commonly-used categories of teacher work. We ask them to evaluate some student work, for instance, and to evaluate some textbook selections. We ask them to plan a lesson, given a particular classroom situation. But since our interest is in their particular ability to do these things when teaching mathematics or writing to diverse learners, we do not, for instance, examine their ability to prepare a lesson plan that conforms to any particular idealized model of a lesson plan. Instead, we ask what they would do with a particular substantive issue and a particular group of students and why, and we examine their responses to see how considerations of subject matter, curriculum, learners, and teacher's role contribute to their decisions.

The teaching tasks we eventually defined are as follows:

- Responding to student difficulties with a particular concept
- Responding to student novel ideas regarding a particular concept
- Generating representations of concepts
- Responding to student questions
- Helping students learn concepts and procedures
- Planning a unit
- Evaluating student work

All of these tasks, we believe, are relevant to teaching both mathematics and writing to diverse learners. Moreover, all of them are tasks which all teachers must be able to do. Virtually every teacher will face situations in which students do not understand a particular concept, unit, or lesson, and the teacher must decide what to do next. Virtually every teacher will face situations in which students invent their own solutions to problems, and the teacher must find a way to respond to these novel ideas. And so forth. These tasks, then, are intuitively correct; they have a high face validity.

In the hypothetical scenarios we developed around these tasks, we endeavored to generate situations in which the teacher would need to take into account both subject matter and learners,

though the particular aspects of subject matter and learners which we drew on varied from situation to situation. This decision to particularize teaching tasks, though—to place them in particular contexts—introduced two other questions: First, what substantive content should be draw on when creating a subject matter context, and second, how can we portray the context of learners without biasing the responses?

5. What criteria should we use to sample teachers' subject matter knowledge?

Although one of our interests is in teachers' knowledge of the subjects of mathematics and writing, we were not in a position to develop thorough, complete portraits of teachers' subject matter knowledge. Such portraits were beyond the scope of our research agenda and inappropriate to our purposes for several reasons. We did not wish to present ourselves as examiners to our study participants. We had, after all, already argued that we expected teachers to change in a number of different directions and that our interest was not in judging the correctness of these changes but rather in trying to find connections between the nature of these changes and the kind of experiences they had encountered as they were learning to teach. It would seem inconsistent to suddenly require them to succumb to an examination of their subject matter knowledge. Second, we believe that teaching decisions might be as influenced by teachers' *beliefs* about particular subjects and attitudes toward subjects as by their knowledge of these subjects. Thus it was not clear to us the extent to which we wanted to concentrate our effort on subject matter knowledge per se.

Yet, on the other hand, how could we say anything reasonable or valid about subject matter knowledge without a full examination? Our solution to this dilemma was to identify, within each of our subjects, a limited set of substantive concepts that met a number of criteria. First, we wanted substance that was central to the curriculum and that appeared throughout the entire K-12 curriculum. That is, we wanted content that virtually all teachers would have to attend to. Second, we wanted concepts that were known to give students difficulty; that is, that were difficult to teach. Third, we wanted substantive ideas that were considered either central or very important to the discipline. In sum, even though we recognized that we could not tap the full breadth of teacher knowledge, even within these two subjects, we did want to assure that the subject matter knowledge we examined was relevant to the discipline and relevant to teaching it.

On the following page, we present a table that shows the substantive ideas we chose as contexts for each of the hypothetical situations we presented to our respondents. In the next section, we discuss the problem of examining teachers ideas about learner diversity.

6. How should we pose questions about learner diversity?

Studying attitudes and beliefs about learner diversity is difficult for a number of reasons. First, there is little agreement among teacher educators about what teachers should know or believe about student diversity. The variety of viewpoints available to us benefits our research, for it enables us to see whether programs which differ in their approach to this issue yield differences in teachers. On the other hand, this same variety introduces problems in terms of defining what we should be looking for, and in terms of what constitutes evidence of a particular view.

Moreover, the issue of student diversity is one in which we can expect teachers to have gathered numerous views from a number of places aside from formal teacher education programs, and we probably could expect these various views to be as influential or more influential than formal knowledge per se. Learner diversity has received so much public attention over the past two decades that teachers and teacher candidates are likely to realize that certain viewpoints are more socially acceptable than others. Thus, the probability is that their espoused views will differ from their real views. Finally, it is not clear how teachers' views in this area might affect their practice. What they say on questionnaires and in interviews may have little to do with how they behave in real classroom situations.

All of these problems make it difficult to document teachers' knowledge and beliefs about learner diversity. And in fact, we altered our attempts over time, so that we have fewer longitudinal data on this issue than we have on other issues. We decided early on that it would be more important in the long run to improve our data collection methods, even if this meant being unable to track changes over time.

We tried several approaches to documenting learner diversity. First, we included, in the questionnaire, questions about tracking and grouping as a way of responding to student heterogeneity—questions such as, "Teachers should avoid grouping students by ability or level of performance," and "Required high school courses should have separate classes for low-achieving and high-achieving students." These questions, we reasoned, were relatively less socially salient, and we expected that we could get relatively straight-forward responses to them.

Subject Matter Contexts Selected for Each Teaching Task

Teaching tasks:	Mathematical Issue	Writing Issue
Responding to student difficulties with a particular concept	Place value	Representing possession in writing: use of apostrophes
Responding to novel student solutions to a problem	Relationship between perimeter and area, nature of mathematical proof	Representing quoted material (elementary) Citing sources (secondary)
Generating representations of concepts	Division by fractions	NA
Responding to student questions	Division by zero (secondary only)	Source of language conventions: pronoun/verb agreement
Planning a unit	Subtraction with regrouping (elementary) Slope (secondary)	Planning for writing, recognition of the writing process
Evaluating student work	Subtraction with regrouping (elementary) Slope (secondary)	Student essay, student story

We also followed these questions up in a later interview, asking respondents if they recalled how they answered these questions and asking them to discuss the rationale for their answers. This gave us not only an opportunity to learn more about teachers' rationales for their views on these issues, but also to compare responses across the two data collection formats of questionnaire and interview. We also tried, in the interview, to learn their views about particular populations of students by asking, again in a relatively direct way, whether they thought particular students should be responded to differently than other students.

Our second approach was to try to incorporate specific aspects of diversity into the hypothetical teaching situations we had developed for mathematics and writing. For instance, in our first interview, we tried a problem about helping students get started writing:

> Imagine you have just taken a new job teaching fifth grade students in an inner city school. Early in the school year you ask your students to write autobiographies. Your main goal for this assignment is to get your students comfortable with writing. One student is not writing. When you ask him why, he says he has nothing to write. How would you respond to this student?

Several probes follow this scenario and, then, this question:

> Some teachers try one or two things with a student and if those don't work they change their goals for the student. If your idea didn't work, might you change your goal for this student? (how, why, etc.)

Our hope was that, if respondents perceived the inner-city setting as relevant, they would discuss the relevance of this setting in their responses. Almost no one did, and we cannot be sure whether they did not notice this cue, whether they did not believe it relevant, or whether they believed it relevant but simply did not articulate how it was relevant.

We also tried to build references to particular dimensions of learner diversity into our probes about other scenarios. For instance, after asking a respondent how he or she would respond to a particular situation, we might then ask, "suppose this occurred at a different grade level?" or "suppose the student was not a native English speaker?". Unfortunately, any questions that directly asked, "what would you do if a student were Black (or Hispanic, or any other categorical group)" usually yielded socially appropriate statements about the importance

of treating all students equally, and we could not be sure these statements indicated their real disposition.

Our third attempt to disclose respondent's views about learner diversity was through scenarios developed specifically to address this issue. One scenario describes a classroom with a variety of students and describes how the teacher responds to some of these students. We then ask our interviewees how well this teacher is responding to the heterogeneity of her students. Another scenario addresses our second issue about learners, the particular populations who have traditionally not been served well in our schools. We purposely chose a population about whom relatively less public attention has been placed—Native Americans rather than Hispanics or Blacks—in the hope that we might reduce our chances of getting socially-dictated responses. These scenarios provided our richest source of data regarding respondent's views about diversity. We suspect this is because the particularity of the scenarios inhibits the socially-desirable admonition to treat all children equally.

The pages that follow describe each of our three data collection instruments, beginning with the interview, since that is the most complicated conceptually, moving then to the observation and finally to the questionnaire. Our method for presenting the instruments varies. Since most readers are familiar with questionnaire design and construction, we spend much less space on our rationale. Instead, we present the questionnaire in its entirety, along with a "conceptual map"—a digest that summarizes the item numbers that tap each of several dimensions of teacher views. On the other hand, since the interview scenarios each tap several dimensions of expertise simultaneously, we present interview items one at a time and accompany each item with an outline of the dimensions of expertise that can be tapped through this question.

THE INTERVIEW

Interviews incorporate some of the advantages of questionnaires, such as standardization across respondents, as well as some of the advantages of observations—being able to explore the unique way each teacher integrates different kinds of knowledge and skill together, for instance. An interview can present respondents with carefully selected teaching situations or tasks and ask questions to find out both what the teachers think and how they think. Teachers' reasoning and justification for their interpretations and plans can also be explored in an interview. However, while we can simulate teaching situations, the contexts remain hypothetical. For example, in describing how she would teach sonnets to a high school English class, a prospective teacher reveals what she knows and believes, as well as what she cares about. The researcher does not know whether she is likely to do what she describes or how competently she could carry off her plan if she did. Here the observational data complements what is learned from the interviews.

Our interview questions were designed around common tasks of teaching. These tasks are ones that all teachers, whatever their view of teaching, perform, although the way in which they deal with these tasks varies as a function of their knowledge, skill, and view of teaching. The tasks include responding to unanticipated student questions or novel ideas, examining students' written work, evaluating curriculum materials, and planning approaches to teaching. Each question is cast in the form of a scenario. After describing the scenario, interviewers ask respondents what they would do or say if this situation came up in their own teaching and why.

Based on patterns in teachers' responses to the interview questions, specific follow-up questions were designed to delve further into what respondents said. These probes are critical to gathering interpretable data. In addition, however, a general list of probes was developed to facilitate researchers' efforts to follow and record as closely as possible what respondents think. This list of general probes is included below.

Each section of the interview is presented below along with a discussion of what we think we learned from interviewees' responses. These discussions are intended to be useful in three ways. First, they can help readers understand the questions in order to use the interview more effectively themselves. Second, they can facilitate data analysis, by making the dimensions of the questions plainer. Third, they can enable researchers to adapt these questions or develop their own new questions, building on these underlying theoretical dimensions.

Section A: General Teaching

This section of the interview comes first, before the specific mathematics and writing scenarios. It was designed to elicit teachers' and prospective teachers' general orientations to teaching and learning to teach, their personal and academic histories, and their views on some general issues about teaching and learning mathematics and writing.

Section A serves several purposes. It establishes a relationship between the interviewer and the respondent, establishing a context for the interview, and it generates some data regarding respondents' views about mathematics, writing, teaching, and diverse learners.

Some questions are not intended to be repeated longitudinally—why the respondent chose to go into teaching, for example. Others are designed to be repeated.

Section A: General

Personal History and Orientations: Baseline Questions

A1. **I'd like to start out by learning a little about what brings you to teaching. When did you first start thinking you might want to te h? Why are you interested in teaching?**

[Probe their own intellectual interests and the perspective they hold as a student. For instance, many of the elementary candidates mention their love of reading. Try also to discover what the person especially enjoys about school or about learning.]

A3. **You're planning to teach elementary school, is that right? When you think back to your own experience in elementary school, what stands out to you?**

Probe for specificity: What do you mean? Can you give me an example of that? Is there anything else you remember?

If the teacher candidate does not mention one of the following: You haven't mentioned (much about) _____. Do you remember anything in particular about that?"

- o what you learned
- o your teachers
- o how you felt about different subjects

A4. **Our research is focusing specifically on two subjects - mathematics and writing, so I'm interested in your own past experience with these subjects.**

a. **What do you remember about learning math in elementary school?**

What about writing? What do you remember about writing in elementary school?

b. **What about the high school level?**

What do you remember about learning math in high school?

What about writing in high school? What do you remember about writing in high school?

If person reports having stopped taking mathematics sometime in high school, probe to find out why and what response s/he got from others.

Probe also how the student's parents (mother, father separately) affected his/her interest in and/or participation in mathematics.

c. **What about college?**

What stands out about writing in college?

Has your writing changed in college?

Have you taken any mathematics in college?

If yes: What stands out to you about math in college?

If no: Why not?

A5. **In your own life, what kinds of writing do you do, and where?**

Discussion:

Questions A1 - A5 serve in part to get acquainted with the interviewee and to put the interviewee at ease. They also, however, provide some useful information about the interviewee. Sometimes comments made in response to these opening questions can provide a context for interpreting comments made later on in the interview.

These questions are also likely to elicit interviewees' emotional responses to schools and to school subjects. Questions A3 - A5, in particular, provide such an opportunity. While it is reasonable to expect elementary teachers or teacher candidates to have different feelings about the many subjects they must teach, it is also reasonable to expect that these feelings will be conveyed to students. Often when we think about the importance of teachers' affect, we think of the benefits to students when teachers are enthusiastic about the subjects teach. But negative feelings toward school subjects can also be important if teachers' affective responses to the subjects become part of what students learn about these subjects. Notice that even in these opening questions, we probe specifically for views of mathematics and writing, the two subjects on which the balance of the interview concentrates.

Given evidence regarding math anxiety among women, we were especially interested in evidence of math anxiety among elementary teachers or teacher candidates, and found that we could categorize interviewee responses as ranging from "highly anxious" through "matter of fact" to "passionate" in their attitudes toward the subject of mathematics.

We also found that it was important, when examining interviewees' comments about school subjects, to separate their attitudes toward the subject from their cognitive understanding

of the subject. Occasionally, an interviewee will demonstrate serious misunderstanding of a substantive issue while at the same time exuding confidence in his or her mathematical understanding. Or, conversely, someone might convey high anxiety over his or her ability within a subject, yet seem, in fact, to have a good understanding that subject.

Personal History and Orientations: Questions for Later Administration

A1. **It's been several months since we last talked and I know you've been busy. I am interested in hearing about what you have been thinking about and doing.**

Think back to a time recently – in the last few weeks or past few months –when you have done something, or something has happened to you that has been particularly important to you in thinking about your teaching?

Tell me about this.
Anything else?

Where were you?

When did this happen?

Why/How was it important?
(What difference did this make to you?)

(Note: We write to people before their interviews, letting them know we will ask this question [A1], so that they have a chance to reflect on this before the interview. We would like to avoid "off the top of my head" responses if possible.)

A2. **As you think about becoming a teacher, are there some things you would like to know more about or be able to do better before you have your own classroom? How or where do you think you can learn each of these?**

If the person doesn't mention subject matter say: Some people mention knowledge of subject matter. Do you feel there is anything else you need to know about the subject(s) you will teach?

If yes: How or where do you think you can learn that?

If the person doesn't mention children: Some people mention students. Is there anything else you would like to know about them?

If yes: How or where do you think you can learn that?

If the person doesn't mention classroom management or discipline: Discipline is an area of concern to some beginning teachers. Is this something you feel you will need to focus on? How do you think you'll handle this in your classroom?

If the person says s/he just needs experience: What do you hope to learn from experience (or "just getting out there and doing it")?

If the person does not mention experience: Some people say they want to have experience teaching. How do you feel about this?

If yes: What do you hope to learn from experience?

Discussion:

The opening questions used for second, third, and fourth administrations of this interview are intended to re-acquaint the interviewer and the interviewee and to re-orient the interviewee to the study. But in addition, these questions offer an opportunity to learn the interviewee's views about learning to teach and about the knowledge needed for teaching. We chose, for Question A1, to give our interviewees some advance notice to assure that they could generate a critical incident for discussion.

When responding to A1 interviewees reveal their assumptions about what is important in teaching both by what they choose to talk about and by what they do not talk about. There are several reasons for caring what teachers and teacher candidates think about learning to teach. If they believe, for instance, that teaching is only learned through experience, they may be less inclined to attend closely to ideas offered in their courses. If they believe there are no general principles of teaching, that it is entirely idiosyncratic, a similar response to formal instruction could occur.

In Question A2, we provide opportunities for interviewees to discuss what they feel they still need to learn in each of several domains of knowledge: subject matter, children, classroom management or discipline. We also examine the interviewee's views about learning from experience.

Views about the Nature of Mathematics and Writing

A6. Now I'd like you to think of someone you know who's good at mathematics. . . . Who is it? Why do you think of _____ as good at math? What does he/she do?

(Note: the issue here is what it means to be "good at math".)

What's your hunch about why this person is good at math?

(Note: the issue here is what the source of success in mathematics is.)

Probe for specificity: What do you mean? Can you give me an example? What does x have to do with being good at mathematics?

A7. What about the flip side of the coin--do you know anyone whom you consider to be not very good at mathematics?

(Note: the issue here is what means to be "not good at math.")

Why do you think of _____ as not very good at math?

Do you have any ideas about why _____ in not very good at math?

(Note: Many people identify themselves for this question. Ask, "What's the explanation you give yourself about why you aren't so good at math?"

A8. Do you know anyone whom you consider to be good at writing?...Who is it? Why do you consider _____ good at writing?

(Note: The issue here is what it means to be "good at writing.")

A9. Do you have a favorite subject or perhaps a favorite area within a particular subject? What do you enjoy about it?

A10. Are there some things in mathematics or about mathematics that you especially like/enjoy? Are there some things in mathematics or about mathematics that you especially dislike?

A11. Is there something about writing that you especially enjoy? Is there something you especially dislike? In your own life, what kinds of writing do you do, and where?

Discussion:

Questions A6 through A11 offer an opportunity to learn what interviewees think about the two subjects of mathematics and writing and how they think these subjects are learned. We have found these items to be particularly fruitful in revealing tacit assumptions about the nature of subject matter knowledge as well as about learning these subjects.

Nature of the subjects

Of particular interest to us are interviewees' assumptions about what subject matter is—that is, do school subjects consist of bodies of clearly-defined statements that can be acquired through memorization, or do they consist of ways of thinking and ways of approaching issues that must be learned through practice in the methods and mores of the subject?

There is now a rather substantial body of research evidence indicating that teachers routinely adapt state and local policies and curriculum materials according to their own sense of what is most important to accomplish. We assume that these numerous local curriculum decisions reflect teachers' own understanding of the subjects they are teaching and their own sense of what should be taught about these subjects. Yet the nature of knowledge in general, and the nature of school subjects in particular, are not topics that are often explicitly discussed. We could not expect to ask our interviewees directly what they think mathematics is all about, or what writing consist of as a school subject. Yet as a proxy, we find that interviewees' responses to these questions provide a useful indicator of their tacitly-held assumptions about these subjects.

When interviewees describe their reasons for defining someone as good or bad at mathematics or good or bad at writing, they reveal much of their thinking about aspects of these subjects that they think are important. For a person who is "good at writing," for instance, one interviewee may nominate someone who is creative while another may nominate someone who has neat handwriting or knows all the rules of grammar and punctuation.

These questions reveal the dominant views regarding the nature of mathematics. Some interviewees perceive mathematics to be a set of rules or formulas that must be applied, so that those who are good at mathematics are those who have memorized all the relevant rules. Other interviewees conceive of mathematics as a set of procedures and concepts that do have meaning; that is, they are not arbitrary pieces that must be memorized, but instead can be understood. Finally, some interviewees perceive mathematics as a domain of inquiry that involves invention, argument, and application.

In writing, the criteria interviewees use to describe someone as good or bad at writing include references to (a) texts their nominee produces (e.g., clarity, tone, punctuation or neatness), (b) properties of the individual (e.g., uninhibited, creative) or (c) processes used by the individual to produce text (time spent, adherence to the writing process).

Learning these subjects

Interviewees also indicate, in their discussions of people who are good and bad in these two subjects, how they think one becomes good or bad in this subject. We ask them to hypothesize about how this person came to be good or bad in the subject. In their comments, interviewees mention numerous contributions to learning, ranging from inherited capabilities to hard work and including assistance from teachers or parents. From our interview data, we have identified four distinct sources for subject matter accomplishments (or for lack of accomplishment): innate ability, time spent working with the subject, perseverance or confidence in one's ability to succeed with the material (or avoidance or lack of confidence), and good or bad teaching. Often interviewees will mention more than one of these, but even when this occurs, one source is generally given more prominence than the others.

Organizing Curriculum: "The Big Ideas"

A12. For this question, I'd like you to pick a grade you can imagine teaching. . . . What grade is that? Now early in the fall, the principal of your school meets with each teacher to discuss the teacher's goals for their students.

When you meet with the principal, what would you say in describing the most important things you'd be trying to accomplish across the year with your _____grade pupils?

A13. What would you say about things you'd be trying to accomplish in math with your _____grade pupils?

A14. What would you say about the things you'd be trying to accomplish in writing with your _____grade pupils?

If person refers to "problem solving" in math, "the process approach" in writing, or other fashionable terms, probe for what they mean by such terms: e.g., You just used the term _____ which is something many people are talking about these days. What do you mean when you use that term?

If person says s/he doesn't know enough about the school curriculum for that grade, ask: Are there any important ideas that come to mind around that grade?" and "Are there any things you'd say regardless of the grade you were teaching?"

A15. What would you be trying to accomplish in writing with your _____ grade pupils?

Why are these the most important things to accomplish?

If person refers to "the writing process" or other fashionable terms, probe for what they mean: e.g., You just used the term _____ which is something many people are talking about these days. What do you mean when you use that term?

In teaching writing to _____ graders, what kinds of writing would you work on?

Are there any kinds of writing you would not work on with _____ graders? Why?

How do these differ from the kinds of writing you would work on?

If person says s/he doesn't know enough about the school curriculum for that grade, ask: Are there any important ideas that come to mind around that grade?" and "Are there any things you'd say regardless of the grade you were teaching?"

Discussion:

Like our questions about someone who is good or bad at mathematics or writing, questions A12 to A15 are designed to learn about interviewees' understandings of the school subject(s) they teach, or plan to teach, and how they decide what is important to teach. Whereas the earlier questions examined the nature of subject matter knowledge in relation to how it is acquired and demonstrated in a learner, these questions examine perceptions of the nature of knowledge as it relates to teaching. Responses to these questions indicate not only what interviewees assume about the nature of their school subjects, and what is important to teach about them, but also where authority for making such decisions lies.

What is Important about a Subject

Teachers' views about what is important in a school subject can have a significant influence on their teaching, regardless of whether or how their school tries to regulate the curriculum. Whether and how well a teacher pursues any substantive topic will depend at least in part on the teachers' understanding of the importance of the topic.

Teachers who have a clear sense of their long-term goal will also be more able to adapt their daily work to unanticipated events and will be able to follow up on student interests without losing sight of their ultimate goals. We had hoped, through this question, to get a sense for the extent to which our interviewees could articulate the big ideas of these subjects that they hoped students would learn. In fact, few interviewees responded by identifying big ideas. Instead, some interviewees identified affective goals or broad cognitive goals such as enhanced problem-solving ability, (e.g., students should become comfortable with writing or students should improve in their ability to solve mathematical problems), while others defined specific content goals (e.g., students should be able to write complete sentences by the end of second grade, or students should be able to compute with fractions by the end of fifth grade).

Authority for Curricular Decisions

With respect to who has the authority to make curricular decisions, some interviewees have no difficulty stating what they would want to accomplish, while others are more inclined to defer to the school curriculum or textbooks. Many of our interviewees seemed to depend on some other authority to determine what their goals should be, often stating a goal of preparing students for the next grade for instance, or covering whatever was in the curriculum. That is, first-grade teachers wanted to prepare students for second grade, fourth-grade teachers wanted

to prepare students for fifth grade, ninth-grade teachers wanted to prepare students for tenth grade, and twelfth grade teachers wanted to prepare students for college. Very few interviewees had much sense of anything inherently valuable that they would want to assure that their students gained from their teaching.

Responding to Student Diversity

A16. Suppose you are teaching a class of 28 students, 16 of whom are boys. You find that the boys tend to talk more in class--both on and off task--than the girls. How would you think about this situation?

Would you do anything about this'?

If yes: What? Why is that what you would do?
If no: Why not?

What led you to this idea?

Suppose this only happened during writing time? How would you respond? Why?

Suppose this only happened during math time? How would you respond? Why?

Discussion:

In the first version of the interview, we asked our interviewees what sorts of individual differences were important for teachers to take into account in their teaching, and then probed for more information about each kind of difference students nominated. But in retrospect, we worried that these questions were not sufficiently concrete, that they encouraged interviewees to recite platitudes regarding the treatment of diverse students in classrooms. We wondered the extent to which their proclaimed views reflected their likely practices.

This question, and the two that follow, represent efforts to place issues of student diversity in more specific contexts to see if we could learn more about what our interviewees might really do or really think about these issues.

Question A16 addresses gender differences. It gives interviewees the opportunity to say whether they would expect to see gender differences in their own classrooms and an opportunity to say how they would handle such differences. The difference between interviewee responses to these questions and the first questions justifies our change in approach. Whereas interviewees

would be quick to argue, when asked which individual differences teachers should attend to, that gender differences should be irrelevant, they are equally quick when responding to this scenario to *assume* the boys' excessive talking is always off task despite our statement that the boys talked more both off-task *and* on-task. Similarly, they rarely construe the problem as one of encouraging more on-task comments from girls, but instead define it as one of suppressing the comments offered by the boys.

30

A17. Imagine that you have been hired midway through the school year to take over for a teacher who is going on maternity leave. During the first day, you notice a group of Native American students sitting together at the back of the class, while white and Asian-American students are sitting in front. The Native American students don't raise their hands to answer questions or to participate in discussions. Later, when you mention this to colleagues in the teachers' lounge, they tell you that the Native Americans are naturally shy and that asking them questions embarrasses them so it's best not to call on them.

What do you think of the teachers' explanation of the Native American students' behavior?

How would you deal with the Native American students in this class?

If the person does not mention dealing with the seating arrangement ask: Would you do anything about the seating arrangements? What would you do? Why?

If the person does not mention Native American students' participation in class, ask: Would you do anything to involve Native American students in classroom activities? What? Why?

Discussion:

Question A17 was designed to help us learn interviewees' views about majority and minority groups of students. We presented them with a relatively common situation in schools, one in which one group has become segregated and marginalized, through no apparent action on the teacher's part. Interviewees' responses to this scenario indicate both how they view their responsibility for dealing with such situations and how they interpret the situation itself

The problem we pose is one that has been identified in research literature and had been commented on by teachers with whom we consulted. Research also indicates that teachers tend to pay less attention to (that is, they ask fewer questions of, make less eye contact with, invite fewer comments from) students on the margins of their classrooms. While we don't expect our interviewees to be aware of this research, we are interested in what they think about situations such as this and what they think they ought to do about it.

Two issues are especially salient in this question. One is whether interviewees accept the ethnic stereotype offered by the other teacher; the second is what they would do in response to the situation we have depicted.

Response to Stereotyping

With respect to the stereotype, our interviewees ranged from those who accepted the other teachers' explanation without question through those who accepted it as a reasonable hypothesis but wanted to seek other evidence, to those who explicitly state that they reject or disapprove of the stereotype.

Views of the Teacher's Role:

With respect to the interviewee's likely response to this situation, we found numerous responses: Change the seating arrangement, devise small group projects, call on or otherwise encourage participation from the Native Americans, talk to the Native Americans about participating, talk to parents or others in the community, arrange some sort of special event that would encourage participation from Native Americans, or explicitly state that they would do nothing to alter the situation.

In retrospect, if we were to further revise this question, we would put the problem in the context of a specific subject matter. The strategies our interviewees chose were all generic strategies; we could have learned more if they had the opportunity to say how they might adapt their approach to the subject matter.

Pedagogical Implications of Student Diversity

A18. The third example is rather long. I'd like to let you read it first, and then we can talk about it.

[Give respondent the attached scenario]

Scenario

Mrs. Jones teaches a large first grade class. She tries to find ways to individualize while still maintaining order. Below are descriptions of some of Mrs. Jones' students, along with examples of how she works with them.

Vikki is a shy Vietnamese girl. She was recently adopted and her English still sounds awkward. Her parents buy her many dresses and put ribbons in her long hair every day. She is very cooperative in the classroom, but tends not to play with the other children. Today, Mrs. Jones has Vikki matching geometric shapes. she moves past Vikki's desk regularly, often patting her on the head or back as she passes, and sometimes stopping to present a new, more challenging shape for Vikki to try to match.

Brian, a black child, just joined the class this month. His father is a corporate executive and moves frequently. As soon as Brian enrolled in school, his mother volunteered to work in Mrs. Jones' classroom each week. Brian is very competitive. He has joined the junior basketball, soccer and softball leagues, and has started swimming lessons. At his mother's request, Mrs. Jones moved James away from Brian's table so that the two boys would not fight. Today Brian is working in a self-contained learning center. He is looking at a picture book and using a tape recorder to dictate a story to go with the pictures. Mrs. Jones will play the tape to the rest of the class after recess.

James, another black student, is so active he sometimes disrupts the other children. His mother never graduated from high school and never married. She relies on her family and on welfare for support. James hasn't as many nice clothes as some other children and sometimes he expresses resentment toward other students in the class. Mrs. Jones has moved James several times because he was disrupting other children. Today, Mrs. Jones has James practicing writing the letters "m" and "n." She tries to keep him on task by frequent comments. Today, her comments included these:

You've made a lot of progress today, James. Let's see how many more letters you can do before recess.

I like the way James is working quietly today.

These letters look much more neat than they did last week.

Don't lean back in your chair, James.

A 18 (continued)

How do you think this teacher is responding to differences among her students?

Now suppose you were in her situation. Would you try to do the same things she is doing?

Are there things she does that you would not do? Why?

Are there other things you would do that she has not done? Why?

Discussion:

The problem posed in Question A18 complements the problems raised above. Whereas the former problems presented interviewees with identifiable groups of students (boys and girls, caucasians and Native Americans) and asked how they would handle behavioral differences between the groups, this question presents a more general problem of heterogeneity in classrooms. Mrs. Jones has numerous students in her classroom and they differ in many ways. Mrs. Jones' way of handling her heterogeneous students is to provide different academic tasks for different students. By asking interviewees to respond to Mrs. Jones' solution to the problem of heterogeneity, we learn the interviewees' own views about how to solve this perennial teaching challenge.

Broadly speaking, there are two ways of responding to classroom heterogeneity. One way is to consider the students' social or emotional needs; the other is to consider the students' cognitive needs. Given our interest in teaching academic subjects, we were particularly interested in whether interviewees attended at all to the academic tasks that Mrs. Jones provided her students. Moreover, Mrs. Jones' response to these students yields substantially different opportunities to learn language arts. Whereas Brian learns that language can be used to communicate and to share ideas with others, James has no opportunity to learn to communicate with language or to see what value written language may have to him. And Vikki's opportunities to learn English are virtually nil. As a result, she will probably continue to be shy and non-verbal.

Pushing one step further, we can distinguish, even within the academic domain, between teacher practices that *succumb* to differences in student capabilities and those intended to *alter* those capabilities. Mrs. Jones succumbs to the differences she finds in her students and makes

substantially different academic demands on her various students. For instance, rather than giving her non-English-speaking student, Vikki, a task that would promote language development, she succumbs to Vikki's language limitation and gives Vikki a non-verbal task. Similarly, she yields to self-initiating Brian by giving him a task that encourages this disposition. Brian can use a tape recorder to develop his own story and will be given special attention in class when he plays it back for the other students. Finally, Mrs. Jones reinforces James' lack of interest in school by asking him to do a more repetitive and less intellectually-engaging task, copying letters.

Our interviewees fell into three relatively distinct groups with respect to what they noticed about the academic work Mrs. Jones assigned her students. One group did not notice, or did not choose to comment on, students' academic tasks. A second group noticed that the tasks were different but did not comment on these differences or appear to consider them to be significant. The third group noticed these differences and explicitly stated that these different tasks would lead to differences in what students learned. Within this third group, some interviewees mentioned differences in what Mrs. Jones' students would learn about the subject while others mentioned differences in what students would learn about themselves as learners (e.g., they may point out that Brian is learning self-reliance whereas James is learning that learning is passive).

In fact, few of our respondents attended to the academic tasks in this classroom, and so were interested in what they did attend to instead. Thus a second issue that we were able to code in these responses had to do with the criteria interviewees used to evaluate Mrs. Jones' teaching. Specific actions which interviewees often approved or disapproved included Mrs. Jones' use of praise and reinforcement (too little or too much), her use of individualized instruction (they approved of individualizing or they disapproved of Mrs. Jones' reliance on stereotypes), the specific academic tasks students have been assigned (they particularly approved or disapproved of the shape-matching, the story dictation or the letter writing practice) and Mrs. Jones' responsiveness to a parent request (approved as a good id a, in general, disapproved because it yielded special treatment of one student). In addition, some students explicitly disapproved of Mrs. Jones' classroom because she offered no opportunities for group work or for social interaction.

Section B: Teaching Elementary and Secondary Mathematics

Section B of our interview presents respondents with a number of hypothetical teaching situations that relate specifically to teaching mathematics. In this study guide, we present each scenario with the full set of probes that go with it, and then discuss the dimensions of knowledge, beliefs and so forth that may be revealed in responses.

The situations we present require interviewees to draw on different combinations of knowledge domains and on different configurations of knowledge domains.

Responding to Student Difficulties: Place Value (Elementary and Secondary)

B1. Some sixth grade teachers noticed that several of their students were making the same mistake in multiplying large numbers. In trying to calculate

```
  123
x 645
```

the students seemed to be forgetting to "move the numbers" (i.e., the partial products) over on each line. They were doing this:

```
  123
x 645
  615
  492
  738
 1845
```

instead of this:

```
  123
x 645
  615
 492
738
79335
```

While these teachers agreed that this was a problem, they did not agree on what to do about it. What would you do if you were teaching sixth grade (or eighth, for secondary candidates) and you noticed that several of your students were doing this?

If person says, "I'd show them to put zeroes in," ask: What if some student asks, "How can we just add zeroes like that—it changes the numbers!"

If person says, "I'd tell them to just put x's in to hold the places lined up," ask: Where did you get that idea?

If person says, "I'd show them to move the numbers over," ask: What if some student asks, "Why do we have to move the numbers over? I thought we were always supposed to line the numbers up in math."

Discussion:

A. **What is Revealed about Subject Matter.** The algorithm for multiplying large numbers is derived from the process of decomposing numbers into "expanded form" and multiplying the number in parts. To understand this, one must understand decimal numerals as representations of numbers in terms of hundreds, tens, and ones. In this example, 123 x 645, for instance, first one multiplies 5 x 123:

```
 123
x  5
 615
```

then 40 x 123:

```
 123
x  40
4920
```

and then 600 x 123:

```
 123
x  600
73800
```

In the final step, one adds the results of these three products. In effect, one is putting the "parts" back together: i.e., 645 x 123 = (600 x 123) + (40 x 123) + (5 x 123).

Often, people have learned to carry out this algorithm without writing down the zeros, so that their computation looks like this:

```
 123
x  645
 615
 492
 738
```

Consequently, many people can perform the multiplication without understanding why it works or seeing the relationship of our decimal place value system to this algorithm.

This procedure, which depends conceptually on place value and the distributive property, is a useful site for examining how people understand place value and the decimal numeration system. We can learn about our respondents' understanding through what they think there is for the errant pupils in the scenario to *know*. Do they think that these pupils need to be told to "line their numbers up"? Or do the pupils need to understand that they are actually multiplying by 40, not by 4, in the second step? We have developed some probes to help us explore how the teachers understand this. For example, if a teacher candidate says, "I'd show them to put zeros in," we probe by responding, "What if some student asks, 'How can we just add zeros like that—it changes the numbers, like from 492 to 4,920!!'" This probe helps us learn more about their understanding of place value and about the role of the number 0 in our numeration system.

In analyzing this item, we have found that some people may use the *language* of "places" to mean lining up numbers in the right places. Many people echo the person who said that doing this "keeps you from getting mixed up and gets you the right answer." Many people do not explicitly confront the fact that the 4 is really 40. For example, one person explained that she would have the pupils "physically put a 0 down—0 doesn't add anything, it's *empty*." Many people talk about "zero as a placeholder."

Our analysis of people's subject matter understanding is not an all-or-nothing matter. We would not infer from these kinds of responses that these people do not know place value or what is going on with the multiplication algorithm. Yet the question does allow us to learn the degree to which their understanding of the concepts and procedures is explicit: the extent to which they are able to surface and articulate the underlying ideas. Tracking changes in people's ways of talking about place value (which is an example of mathematical knowledge that is submerged or tacit for many adults), we will learn about teachers' learning and understanding of subject matter.

B. **What is Revealed about Teaching and Learning the Subject Matter:** Our conceptual framework assumes that teachers' understanding of the subject matter interacts with their knowledge and beliefs about teaching and learning. Perhaps they tell kids to "line up the numbers" or "put down zeros as placeholders" because they believe that this is the way kids will learn the material best. Perhaps they think kids should acquire algorithms first, and conceptual understanding later. There are several other issues about teaching and learning, listed below, that might influence what people would do in this scenario.

1. **Curriculum**

When is multiplication taught? Knowing when children usually learn the multiplication algorithm is part of interpreting this scenario. For example, in the secondary interview, we identify the context as eighth grade. This is about four years after the algorithm is usually taught, and knowing this affected the responses of many of the experienced teachers whom we have interviewed. Some prospective teachers know and consider this, some do not.

2. **Teaching and Learning**

Ideas about how pupils learn algorithms best. Teachers' responses to this scenario are often influenced by their ideas about how pupils learn mathematical procedures most effectively, which in turn are shaped by their ideas about what there is to learn. Do pupils need drill on this procedure so that they know it cold and will be unlikely to forget it again? Do they need a clear explanation of the procedure, accompanied by mnemonics to help them remember, followed by practice? Or perhaps they need an opportunity to explore why the procedure works.

Ideas about how to help students who have not learned something. Teachers' assumptions about what teachers should do when kids have apparently failed to learn—i.e., what some call "remediation"—also influence what they say about this scenario. For instance, many prospective teachers talk about the importance of patiently and slowly "going over" the steps "step-by-step."

Disposition toward pointing out errors to students. Some people are very reluctant to tell students that they have made an error. Two rather different reasons seem to underlie this reluctance: (1) fear of making students feel bad; (2) commitment to having students figure out for themselves that something is wrong.

3. **Learners**

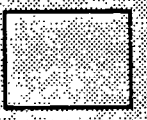
Knowledge and assumptions about sixth or eighth graders' attitudes. (The elementary interview sets the question at sixth grade, the secondary interview at eighth.) People's ideas about kids of this age may also shape their responses. For example, one prospective secondary teacher felt that eighth graders would be offended because it was such easy content. Consequently, he would be wary of bringing it to their attention very explicitly, but would try to couch it in a "Look, you guys, you're forgetting something important" tone.

4. **Context: Classroom**

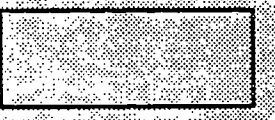
Orientation toward the classroom. The question states that "several students" were having difficulty with the multiplication algorithm. We are interested in whether and how teachers consider the other pupils in deciding what to do in this situation. Most prospective teachers respond in terms of one student, while most of the experienced teachers refer to the rest of the class. For example, experienced teachers say that they would want to know how many kids were doing this in order to decide whether to review it with everybody or not. This difference is not surprising.

Responding to Students' Novel Ideas: Perimeter/Area, Proof (Elementary and Secondary)

B2. **Imagine that one of your students comes to class very excited. She tells you that she has figured out a theory that you never told the class. She explains that she has discovered that as the perimeter of a closed figure increases, the area also increases. She shows you this picture to prove what she is doing:**



perimeter = 16 ft.
area = 16 square ft.



perimeter = 24 ft.
area = 32 square ft.

How would you respond to this student?

If person asks about grade level, say middle school or junior high.

If person is uncertain about whether this is actually true or not, say: **In teaching, this will happen that something may come up where you aren't sure yourself about whether the mathematics is correct or not. I'm interested in how you think you'd react to that. What would you do or say?**

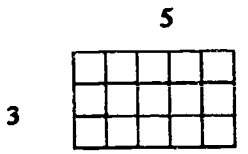
If person comments that this is not a proof or that they would be concerned that the student thinks this is a theory, try to learn why this is not a proof or a theory, and what they'd want to do or say in response to the student.

If person focuses on praising the student for doing some math outside of class: **Is there anything else you'd want to do or say?**

Discussion:

A. What is Revealed about Subject Matter:

1. **Relationship between perimeter and area.** The *perimeter* of a figure or a region is the length of its boundary, while the *area* is number of unit squares it takes to cover the figure or region. For example, calculating the perimeter of a dog pen in your backyard would tell you the length of fencing.

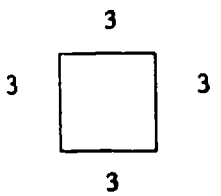


3 + 5 + 3 + 5 = 16 feet

Figuring the area would tell you how much space your dog had in which to play.

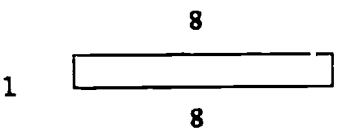
3 x 5 = 15 square feet

Intuitively, the two measures seem related. That is, it seems logical that longer amounts of fence would necessarily yield bigger spaces for your dog. This is what the student in the above scenario claims. While it seems intuitively right, however, it isn't. Imagine, for instance, a square, 3 feet on each side. Its perimeter is 12 feet and its area is 9 square feet.



perimeter = 12 feet
area = 9 feet

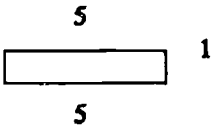
Now suppose you take 20 feet of fence. You might construct a narrow rectangle, 1 foot wide and 8 feet long. This rectangle with perimeter of 18 feet will have an area of only 8 square feet. In this case, the area is actually *less* despite a greater perimeter.

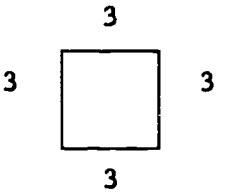


perimeter = 18 feet
area = 8 square feet

Two regions can have the same perimeter but different areas:

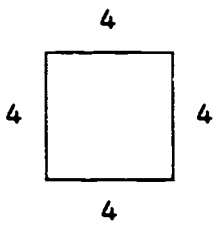
perimeter = 12 feet
area = 5 square feet



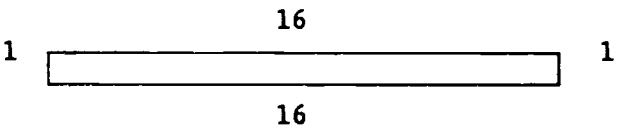


perimeter = 12 feet
area = 9 square feet

or the same area but different perimeters:



perimeter = 16 feet
area = 16 square feet



perimeter = 34 feet
area = 16 square feet

We are interested in whether our teachers know that there is no direct relationship between perimeter and area. For those who believe that there is a relationship between perimeter and area, how do they know that? Most of the people we interviewed were not sure whether the relationship claimed by the student in the scenario was true. For those who aren't sure, we are interested in how they think about it. Are they skeptical or inclined to believe it? Why? We usually learn something about their view of mathematics and their feelings about themselves in relation to it from their comments. For example, one student asked, "*Is* that true?" and said she was skeptical simply because, in math, "there's always some weirdo exception—math is so contradictory."

What do people do or what do they say they *would* do to resolve their uncertainty? Would they look it up, search for counterexamples, "try a few more" to see if the relationship holds up? How do they feel about their ability to resolve it?

2. **Theory and proof.**

Another crucial piece of subject matter here in this question has to do with mathematical knowledge and the justification of knowledge—"theory" and "proof." The student claims to have "discovered a theory" and offers a picture as a "proof." In mathematics, however, as in any other discipline, an example does not establish the truth of a generalization. The student has illustrated, not proven, her claim. Her claim is a conjecture, not a theory. We are interested in whether people pay attention to this dimension of the question. One prospective teacher commented emphatically, "Examples are not proofs," while another, studying the picture, said, "It looks right." Many people say they would "try a few more examples" to see if the relationship holds up. For these people, we are interested in what constitutes sufficient evidence. For people who say they would seek a counterexample, we listen for how they might go about this, for their strategy gives us information about their understanding of the content. One person said she would try it with "bigger numbers" (i.e., with regions with larger dimensions); another said she would try shapes other than rectangles. These approaches are exploratory. The concept of area itself leads other people to use a more focused strategy: They say they would investigate "long, skinny" rectangles.

B. What is Revealed about Teaching and Learning the Subject Matter

People's responses to this question highlight how teachers' understanding of the subject matter interacts with their knowledge and beliefs about teaching and learning. People with apparently similar understandings of the mathematics choose very different ways of responding to the student. One prospective teacher declared that the student "is *wrong* and I'd tell her she's wrong and show her an example." Another prospective teacher, who also knew that no direct relationship exists between perimeter and area, said he would pose a specific task: to see if the student could find an example where the perimeter increases and the area doesn't. These two prospective teachers have different ideas about the teacher's role, about teaching, and about how people learn mathematics, that shape their decision about how to respond to the student in the scenario. Experienced teachers, who have considerable knowledge about learners compared to most beginners, often describe several alternative responses based on "the kind of kid" it is (and we probe their categories of "kinds" of pupils).

Below are some of the specific issues that this question tends to highlight:

1. **Teaching and Learning**

Responding to students' novel ideas. Three basic categories of response have emerged in our interviews so far: (1) praise student; (2) encourage student to pursue her idea; (3) tell student if her idea is right or not.

(1) People's responses to this scenario are often dominated by their pleasure at the fact that a student "did some math on her own outside of school!" Many people seem drawn to focus on this and to praise the student for her initiative and interest.

(2) Others propose to help the student pursue her own inquiry—but for a range of reasons. For instance, some see this as off the track of the curriculum and would not want to divert their own time to it. Some believe that people learn math best when they have to "figure things out for themselves" (what people mean by this is an issue worth examining in its own right). Others simply do not know whether she is right or not, and encourage her to try a few more cases (see below).

(3) Finally, other people think that teachers should be able to tell the student if she is right or not (see below).

2. **Learners**

Ideas about middle school students' interests and attitudes. People's responses to this question often reveal what they think pupils of this age are like. For example, is it surprising that a middle school student would think about math outside of class? Why? How would other students view her? Would the rest of the class enjoy examining her theory or would they groan? This question is also one where we tend to hear comments about "some kids" or "it depends on what kind of kid"—all of which can help us learn some of the categories people form, as well as where and how this kind of knowledge of learners develops.

3. **Context: Classroom**

Orientation toward the classroom as a collective. Some people consider whether they would bring up the student's theory with the rest of the class. This is an interesting issue for the ideas that influence people's deliberations about this vary widely and illustrate the complex interaction of ideas in teaching. For example, some people would bring up her theory to remind everyone that perimeter and area are not related, some would bring it up for everyone to investigate, and some would bring it up to positively reinforce her initiative and interest and to encourage others to pursue mathematics outside of class. Some people would not bring it up because it might have negative social consequences for the student—i.e., she might be seen as "too smart." Some people would bring it up depending on who the student was (and we probe what they would take into account in deciding this). Especially interesting in all of this is how people's own understanding of the mathematics affects their deliberations.

C. **What is Revealed about Views of Teaching and Learning to Teach**

The teacher's role and what teachers need to know. Since many people are not sure about whether the student is right or not, this question often reveals their ideas about what teachers need to know or be able to do. For example, some people think that teachers are supposed to be able to answer students' questions and evaluate their ideas. If a student proposes a "theory" like the one in this example, they think they should be able to say if the student is right or not. If they can't, they say they would admit honestly that they didn't know, and they would promise the student that they would find the answer by tomorrow. Others think that teachers probably ought to know everything, but realistically cannot. Their stance is to investigate the question *with* the student.

Generating Representations: Division, Fractions (Elementary and Secondary)

B3. Division by fractions is often confusing. People seem to have different approaches to solving problems involving division with fractions. Do you remember how you were taught to divide fractions? How do you solve a problem like this one?

1 ¾ ÷ ½

If person struggles with this, or cannot do it, say: Many people find this hard. In your view, what makes this especially difficult?

If the person seems unsure or uncomfortable with their answer, ask: Why are you unsure about this?

If the person continues to seem uncomfortable, suggest going on to the next part of the question. Say: Let's go on to the next part of the question. We can always come back to this if you want to.

B4. Something that many teachers try to do is relate mathematics to other things. Sometimes they try to come up with real-world situations or story problems to show the application of some particular piece of content. Sometimes it is pretty challenging to do this.

What would you say would be a good situation or story or model for 1 ¾ ÷ ½ (that is, something real for which 1 ¾ ÷ ½ is the appropriate mathematical formulation?)

After person has described a situation or story, ask (point to their calculations above or if no written work, point to the problem): How does that fit with 1 ¾ ÷ ½?

Would this story (or drawing) be a good way to help students learn about division by fractions?

If person struggles with this, or cannot do it, say: Many people find this hard. In your view, what makes this difficult?

Discussion:

A. What is Revealed about Subject Matter

This is a question about division. Division has to do with forming groups. Two kinds of groupings are possible:

(1) Forming groups of a certain size (e.g., taking a class of 28 students and forming groups of 4). The problem is how many groups of that size can be formed?

(2) Forming a certain number of groups (e.g., taking a class of 28 students and forming 4 groups). The problem is to determine the size of each group.

Dividing by fractions is not different conceptually from dividing by whole numbers. Suppose, for example, that you owe a friend $100 and that you have to repay the money but without interest. You want to know how long it would take you to pay your friend back, given different payment amounts. If you pay her $2 per week, it will take you 50 weeks. This can be formulated as $100 \div 2 = 50$. Now consider how long it will take you if you pay her only 50¢ per week. 50¢ = ½ dollar, so this question can be expressed as $100 \div \frac{1}{2}$. Because you understand division, and have a feel for money, you know that 200 weeks is a reasonable answer to this (even though 4 years to pay back $100 will probably jeopardize your friendship!). Both questions are examples of the first meaning of division above—i.e., you have $100 and you form "groups" first of $2 and then of ½ dollar. The problem in both cases is how many "groups"—or payments—of that size there are in $100.

Most people's understanding of division with fractions, however, is held separately from their understanding of division of whole numbers. In school, a special procedure is taught—"invert and multiply." In other words, to calculate

$$100 \div \frac{1}{2}$$

people have been taught to "invert" ½ and multiply 100 times 2, producing an answer of 200 just as we did above. Yet many people have never stopped to wonder why the answer is larger than the number they started with, even though, if asked, they would explain that "division always makes the number smaller."

Similarly, most people do not see that multiplying by the reciprocal of the divisor (i.e., inverting and multiplying) applies equally to division with whole numbers. $50 \div 2$ produces the same result as $50 \times \frac{1}{2}$.

In division with fractions, procedural knowledge dominates for most people. Many people can follow the procedure, but do not understand what it means to divide fractions. Some people cannot perform the calculation, often because they vaguely remember that they should invert something, but are not sure which number to invert.

The fact that many people do not understand what dividing fractions means shows up when they confuse dividing a quantity *by* ½ with dividing a quantity *in* ½ (dividing by 2). This is revealed when we ask people to generate a story problem or describe a "real-world" situation for which 1 ¾ ÷ ½ is the mathematical formulation. An appropriate representation for 1 ¾ ÷ ½ might be:

> How many ½-yard lengths of ribbon can be cut from 1 ¾ yards of ribbon? (Answer: 3 ½ pieces, each ½ yard long.)

However, the most common example people give goes something like this:

> You have 1 ¾ pizzas and you want to split them equally between 2 people. How much pizza will each person get?

Instead of noticing that the answer to their question is ⅞ of a pizza because they have actually represented division by 2, most people unknowingly convert the unit from a whole pizza to a slice. In drawing their pizzas, they divide each into 4 pieces. This results in 7 pieces of pizza (1 ¾ whole pizzas, each divided into fourths).

When two people share 7 pieces of pizza, they each get 3 ½ pieces—the same *number* as people get when they "invert and multiply" to calculate 1 ¾ ÷ ½.

What people often do not appear to notice is that, in their calculation, the number 1 ¾ represents a quantity of whole pizzas; in their story, the number 1 ¾ represents a quantity of *pieces*.

Quite a substantial proportion of the people we interviewed say they cannot generate an example or a story problem. Their comments help us learn their view of mathematics as well as their understanding of the particular concept. For most people, the *fractions* attract their attention; for them, *division* does not stand out as the central idea in the question. Several make comments about disliking fractions or being afraid of fractions. One prospective teacher said, "It's hard to relate ¾ of something real."

B. What is Revealed about Teaching and Learning the Subject Matter

This question is much less contextually-grounded than the others. Here we are primarily interested in learning how people understand the subject matter—how they represent it to

themselves. The only place where the question veers toward teaching and learning is near the end. We ask whether they think their representation would be good to use with kids. With some people, this question helps us understand what they take into account in judging the appropriateness of a representation in teaching.

For instance, on one hand, many people think food is good for representing fractions—pizzas or cookies, for example. They explain that students are likely to be interested in food. On the other hand, although these foods are usually also circular, people do not comment on the advantages or disadvantages of circles as models for fractions.

We also ask people why they think many people find this question difficult. Some people's comments help us understand more about how they feel about mathematics and about math teaching, as well as how they see themselves (and others) in relation to mathematical knowledge. Many people remark that they were never taught what things *mean* in mathematics—only how to *do* the procedures. As one person said, "I know how to do it, but I don't know the ideas behind it." Others reveal an understanding of mathematics that disconnects it from the real world—"It's hard to have ½ a person. Usually in the real world you're dealing with discrete things."

Responding to Student Questions: Division By Zero (Secondary only)

B5. Suppose you have a pupil who asks you what 7 divided by 0 is. How would you respond?

If the person says, "It depends what age" say: Why don't you choose an age you might teach, and think about the question for that age?

Why would you do that?

If the person says, "I'd say it's undefined," say: What do you mean by "undefined"?

If the person says, "I'd say you can't divide by 0, say: What if a student asks, "Why can't you divide by zero?"

If person says they would show students how, as you divide by smaller and smaller numbers, answer gets larger and larger say: What would I see or hear you doing?

What if this didn't seem to make sense to the student? Is there something else that you would try?

How would that help?

What if the student said, "It seems that if you divide by nothing, you don't divide and so you would still have 7". How would you respond? Why?

Discussion:

A. What is Revealed about Subject Matter

This question deals with four important ideas in mathematics: division, the concept of infinity, what it means for something to be "undefined", and the number 0. In addition, this question helps us learn about people's ideas about mathematical knowledge.

1. **Division**, discussed in detail above (B3), is the central concept in this question. Consider a typical division statement such as 7 divided by 2. What does this mean? It may represent one of two situations:

   a. I have 7 slices of pizza. If I want to serve 2 slices per person, how many portions do I have? (Answer: 3 ½ portions)

   b. I have 7 slices of pizza. I want to split the pizza equally between 2 people. How much pizza will each person get? (Answer: 3 ½ slices)

(Note once more that these are two different meanings for division, and that therefore the referent for 3 ½ is different in the two cases.)

Now take 7 divided by 0. We try the same approach:

a. I have 7 slices of pizza. If I want to serve 0 slices per person, how many portions do I have? (Answer: An infinite number of portions, or as many or as few portions as you like)

b. I have 7 slices of pizza. I want to split the pizza equally among 0 (no) people. How much pizza will each person get? (Answer: This doesn't make sense. You actually aren't splitting, or dividing, the pizza at all.)

Since the second meaning of division does not make any sense here, take a closer look at the first.

What does it mean for there to be an *infinite* number of portions? In a way, it is a kind of oxymoron, for the idea of "portion" implies some way of dividing into a finite number of parts. Here the point is that you have endless portions if a portion is zero amount—i.e., you could go on "dividing" it forever and never finish.

The idea that one could "divide" 7 forever conflicts with the *definition* of division—that is, that dividing something into some finite number of equal parts that, when recombined, form the whole. Dividing 10 into 5 parts, for instance, yields groups of 2. One can reverse the process: 5 portions of 2 equals the original quantity 10 (5 X 2 = 10). Dividing 7 by 0 does not work this way, however. To divide 7 by 0, theoretically, one could divide as long as one wishes. One might decide to stop at 15 or 710 or 5,983 groups of 0. Yet, there is no number of portions of 0 that can be recombined to total 7—i.e., there is no number that can be multiplied by 0 to equal 7. Therefore, division by zero is actually *undefined*—it does not fit the *definition* of division.

Yet, this is not the way many people understand the notion of infinity or what it means for something to be undefined. They say things like, "As you get closer and closer to infinity." Their ways of talking about infinity seem to imply that infinity is a point at the end of the number line. For them, infinity is the largest number, and the *answer* to 7 divided by 0 is "infinity."

2. **Zero.** This question also elicits people's ideas about 0. Zero is a number like all the other numbers. It represents the empty set and, like all counting numbers, it is a plausible answer to the question, "How many?" (Reid, 1960). Still, it is a special number; there are many special cases involving zero (e.g., 0/0 does not equal 1). Perhaps as a result of its specialness, or perhaps because of everyday experience with the idea of "nothing," a substantial number of people believe that zero is not a number, that it does not "count." (Another place in the interview where we can learn about people's understanding of zero is B1, as people talk about the role of the zeros in the multiplication algorithm.)

3. **The nature of mathematical knowledge.** Is mathematics a domain in which reasonable explanations are possible, or is it largely a domain of right and wrong answers, of rules? People's explanations about division by zero often reveal or imply their ideas about math, or at least about some mathematics.

Kinds of responses. Respondents' understanding of division by zero tend to fall into three categories: A focus on the meaning of division by zero, the recall of a rule, or not knowing. Of those who cite a rule, many identify a rule that is incorrect: i.e., "anything divided by zero is zero."

B. **What is Revealed about Teaching and Learning the Subject Matter**

1. **Learners**

Age as a variable. This question does not specify the age of the pupil and so some people ask how old the student is. We ask them to tell us how that makes a difference to them, and then let them pick an age. Not asking this does not imply that people do not take the learner into account when they decide what to do, but when people ask, we get a snapshot of how they think about age as a variable. For instance, do they think that younger pupils could not understand infinity? Do they think that explanations ought to be stated as rules?

2. **Teaching**

The teacher's role in promoting learning. People's responses to this question also help us learn about their views of the teacher' role. What should a teacher do when a pupil asks a direct question like this? Some people think that teachers should give pupils

answers, others believe that teachers should lead or guide pupils to figure out the answers for themselves. Of course, people's views of this often depend on other situational considerations, such as whether the concept has already been taught, who the student is, and do on. If people give an "it depends" kind of response, we try to learn on what it depends.

C. What is Revealed about Teaching and Learning to Teach

Sources of knowledge about teaching mathematics. As in the other questions, we are interested in how teachers have acquired the ideas they have about how to teach particular content. Possibilities include their own (high school) mathematics teachers, their education courses, colleagues, teachers of other subjects, or inventing strategies on their own.

Improving one's own teaching. In any case, we are also interested in why they consider the approach they describe to be a good one, as well as what they are dissatisfied with. If they see weaknesses, why? And where or how do they believe they could compensate for or remedy these?

Helping Students' Concepts and Procedures: Solving Equations (Secondary only)

B6. Suppose you are teaching algebra. How would you help your students learn to solve equations like this:

Hand person the problem.

$$\frac{x}{0.2} = 5$$

Why is that what you would do?

If person struggles with this, say: Many people find this hard. In your view, what makes this especially difficult?

If a student says "I don't get this." Is there something you could do or show that would help the student make sense of it?

How would that help?

Where did you get this idea?

If the person says s\he can't think of anything, ask: Many teachers say that this is difficult. What do you think makes it so hard?

Discussion:

A. **What is Revealed about Subject Matter:**

The equation

$$\frac{x}{0.2} = 5$$

gives information which permits one to identify the correct value for an unknown number, denoted as x. In common language, it says that when one divides this unknown number by .2, one gets 5 as the answer. Understanding division makes clear what this means: that there are 5 groups of .2 in the number, or, more colloquially, .2 "goes into" this unknown number 5 times. Reasoning conceptually about division in this way allows one to identify the number without performing any manipulations on the equation. The answer is 1. 1 can be divided into 5 groups of .2; .2 "goes into" 1 5 times.

In algebra classes, students are taught procedures for "isolating x"—i.e., for manipulating equations so that the unknown number is on one side of the statement and a number is on the other. This enables one to "solve" the equation, or figure out what number(s) x could be. For example, a common procedural "script" for solving the equation discussed above is:

You want to isolate x, so you want to get rid of the "point 2" in the denominator.

Multiply both sides by point 2.

$$\frac{(.2)\,x}{0.2} = 5\ (.2)$$

The point 2's cancel on the left side; 5 times point 2 is 1.

So x equals 1.

Learning procedures such as these often seem to eclipse any focus on the meaning of the equations. We wanted to learn about our respondents' understanding of this procedure.

Kinds of responses. The people we interviewed gave three kinds of responses. Some (very few) focus on the meaning of the equation; most emphasize the procedural steps; and a few do not remember how to deal with equations like this at all. Most of the latter group say they know there is a rule.

Moreover, examining people's responses to this item along with their responses to the questions about division by zero and division with fractions allow us to examine how connected their knowledge of division is. Do they understand each of these as a separate bit of knowledge—with an appropriate rule? Do they use the idea of division and what division *means* to unpack each item? Analyzing the connectedness of their understanding of division is important because of our interest in characterizing the nature of their substantive understanding of mathematics.

B. What is Revealed about Teaching and Learning the Subject Matter

Teaching and learning algorithms. How should teachers teach procedures? Is it best to give students an algorithm for proceeding? Is it important to focus on the concepts underlying the procedure? We are interested in learning what our respondents think about how pupils can best be helped to learn procedures in mathematics.

The teacher's role in promoting learning. We also hoped to gather some information about what our respondents think is the teacher's role. Some people, for instance, believe that teachers should present material as clearly and straightforwardly as possible, that the pupils' role is to absorb or remember what teachers tell them. Others believe that students must be helped to construct the appropriate algorithms so that they have some ownership in the procedure.

We are interested in the image that teachers (especially prospective teachers) have of their role. Do they see themselves up at the board, showing and telling? Some may see themselves as asking guiding or leading questions.

C. What is Revealed about Teaching and Learning to Teach

Sources of knowledge about teaching mathematics. As in the other questions, we are interested in how teachers have acquired the ideas they have about how to teach particular content. Possibilities include their own (high school) mathematics teachers, their education courses, colleagues, teachers of other subjects, or inventing strategies on their own.

Improving one's own teaching. In any case, we are also interested in why they consider the approach they describe to be a good one, as well as what they are dissatisfied with. If they see weaknesses, why? And where or how do they believe they could compensate for or remedy these?

Section C: The Structured Exercises in Mathematics Teaching:

Elementary—Subtraction with Regrouping
Secondary—Slope

The structured exercises are longer tasks at the end of the mathematics section of the interview. The purpose of these is to provide an occasion for our respondents to engage in a larger piece of thinking about teaching mathematics. This affords us the opportunity to examine how their ideas about teaching and learning interact with their understanding of mathematics in performing a series of *connected tasks of teaching*: Evaluating curricular material (as a representation of the subject matter), planning to teach, evaluating student work, responding to students' questions. The structure of the two exercises is parallel: We show people a section from a math textbook at their level (the topic is slope for secondary, subtraction with regrouping for elementary). We ask them to appraise the textbook section. Then we show them a section (on the same topic) from another textbook and ask them to compare it to the first one. Next we ask them how they would go about teaching this topic if they were working on it with a class of pupils. To explore their knowledge of learners, we probe to learn whether they think there is anything about this that students might find particularly easy or difficult. After that, we show them a student's paper, based on student exercises from the first textbook section. We ask respondents to evaluate the student's work and to discuss what they would do next if they were that student's teacher. Finally, we pose several questions students might ask. We then ask people how they would respond. The structured exercise concludes with a question about what they think they would like to know more about in order to teach this topic better, and where and how they think they could learn that.

NOTE: For the following exercise we used excerpts from two high school Algebra I textbooks. Each excerpt was one lesson, and included the presentation of material, examples, and oral and written exercised for students. We duplicated both the student text pages and the teacher's guide pages to give the interviewee. We chose the selections to be in contrast with each other—that is, one was more algorithmic and rule-oriented, the other somewhat more focused on meanings and concepts. We also made a page of a high school student's work on the exercises at the end of one of the books' sections. We deliberately designed the page to include some errors that students tend to make.

C. Secondary Mathematics Exercise

Interviewer: Here's a section from an algebra textbook. I've included the pages from the book as well as the teacher's guide notes. I'd like to use this as the basis for this last part of the interview. Since it's kind of long, why don't you take a few minutes to look it over, and then we'll talk.

C1. What are your initial reactions to this textbook section?

Are there things you think are quite good in here?

Some things you think are weaknesses or flaws? Why?

C2. Now here's a section from *another* text series. Can you compare the two? Does anything seem different?

Which do you prefer? Why?

C3. What would students need to understand or be able to do before they could start learning this?

Why is _____ important for this?

C4. How you would approach this if you were teaching, say, ninth grade? Don't feel that you have to stick to any of this text material if you have another way you'd want to work with your class, but you can use it if you choose.

Probes to elicit concrete and specific descriptions:

Can you give me an example?

If I were in your classroom, what would I see?

What do you mean by _____?

Examples of things to listen for and probe:

"I'd try to connect it to something the students can relate to": Could you give me an example?

"I'd do a few examples on the board": For example? What would I hear you saying or see you doing?

Why would you do it this way?

How did you come up with this idea/approach?

Is there another way you can imagine doing this?

C5. **What kinds of problems do students have with this?**

How do you know?

C6. **How could you tell if your students were "getting it"?**
Probe for what it means to "know" or "understand" something in mathematics.

What would you look at or pay attention to?

If a person says s/he would see if pupils could explain their answers or procedures, ask: **What kind of explanation would satisfy you that they were "getting it?"**

If person says s/he would "ask some questions" or "give a quiz" to see if students were getting it, say: **Could you give some examples of questions you might ask?**

C7. **Here is part of a student's homework paper. Lynn has done #7 through #14 of the exercises from the first textbook section. Take some time to look it over and then let's talk about what you make of Lynn's work.**

What do you think is going on here with Lynn? What do you think she understands? Why?

What's your hunch about why she got some of these wrong? Why do you think that?

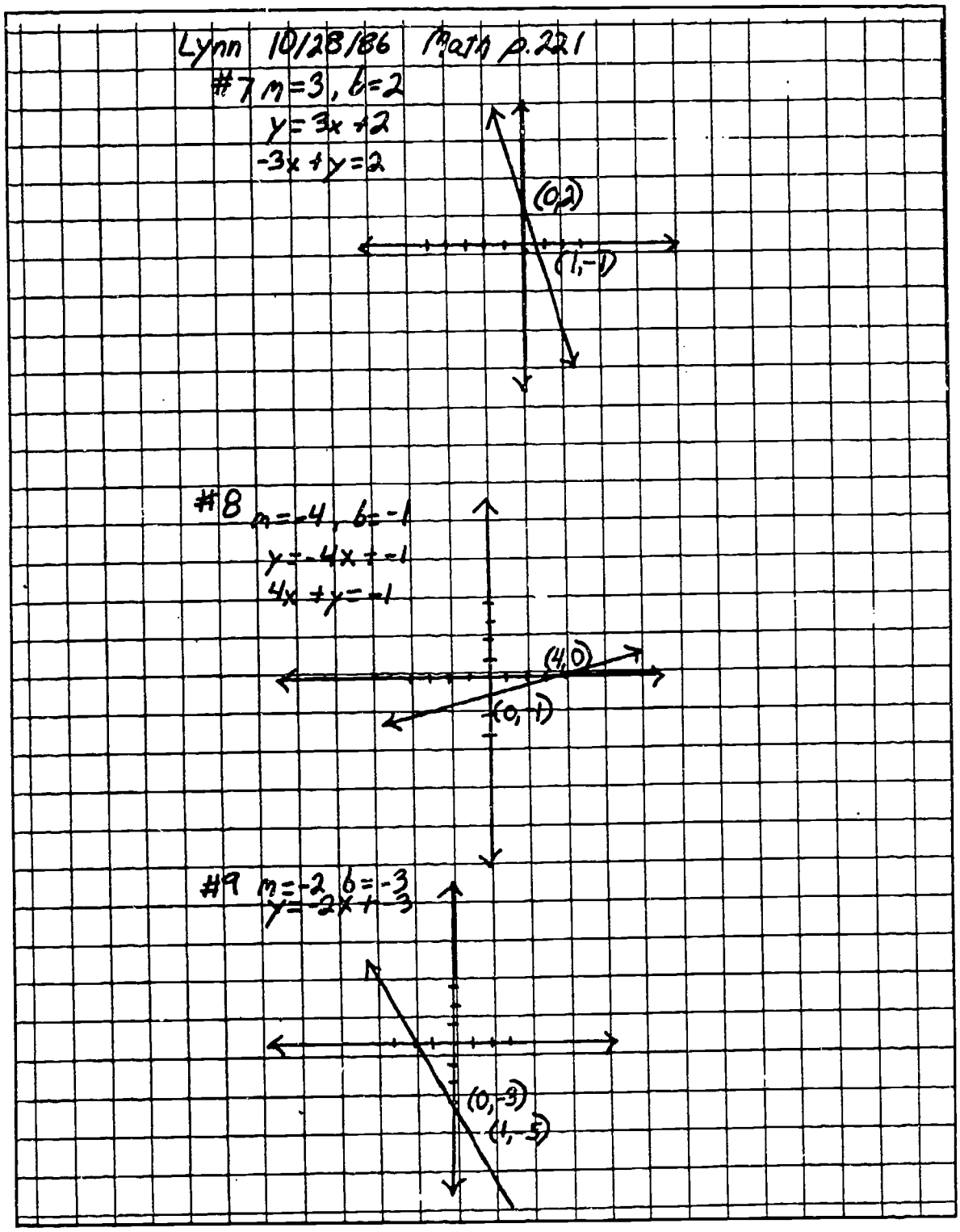
C8. **Okay, imagine that Lynn is a pupil of yours. How would you respond to this paper? What would you do next? Why?**

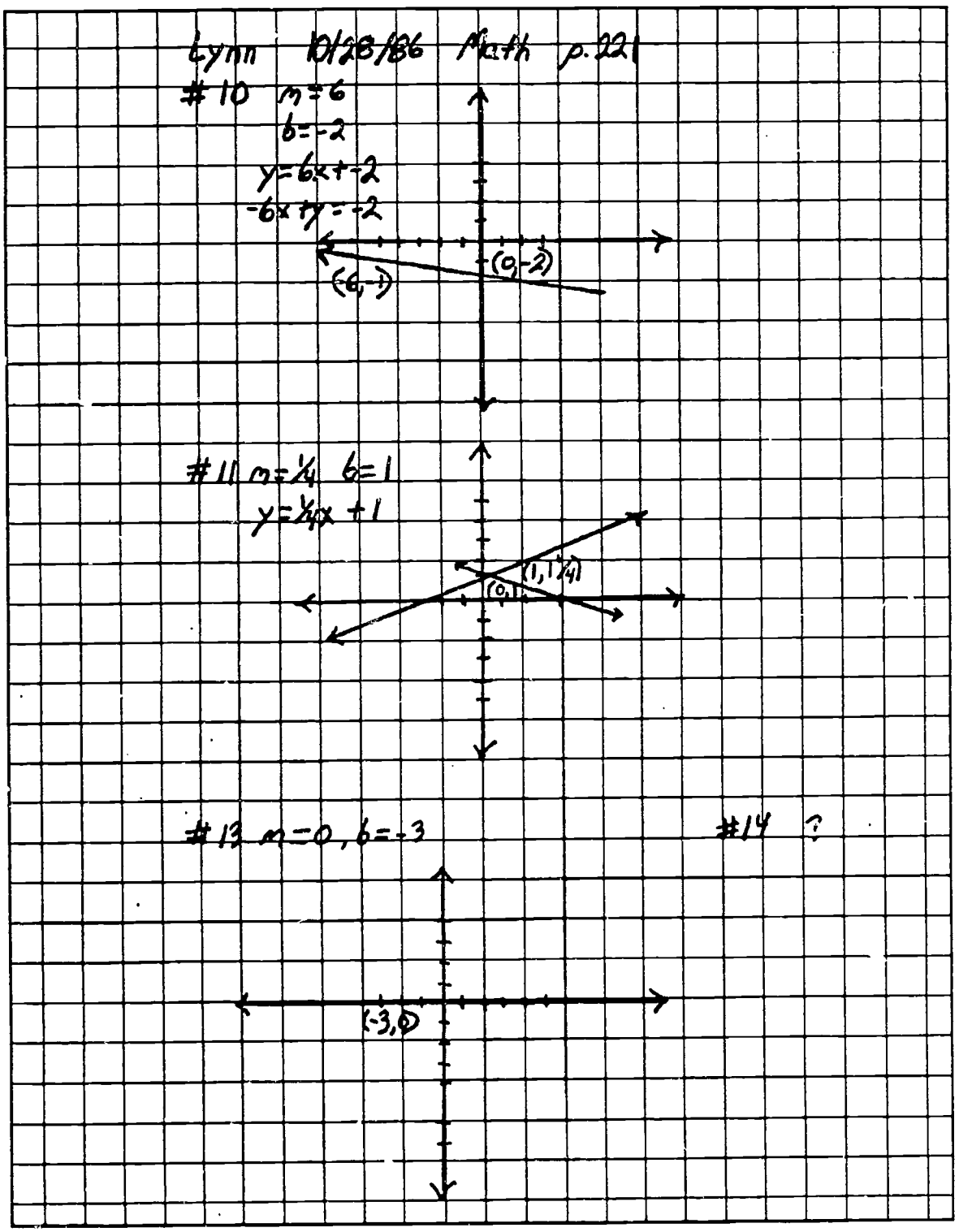
If person says s/he would see if others in the class were having the problem and maybe "go over it" with the whole class say: **How would you decide whether or not to do something with the whole class?** (Try to find out what proportion of the class would need to be having trouble before the person would do something with the whole class.)

Discussion:

A. What is Revealed about Subject Matter

Slope. Slope is a central mathematical idea, first introduced formally in first-year high school algebra. The slope, or steepness, of a line is represented by a ratio of the vertical change (rise) compared to the horizontal change (run). One finds the slope of a line by picking two points on a line and determining *how much the line is rising or falling*

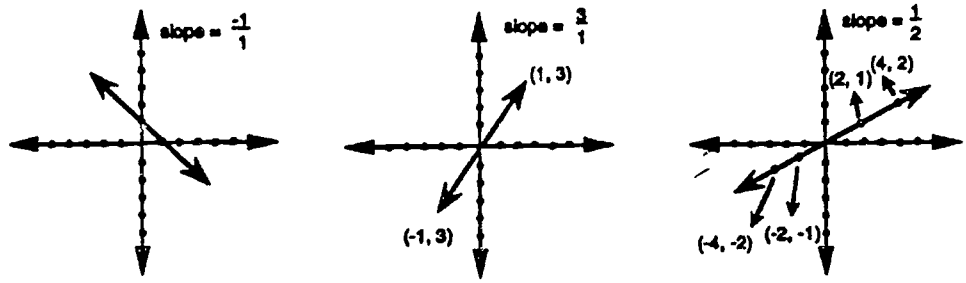

Lynn 10/28/86 Math p.221
#7 m=3, b=2
y=3x+2
-3x+y=2
(0,2)
(1,-1)
#8 m=-4, b=-1
y=-4x+-1
4x+y=-1
(4,0)
(0,-1)
#9 m=-2 b=-3
y=-2x+-3
(0,-3)
(1,-5)


Lynn 10/28/86 Math p. 221
#10 m=6
b=-2
y=6x+-2
-6x+y=-2
(0,-2)
(-6,-1)
#11 m=¼ b=1
y=¼x+1
(1,1¼)
(0,1)
#13 m=0, b=-3
#14 ?
(-3,0)

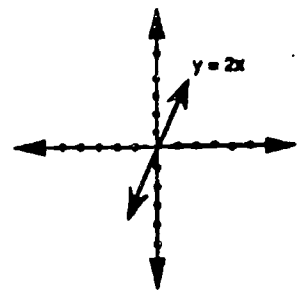
and *how much the line is increasing to the right* between those two points. In other words:

$$\frac{\text{rise or fall}}{\text{run}}$$

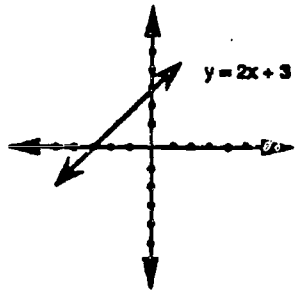
The sketches below illustrate different slopes. Notice that lines that slant down to the right have *negative* slopes: This is because the line drops rather than rises, so the ratio comprises a negative value over a positive value (the horizontal run of the line).



Assigning a numerical value to represent steepness allows one to compare the relative slopes of two lines, as well as to predict accurately other points on a given line. A line can be represented as an equation—this equation includes the slope. For example, the equation for this line is $y = 2x$. In other words, the value of y at each x is double the value for x. If x is 2, y is 4, If x is 3, y is 6. The slope of this line is 2/1 (or just 2) because the line is rising 2 for each horizontal increase of 1.



Now look at this line:



This line is parallel to the line sketched above, but you can see that it is shifted up on the coordinate plane. Instead of intersecting the origin (0,0), this line crosses the y-axis at 3. So the equation is written as $y - 2x + 3$. Consider: When x is 0, y is 3. When x is 1, y is 5, y is always 3 more than twice the value of x. This form of writing equations for lines is called the *slope-intercept* form because it contains information about both the slope and the point where the line intercepts the y-axis. This equation form is also referred to in its general form as $y = mx + b$, where m is the value of the slope and b is the point where the line intercepts, or crosses, the y-axis. This form is the favorite of many students and teachers because it is most directly "graphable"—that is, because one knows the intercept and the slope, one can quickly graph the line.

The last example also highlights another important point about slope—lines that are parallel have the same slope—i.e. they are slanted in exactly the same way.

Besides the popular slope-intercept form of a line, there are also other forms of equations. One that comes up in this structured exercise is, in its general form, referred to as

$$ax + by = c$$

So, for example, $-2x + y = 3$ is another way of representing $y = 2x + 3$. Consider some of the solutions to the latter equation: (0,3), (3,9). Each of these of course also satisfies $-2x + y = 3$.

This form (ax + by = c) is not favored because it cannot be graphed as directly at the (y = mx + b) form (through algebraic manipulation, to "isolate" the y on the left side of the equation).

What are lines and equations and what do they represent? One can think of lines and equations and the relationship between them in three ways. On one hand, an equation may be understood as a representation of an actual line. The equation allows one to describe symbolically the slant and orientation of that line. For example, y = 2x is a representation of the line in Fig. 4.10.

On the other hand, a line can be thought of as a representation of the solution set for a mathematical equation. The line includes all the points that are solutions to the equation. For example, if the equation is y = 2x, as discussed above, then (1,2) and (2,4) and (4,8) are some of the solutions to that equation. These points are all on the line that one draws based on y = 2x.

Finally, a line may be a graphical representation of the relationship between two variables —amount eaten and weight gained, or children's ages and their heights, for example. Points may be plotted to represent the pertinent data, and an equation may be derived to describe the relationship between the two variables. In this case, both the line and the equation are representations of some real world relationship.

This polyfocal approach to thinking about the relationship between lines and equations is significant in thinking about slope and graphing, and especially in teaching it, for each perspective has implications for how this topic might be taught.

B. What is Revealed about Teaching and Learning the Subject Matter

Evaluating curriculum materials. We are interested in what respondents pay attention to in appraising these materials. There are issues of content, of learning, of learners on which they might focus.

For both structured exercises, the text materials were selected to contrast with one another. With the secondary text sections, the first slope section does not mention the conceptual mnemonic "rise over run," while the second does. The first includes examples of negative slopes expressed in ratio terms, the second sticks with positive slopes. The first section deals with equations for lines, the second does not. The second textbook section lays out the material in step-by-step terms, highlighting the main points in boldface. The first section provides practice exercises that seem less focused on the particular content of the section, the second gives practice on each piece of the section.

Planning to teach. We are interested in how our respondents would teach the topic. How detailed are their descriptions? Do they have alternatives? Why do they use the approach they do? To what extent do they deliberate about the content, about what is critical to learning the content, about the age of the learners and what they might find interesting or difficult, or about what prerequisite knowledge pupils must have?

Learners—anticipating student difficulties. This exercise offers us a chance to learn how our respondents view the content with respect to the learners. What is their frame of reference for thinking about teaching the content? Some prospective teachers depend on what they remember from learning it themselves, others see it only from their adult perspective (e.g., borrowing is not difficult when one thinks of it from an adult point of view).

Responding to student questions. We present respondents with two kinds of questions: one deals with the usefulness or worthwhileness of learning this content, the other raises an off-beat issue that represents student novel thinking in mathematics. We use these questions to learn how respondents think about the usefulness of the content, and about how they would interpret and respond to students' novel ideas.

Evaluating student written work. On the slope paper, "Lynn" proceeds algorithmically, graphing lines directly from the $ax + by = c$ form of the equation, and using the x-coefficient (a) for the slope.

C. **What is Revealed about Teaching and Learning to Teach**

Sources of Knowledge About Teaching Mathematics. As in the other questions, we are interested in how teachers have acquired the ideas they have about how to teach particular content. Possibilities include their own (high school) mathematics teachers, their education courses, colleagues, teachers of other subjects, or inventing strategies on their own.

Improving one's own teaching. In any case, we are also interested in why they consider the approach they describe to be a good one, as well as what they are dissatisfied with. If they see weaknesses, why? And where or how do they believe they could compensate for or remedy these?

C. Elementary Mathematics Exercise

Interviewer: Now we'll spend a little more time thinking about one particular topic that you may work with when you teach. We'll use this page from a second grade math textbook as the basis for this last part of the interview (See Appendix B for textbook selections). Take as much time as you like and let me know when you're ready to talk about it.

C1. What are your initial reactions to this workbook section?

Are there things you think are quite good in here?

Some things you think are weaknesses or flaws? Why?

C2. Now here's a section from another text series. Can you compare the two? Does anything seem different?

Which do you prefer? Why?

C3. What would students need to understand or be able to do before they could start learning this?

Why is _____ important for this?

C4. How would you approach this if you were teaching second grade? Don't feel that you have to stick to any of this text material if you have another way you'd want to work with your class, but you can use it if you choose.

Probes to elicit concrete and specific descriptions:

Can you give me an example?

If I were in your classroom, what would I see?

What do you mean by _____?

Examples of things to listen for and probe:

I'd try to connect it to something the students can relate to:
Could you give me an example?

I'd do a few examples on the board: For example?
What would I hear you saying or see you doing?

Why would you do it this way?

How did you come up with this idea/approach?

Is there another way you can imagine doing this?

C5. What kinds of problems do students have with this?

How do you know?

C6. **How could you tell if your students were "getting it"?**
Probe for what it means to "know" or "understand"—or whatever word they use—something in mathematics.

What would you look at or pay attention to?

If a person says they would see if pupils could explain their answers or procedures, ask: What kind of explanation would satisfy you that they were "getting it?"

If person says s/he would "ask some questions" or "give a quiz" to see if students were getting it, say: Could you give some examples of questions you might ask?

C7. **Now here's a copy of one student's work on this page. Take some time to look it over and then let's talk about what you make of Susan's work.**

What do you think is going on here with Susan? What do you think she understands? Why do you think that?

What's your hunch about why she got some of these wrong? What do you think that?

What do you think Susan doesn't understand? Why do you think that?

C8. **Okay, imagine that Susan is your second grade pupil. How would you respond to this paper?**

What would you do next? Why?

Could you give me an example?

If a person says s/he would see if others in the class were having the same problem and maybe "go over it" with the whole class, say: How would you decide whether or not to do something with the whole class? (Try to find out what proportion of the class would need to be having trouble before the person would do something with the whole class.)

C9. **If the person has not mentioned grades in C8, ask: What grade would you give this paper? Why?**

If person resists the idea of grades, ask: Would you mark this paper in any way?

Then say: Many teachers do have to assign grades, and we are interested in learning how these decisions are made. Suppose you taught in a school where you had to assign grades—what grade would you give this paper?

If person says s/he wouldn't give Susan a poor grade if she was trying, say: How would you decide if she was trying? Why is effort important in determining the student's grade?

If person says Susan seems to "have the concept" or "the basic idea," say: How can you tell? (Make sure it's clear what the person means by "the concept.")

C10. **Suppose a parent came in to see you and asked, "Why are you spending so much time working on computational skills like this?" How would you respond?**

Why is that what you would say?

C11. **Is there anything you wish you knew more about in order to teach this? How would you go about learning that?**

Discussion:

A. What is revealed about subject matter

Subtraction with regrouping. This procedure and its associated concepts are central to the elementary mathematics curriculum. The level at which it is first introduced is second grade, the grade from which we selected text material.

Note that most people refer to this procedure as "borrowing." This is the standard algorithm that everyone learns in elementary school for subtracting multi-digit numbers, for example:

$$\begin{array}{r} 64 \\ -46 \\ \hline \end{array}$$

This procedure is rooted in concepts of place value. In the problem above, one "regroups" the tens and ones of 64 to form 5 tens and 14 ones. Then one subtracts 14 - 6, and 50 - 40.

Many people do not necessarily think explicitly about this but just operate mechanically and automatically with the numbers. They are able to compute accurately, yet may understand the underlying concepts only tacitly. Analyzing responses to this item together with responses to B1 (the multiplication algorithm) allows us to learn about the nature and connectedness of our respondents' understanding of place value.

The term "borrowing" is also conceptually misleading. It does not imply that the numbers are being regrouped but emphasizes instead that one doesn't have enough of something and must "get more" from someone. The misconceptions that can result from this term can be illustrated best with the following example from an interview with a prospective teacher. She explained how she would help pupils understand the *need* for the procedure:

> I would say "OK, you've got. . . for example. . . you've got 4 Cokes here and you've got 6 people. Every one of these people, they want to drink one Coke. Do you have enough, is it going to work?" They'll say "no" and someone will say "Well, we'll split one down the middle." (laughs) So I say, "Okay, *that's* not going to work, but then you go back to the store. . . I would just show that relationship isn't going to work. I'd say, "4 minus 6 doesn't work, so you have to borrow."

This story of 4 Cokes and 6 people represents division as well as subtraction. Although she wanted pupils to see that 4 - 6 "doesn't work," pupils may, as she anticipated, suggest sharing, or dividing, the Cokes. In that case, the story represents 4 *divided by* 6. She would explain, however, that "that relationship doesn't work, so you have to borrow." (In fact, she wanted pupils to see that, short of Cokes, they would go back to the store and get more—not exactly "borrowing," either.) This story does not pick up the "borrowing" of *tens* either, the central idea underlying regrouping in our numeration system. This respondent focused instead on getting *enough more*—however many that takes. In regrouping, however, one always regroups by tens, regardless of the quantity one is short. The story could also have been interpreted as a representation involving negative numbers (i.e., we are short 2 Cokes, or 4 - 6 = -2), however, like many of the other prospective teachers, this person was trying to make the (false) point that a larger number *cannot* be subtracted from a smaller one.

B. What is Revealed about Teaching and Learning the Subject Matter

Evaluating curriculum materials. With the elementary textbook sections, the first does not emphasize the regrouping of numbers, although it does mention tens and ones. The second takes a more conceptual approach, with illustrations of bundles of sticks and loose sticks to model tens and ones and the regrouping of tens and ones. The first section is colorful and sets the exercises in the context of a story about what was sold at a fair. The second section is done in back-and-white and the practice page is unadorned. A final difference lies in the way in which the content is structured: the first section presents only exercises in which regrouping and some that do not. We are interested in how respondents view curriculum materials.

1. To which aspects of the curriculum materials do they attend?
2. Do they attend to differences in how mathematical ideas are presented?
3. Do they attend to the assumptions underlying how the material is presented?

Planning to teach. We are interested in how our respondents would teach the topic. How detailed are their descriptions? Do they have alternatives? Why do they use the approach they do? Do they have alternatives? Why do they use the approach they do? To what extent do they deliberate about the content, about what is critical to learning the content, about the age of the learners and what students might find interesting or difficult, or about what prerequisite knowledge pupils must have?

Learners—anticipating student difficulties. This exercise offers us a chance to learn how our respondents view the content with respect to the learners. What is their frame of reference for thinking about teaching the content? Some prospective teachers depend on what they remember from learning it themselves, others see it only from their adult perspective (e.g., borrowing is not difficult when one thinks of it from an adult point of view.)

Responding to student questions. We present respondents with two kinds of questions: one deals with the usefulness or worthwhileness of learning this content, the other raises an off-beat issue that represents student novel thinking in mathematics. We use these questions to learn how respondents think about the usefulness of the content, and about how they would interpret and respond to unconventional student ideas.

Evaluating student written work. Both student papers contain significant errors. In both cases, the errors are typical for students who are beginning the particular topic, and would likely be easily recognized by experienced teachers. For example, on the subtraction paper, "Susan" takes the difference of the top and bottom numbers, never using the borrowing procedure at all:

$$\begin{array}{r} 64 \\ -\,46 \\ \hline 22 \end{array}$$

C. **What is Revealed about Teaching and Learning to Teach**

Sources of knowledge about teaching mathematics. As in the other questions, we are interested in how teachers have acquired the ideas they have about how to teach particular content. Possibilities include their own (high school) mathematics teachers, their education courses, colleagues, teachers of other subjects, or inventing strategies on their own.

Improving one's own teaching. In any case, we are also interested in why they consider the approach they describe to be a good one, as well as what they are dissatisfied with. If they see weaknesses, why? And where or how do they believe they could compensate for or remedy these?

Section D: Teaching Elementary and Secondary Writing

Section D of the interview presents interviewees with hypothetical teaching situations that are likely to arise in the teaching of writing. Each situation requires interviewees to draw on different combinations of knowledge and ideas about writing, how students learn to write, and how teachers can help students learn to write. In the scenarios that follow, we present the full set of probes associated with each situation and then present a discussion of how our interviewees responded to these questions.

Helping Pupils Understand Punctuation: Apostrophes (Elementary and Secondary)

D1. **First I'd like to talk to you about a situation that involves helping students with a very specific difficulty.**

Many third (or ninth) grader have problems using apostrophes with nouns to indicate possession.

D1. **What would you say is difficult about apostrophes for students of this age? Why is that difficult?**

D2. **Is this a topic you would work on with third (or ninth) graders?**

If yes: How would you go about it? What would you do?
Do you remember where you got that idea?

If maybe: What would it depend on?

If no: Why not?

Discussion:

A. What is Revealed About Subject Matter

Most language conventions exist at both a procedural and a conceptual level. The use of apostrophes, for instance, hinges on an understanding of the concept of "possession"—what it means to use the possessive form—as well as on knowledge of conventional procedures for indication possession in a text. To show possession, an apostrophe is used before an s ('s) in the case of singular (e.g., dog's, girl's) or collective nouns (e.g.,family's), and after an s (s') with plural nouns (e.g., friends'). The special case of "its" is confusing, because "it's" is the contraction for it is, while "its" is the possessive form.

We chose the use of apostrophes as an example of a kind of language convention that students may have difficulty with at nearly every grade level, and that, therefore, teachers should be able to explain. Of particular interest to us is the extent to which interviewees believe language conventions such as these can be understood by students, or whether they believe students should try to memorize a set of rules. For instance, when we ask interviewees what is difficult about apostrophes, some argue that pupils will confuse apostrophes with commas or with apostrophes indicating contraction because they look the same. They see the problem as a jumble of arbitrary procedures that can easily be confused with other arbitrary language procedures: Adding apostrophes before an "s" to indicate possession is an arbitrary convention that has little conceptual meaning. Other respondents seem to think that the issue is slightly

more substantive, that **possession is an idea that pupils first need to grasp** before they learn the convention.

B. What is Revealed about Teaching and Learning the Subject Matter:

1. **Motivation to teach apostrophes.** Views differ on teaching conventions such as the use of apostrophes to indicate possession. Some teachers of writing will argue that knowledge about apostrophes is fundamental to correct writing and should be taught explicitly and directly as a part of the writing curriculum. Others will argue that teaching such conventions before pupils understand the need for them is not only fruitless but can alienate students from writing. Students need an understanding, the latter group would argue, that grows out of their efforts to communicate to a specific audience. Hence, the argument goes, teaching should occur when the pupils discover the need for the convention in their own writing. Those who think that apostrophes need to be an explicit part of the curriculum think the way to teach it is through examples. Most say they teach possessives by writing examples of words ending in "s" on the board and having pupils decide whether or not the words need apostrophes. Those who would wait until pupils are ready would teach it in the context of the pupils' own writing, using their writing as the example.

2. **Curriculum.** Whether or not they would teach apostrophes to indicate possession appears to be, for most teachers, *a matter of prescribed curriculum*: If it is part of the ninth or third grade curriculum, they will teach it.

A few teachers, however, indicate that *pupil's readiness* will determine whether or not they teach this convention. Some say they would try to get pupils to think about the idea of possession. Interestingly, some of those who say they would wait until pupils discovered they needed the convention through their own writing indicate that they would help students learn it by giving a "mini-lesson" that sounds remarkably like what those who would teach it if it were part of the curriculum would do. A "mini-lesson" is a brief, teacher-directed explanation of a grammatical convention, literary device or form, common usage, and so on.

Responding to Students' Novel Ideas: Quotation Marks (Elementary)

D2. **Next, I'd like you to imagine that you third graders are writing stories. Jessie, one of your students, hands you the following story:**

(Hand story to person)

One day my frend mary asked me. Do you want to have a picnik? When we got ther we started playing. At the picnik pepol said. Where's your puppy? He is at home? We went home happy. My mother said. I'm glad you had a picnik.

What do you think of Jessie's story?

How would you respond to Jessie? Why?

If the person not mention quotation marks or direct speech: **Suppose you had asked why there is a period in the middle of the first sentence and Jessie explained, "When you get to a period you pause. I want people to pause so that they know the words following the period are Mary's words." What would you do? Why?**

If the person does not mention the rest of the class: **Is this something you would want to bring up with the rest of the class? Why (or why not)?**

If person mentions spelling error, ask: **How would you deal with spelling errors? Why?**

If person does not mention spelling errors, ask: **Are the spelling errors in this paper something you would deal with? Why/why not?**

If yes: **How?**

What grade would you give this paper? Why? (Note: Be sure to get the person's rationale.)

If respondent says she/he would not grade the paper, then say: **Many teachers do have to assign grades, and we are interested in learning how these decisions are made. Suppose you taught in a school where you had to assign grades--what grade would you give this paper? Why?**

Discussion:

A. What is Revealed about Subject Matter:

The advantage of asking a teacher or teacher candidate to respond to a real piece of text is that the text provides almost an X-ray view into the teacher's values and beliefs about what is important in writing. Jessie's story, for instance, provides numerous avenues for response, depending on what the teacher perceives as salient in the story. In this case, our questions about the text provide two different opportunities to learn interviewees' values about writing. First, we ask interviewees early on what they think of Jessie's story. This question is phrased to permit them to focus on whatever aspects of the story they feel are important. We then return to their assessment of the story at the close of the segment, this time asking them what grade they would give the paper and why. Our interest was less in the actual grade than in their reasoning for assigning the grade: In justifying their grade, interviewees indicate the aspects of Jessie's story that mattered most to them.

1. **Focusing on student transcription intention.** The first thing we hope to learn through Jessie's story is whether our interviewees were disposed to discover student transcription intentions and what they see if they look for intentions. Research has indicated that many of the transcription errors made by novice writers are not random errors and are not merely the product of ignorance, but instead represent efforts on the part of the novice to make sense of the language and to convey his or her ideas. In this sample, Jessie has invented a method for indicating that someone else is speaking. Ignorant of the convention of quotation marks, Jessie decided to place a period before each quote, hoping the reader would pause at that point in the story. The student's intentions are clear in the text once this has been pointed out to the interviewee, but the errors could otherwise appear to be random punctuation errors.

The teachers' disposition and ability to diagnose student intentions can have significant consequences for instruction for, in a case such as Jessie's, the teacher who fails to recognize Jessie's intentions may decide to focus his or her instruction on a completely tangential issue such as sentence fragments, rather than on the topic Jessie needs help with, i.e.,the use of quotation marks. Such a lesson may not only fail by teaching the wrong content, but fail again by alienating Jessie, who may not understand the relevance of this lesson.

Failure to diagnose student intentions can also lead to misperceptions of the student's capabilities. The teacher who misses Jessie's intentions may develop a negative perception of Jessie based on the number of apparent transcription errors in this text, whereas a teacher who perceives Jessie's intentions may be impressed with Jessie's ingenuity. These differing

assessments can have important consequences for the amount and kind of instructional attention Jessie receives in the future.

2. **Focusing on the number of transcription errors.** Many of our interviewees focused solely on the number of spelling and punctuation errors Jessie makes. Interviewees who attend primarily to the number of errors do not see patterns in the errors and do not interpret these error by taking into account student intentions. In this text, for instance, three incomplete sentences result from Jessie's invented method for indicating quoted material, and the word picnic is misspelled the same way four times. Taken together, these errors could be counted as seven errors (three incomplete sentences and four spelling errors) or as two errors (a problem with how to indicate quotes and a problem spelling picnic. Most of our interviewees focused on the number of errors rather than the types of errors, and seemed overwhelmed by the magnitude of Jessie's writing problems.

3. **Focusing on story content and structure.** Another important feature of Jessie's story on which interviewees could concentrate was the structure of the story as a story. Some interviewees noticed, for instance, that the story had a clear beginning, middle, and end; others that the role of the puppy in the story was not clear, and that the story seemed to omit some important transitions.

Though some interviewees noticed more than one of these aspects of Jessie's story, most attended primarily to one dimension. In fact, remarkably few interviewees notices either the large number of transcription errors in the text or the story structure. In commenting as they did, they gave us a notion of what they would focus on as teachers of writing.

B. What is Revealed about Teaching and Learning the Subject Matter.

1. **Teacher's role in promoting learning.** Jessie's story is useful not only for what it tells us about what our interviewees think is important in writing, but also for telling us how they think teachers can help students learn to write. We ask them not only what they think of Jessie's story, but also how they would respond Jessie and whether any of the issues they raise would be brought up with the rest of the class. In their responses, interviewees often not only describe a pedagogy but also reveal their assumptions about their role as teachers in facilitating student learning. Pedagogical responses, and the assumptions that seem to be tacit in them, include the following:

The most common teacher role is the *search and destroy* all transcription errors. Some interviewees would literally circle all errors with a red pen: Others feel this strategy is too harsh and prefer some other feedback device such as a conference. Still others feel it would be too painful for the student to enumerate all the errors and to seek to limit the number they identify. Regardless of how this theme varies, these pedagogical strategies all assume that the teacher's role is to see that all errors are eventually removed from the text so that the final products are produced by students. Presumably, students learn by producing such texts, even though they may not understand what they are doing or why.

Another pedagogical response we often saw was to *inform Jessie, and perhaps other students as well, about particular editorial rules*. An interviewee might decide, for instance, to include the word "picnic" in the next spelling list, or to develop a lesson on the use of quotation marks. This response retains the teacher's authority and retains the students' dependency on the teacher to learn what should be done in writing. It differs from the first response in assuming that learning occurs through the acquisition of specific content knowledge about the conventions of writing, rather than merely by following the teacher's directions.

Still a third common response was to assume that the student, rather than the teacher, is responsible for the story. Interviewees who hold this view tend either to say that their response to Jessie would depend on whether this was a first, second, or third draft, or they say that they would ask the student to discuss his or her story's intentions, or ask what happened at the picnic itself, in the hope that such a conversation would enable the student to find his or her own ways of strengthening the story. Teachers who adopt this strategy seem to give students more responsibility for determining the direction their work will take, and see the teacher's role as one of facilitating student work rather than directing it.

2. **Role of evaluation in the teaching/learning process.** We ask people what grade they would give Jessie's paper Many people balk at this; we ask them why. Typically those who do not want to grade the paper are concerned that a bad grade might make the child feel bad. This tells us three things; (1) the story warrants a poor grade based on the number of errors, which in turn reveals an emphasis on technical correctness; (2) they are anxious about giving poor evaluations—they see evaluation as summative and believe that evaluation may hurt students' feelings; (3) they do not see their role as evaluating students' writing as they think students must decide for themselves if their writing is good or not.

We care about evaluation because it is a central task of teaching. Teachers must decide whether and how they will evaluate students' writing. Sometimes their personal views of

evaluation conflict with school expectations. How teachers deal with the task and any related conflicts is something we want to examine.

Moreover, the standards people use to evaluate Jessie's paper help us see what matters to them in looking at student writing and are also a clue to what they think writing *is*.

After we explore why they do not want to grade the paper, we ask them what grade they would give if they had to assign the story a grade. (Some people also grade the story when we first pose the question.) The grades people give Jessie's story, together with their reasons for doing so help us understand what standards they hold for good writing, at least at this level. Some of the standards people use include: length, spelling, penmanship, mechanics (capitalization, punctuation), creativity or authenticity, and innovation. Some people also say that their grade would depend on what they knew about Jessie—for example, does this represent a lot of effort? Is this good for Jessie? Others' standards of evaluation seem less dependent on the particular child.

3. **Orientation to the classroom as a collective.** We ask people if they would bring this up (i.e., how to denote direct speech) with the rest of the class. We want to explore whether people focus on individuals in teaching writing or whether they use the "groupness" of the classroom in some way. How people think about this interacts with how they interpret Jessie's story.

For example, if they see their role as one of assuring that students produce correct texts, they may want to bring it up with the whole class to emphasize the importance of using quotation marks correctly or of spelling correctly, etc. Or, alternatively, they may want to shield Jessie from the embarrassment of having the deficiency pointed out, and thus work with Jessie individually.

People who see Jessie's writing as embodying a novel invention may wish the rest of the class to hear how Jessie thought about the problem of denoting direct speech and went about resolving it. Others may not want to make an example of Jessie (other kids may ostracize pupils whose work is used as a positive example in class).

Responding to Students' Novel Ideas: Documentation (Secondary only)

D2. Next I'd like you to imagine that a student in your class, Dana, hands you a nearly completed research paper. This is a representative selection from Dana's paper. Can you look this over for me?

(Hand the paper to person.)

****

For those artificial sun worshipers who have curled up to a bank of ultraviolet lamps seeking the "perfect" tan for up to thirty dollars an hour.....this quote's for you: "Who needs to pay good money to get cancer when it's free out on your back porch on a summer day." A3 According to the experts, the high risk of skin cancer and repeated warning concerning ultraviolet light has not kept the public away from the corner salons. The price of beauty varies from three dollars for half an hour in the less exclusive salons to thirty dollars per hour in the trendiest parlor in the nation, Hollywood's Uvasum. Salon goers believe that the price for synthetic sunlight is well worth it. "It's worth the money. . . I feel better about myself when I have a tan, people notice me." B1 Salon goers are not alone in their opinion; tanning salon owners express their new-found wealth. "Tanning salons are the best thing since the Ferrari 308-GTO. . . they're hip, they're in, they are worth every penny." C1 To most salon owners, they are worth every penny, considering tanning salons across the country raked in an estimated three hundred million dollars in 1985. D2 Whatever the price, whatever the risk, tan enthusiasts are willing to overlook them for the immediate benefit: a healthy-looking golden glow.

****

Relevant bibliography:

A. "The High-Tech Tan," *Harpers Bazaar*, May 1985: 150-155.

B. "Catching Dangerous Rays," *Newsweek*, June 24, 1985: 69.

C. "Tanning Salon Sees the Light: Putting the Heat on the Midnight Sun." *FDA Consumer*, January 1987: 37-38.

D. "Going for the Bronze," *Time*, February 5, 1985: 82.

What do you think about Dana's paragraph?

How would you respond to Dana? Why?

If the person asks whether documentation has been taught: No.

If the person does not mention novel documentation: What do you think these numbers and letters mean? (Indicate the "footnotes" in the text.)

If the person does not mention the rest of the class: Is this something you would want to bring up with the rest of the class? Why (or why not)?

If you had to assign a letter grade to Dana's paper as it currently stands, what grade would you give it and why?

If the person resists the idea of grades: Many teachers do have to assign grades, and we are interested in learning how these decisions are made.

Discussion:

A. **What is Revealed about Subject Matter:**

Dana's paragraph was intended as a secondary-school parallel to Jessie's elementary-school story, though it does not have such an egregious set of surface errors. As was the case with Jessie's story, we hoped to learn whether the interviewees attended to the student's transcription intentions, to the number of transcription errors they could find, or to the content and structure of the essay itself.

1. **Focus on student transcription intentions.** When presenting Dana's research paragraph, we were interested in whether our interviewees were disposed to discover Dana's invented methods for citing references. Apparently ignorant of the conventional formats for footnotes, Dana has created a novel method for citing references. Dana's intentions are clear in the text once they have been pointed out to the interviewee, but the markings otherwise have no clear meaning. While we intended this student invention to parallel Jessie's invented quotation system, the device did not work as well in our interviews, for some interviewees thought these markings has been placed there by us, the researchers, rather than by Dana.

2. **Focus on the number of transcription errors.** Even though Dana's paper has far fewer transcription errors than Jessie's story did, a common response to the paper was to search out all possible errors. Interviewees who attend primarily to the number of errors do not see patterns in the errors and do not interpret these errors by taking into account Dana's intentions.

3. **Focus on essay content and structure.** Another important feature of Dana's essay on which interviewees could concentrate was the content or structure of the essay itself. Some interviewees mentioned, for instance, that the essay had a clear opening argument, a clear point of view, or that it provided supporting details. Some would comment on the tone as well.

Though some interviewees notice more than one of these aspects of Dana's essay, most attend primarily to one dimension. In so doing, they indicate to us what they value about writing.

B. **What is revealed about Teaching and Learning the Subject Matter.**

1. **Teacher's role in promoting learning.** In their responses to Dana's essay, interviewees often not only describe a pedagogy but also reveal their assumptions about their role as teachers in promoting student learning. Pedagogical responses, and the assumptions tacit in them, include the following:

One teacher role that was prominent among our interviewees was the *search-and-destroy* role: many interviewees seemed to assume that their role as teacher was to assure that students did not produce papers that contained any of the errors they could identify. Indeed, the "searching" part of this role was more apparent in Dana's paper than in Jessie's because the errors were not so numerous and obvious. Yet despite the higher technical quality of Dana's paper, many interviewees studied it carefully, searching for errors. Once a list was developed, it resulted in revisions from Dana which were designed to make the paper conform to the teachers' idea of what a good essay should look like.

Another common response was to *inform students about rules or standards for essay writing*. Many respondents thought a unit on the five-paragraph essay would be in order here, and others thought it would be useful to have students read some examples of professionally-written essays. This pedagogical response still presumes the teacher is fully in charge of the student's learning and that the student is largely dependent on the teacher for direction. But interviewees who adopt this role differ from the first group of interviewees in that they assume student learning derives not merely from following the teachers' directions, but instead by acquiring specific information about writing conventions.

Still a third teacher role was to assume that the student, rather than the teacher, is responsible for the essay. Interviewees who held this view tended either to say that their response to Dana would depend on what draft this was, or they say that they would *ask Dana to discuss his or her goals*, or ask about the essay subject itself, in the hope that such a conversation will enable the student to find his or her own ways of strengthening the essay. Teachers who adopt this strategy seem to give students more responsibility for determining the direction their work will take, and see the teacher's role as one of facilitating students' work rather than directing students with their work.

A small fraction of our interviewees stated that they thought this essay was quite good as it stood, and that they would be happy to have students in their classes who could write this well.

2. **Role of evaluation in promoting learning.** We also asked interviewees what grade they would give Dana's paper. Although elementary teachers often balk at this (on the parallel interview item), far fewer of the secondary teachers do. Some resisted grading a paper of which they have only seen a "representative selection." Others say they cannot grade the paper without knowing more clearly what the assignment was or what standards were given for the assignment. These kinds of responses do not seem to reflect a resistance to grading in principle, but rather a view of an appropriate process of evaluating students' writing—they think students should

decide for themselves if their writing is good or not. This response indicates a particular view of the teacher's role and responsibilities in teaching writing.

We care about evaluation because it is a central task of teaching. Teachers must decide whether and how they will evaluate students' writing. Sometimes their personal views of evaluation conflict with school expectations. How teachers deal with the task and any related conflicts is something we want to examine. Moreover, the standards people use to evaluate Dana's paper help us see what matters to them in looking at student writing, which yields clues to what they think writing *is*.

After we explore why they do not want to grade, we ask them what grade they would give if they had to assign the paper a grade. The grades people give Dana's paper, together with their reasons for doing so help us understand what standards they hold for good writing, at least at this level. Some of the standards people use include: Length, spelling, neatness, mechanics (capitalization, punctuation), creativity or authenticity. Some people also say that their grade would depend on what they knew about Dana—for example, does this represent a lot of effort? Is this good *for Dana*? Other people say they would need to know more about what other students' papers were like. Still others' standards of evaluation seem less dependent on the particular student.

3. **Orientation to the classroom as a collective.** We asked people if they would bring up how to document sources with the rest of the class. We wanted to explore whether people focused on individuals in teaching writing or whether they use the "groupness" of the classroom in some way. How people think about this interacts with how they interpret Dana's work.

For example, if they view their role as assuring that student papers meet their criteria for correctness, they may want to bring it up with the whole class to emphasize the importance of documenting sources correctly or using paragraphs, etc. Or, alternatively, they may want to shield Dana from the embarrassment of having the deficiency pointed out, and thus work with Dana individually.

People who see Dana's approach as novel or clever may wish the rest of the class to hear how Dana thought abut the problem of documenting sources and went about resolving it. Others may not want to make an example of Dana (other kids may ostracize pupils whose work is used as a positive example in class).

These kinds of responses illustrate how teachers' decisions are influenced by their ideas along a number of dimensions. We are interested in these ideas and the ways in which they combine to produce judgments in teaching. We want to understand how both the ideas and the way they interact change over time.

Responding to Student Questions: Pronoun/Verb Agreement (Elementary and Secondary)

D3. Now I'd like to know how you'd deal with a problem that people frequently have in writing.

A second (or eighth) grade student asks you whether to use "is" or "are" in the following sentence: (Hand the person the sentence).

None of the books _____ in the library.

How would you respond and why?

If the person used terms such as "singular," "plural," "prepositional phrase," or "subject," or a technical explanation or analysis:

Is this how you'd respond to the student?

If no: What would you say to the student?

What if a sixth grade senior student asks you this question? Would your answer be different?

If no: Why not:

If yes: What would you say? Why would you answer differently?

If the person uses terms such as "singular," "plural," "prepositional phrase," or "subject," or technical explanation or analysis:

Is this how you'd respond to the student?

If no, ask: What *would* you say to the student?

Some people argue that teaching things like whether to use *is* or *are* in the sentence "none of the players [blank] on the field" is more important for minority children than for non-minority children. What do you think? Why?

Discussion:

A. What is Revealed about Subject Matter:

Students ask a variety of questions of their teachers. Each time they do, the teacher needs to decide whether to answer the question directly or to use the question as an occasion to explore a substantive issue more deeply. Their choice of response, then, represents in part their perception of the importance of the issue the student has raised and in part their understanding

of the issue itself. Of particular interest to us in this question is how our interviewees respond to a complicated issue of verb usage. The question gets at several issues simultaneously.

1. **The importance of the decision.** One thing we can learn from our interviewees is the degree of significance or importance they attach to this issue. Some interviewees would tell the student it doesn't matter which verb they use or that they should not worry about the technical aspects of their writing. Others would give the student a verb with no accompanying explanation. Still others would have the student look this up and still others would devote an entire lesson to it.

Related to the question of the importance of this decision is a perception of the importance of language usage decisions in general. Some of our interviewees not only found such decisions important but were extremely intimidated by them as well and expressed high anxiety over their own inability to solve this problem.

2. **The historical context for this problem.** The particular problem this student has posed is one that has been argued about by grammarians for at least two centuries, with the consensus regarding the best solution changing from one period to the next. If a teacher were so inclined, this student's question could provide a springboard for a more general discussion about who decides on language conventions, how such decisions are made, and how fixed or changeable such decisions are. Though the student's question could, in principle at least, provide an opportunity for examining the source of language conventions, none of our interviewees mentioned this historical context in their responses. This might indicate that they are unaware of the issue of conventions as important, or that they are exclusively concerned that students learn grammatical conventions with no regard for context.

3. **The particular language usage principles involved in this problem.** The problem this student poses involves subject-verb agreement. That is, the English language requires a plural verb to accompany plural nouns and singular verbs to accompany singular nouns. However, this student's sentence is more complex because the subject is the pronoun "none", which *is by itself neither singular nor plural.* A popular solution to the problem is to assume "none" is singular, and many of our interviewees had learned this as a rule for filling in this particular blank However, the singular solution is far from agreed upon by language arbiters. The most prominent recommendation today is to consider ambiguous pronouns (none, some, all, any) as changing from singular to plural depending on their referent. That is, when the pronoun "some" refers to pie, you place a singular verb with it ("Some of the pie is gone"), but when it refers to coins, you place a plural verb with it ("Some of the coins are gone"). Extending this

argument to the pronoun "none" yields the singular form for a sentence like, "None of the pie is missing," and a plural form for the sentence, "None of the books are in the library." In the library sentence, the pronoun "none" refers to the plural "books" and therefore takes a plural verb, "are."

Almost none of our interviewees knew the history of the argument about this point of usage, nor knew the current resolution to it. In fact, the range of rules and admonitions they provided for solving this problem was astonishing. Many of their rules had nothing to do with the general principle of subject-verb agreement, let alone with the special case of ambiguous pronouns.

B. **What is revealed about teaching and learning the subject matter.**

1. **The "teachability" of the usage principles involved.** Yet another aspect of language that is revealed through this question has to do with whether the principles involved in choosing a verb for this sentence can even be understood, articulated or discussed. Many interviewees seemed to think the question reflected such an esoteric aspect of language that it was beyond their own or their students' capacities. Rather than trying to explain the language usage issues involved in this sentence, they would tell their student one of the following:

(a) "Look it up." Interviewees who took this approach often seemed unsure themselves of what verb should be used here, and so suggested that students look it up. They seemed to imply that such usage issues were essentially unfathomable, and it was therefore necessary to check with an expert rather than try to reason it out on one's own. Those who adopted this pedagogical strategy, though, never said where the student should look to find a solution to this problem.

(b) "Use your ear." Some interviewees suggested that the student try writing or speaking the sentence both ways and select the verb that seemed right based on this intuitive test. While such a solution may be successful for native English speakers, it may not help others. Even for native speakers, this pedagogy does not help students understand the reasoning behind the conventions they are using, and may not help them through the next problem they encounter.

(c) "Obey a rule of t' umb." Many of our respondents offered the student a rule of thumb for choosing the appropriate verb. These rules were remarkably diverse,

and often yielded different discussions. Some had no apparent relationship to the subject-verb agreement principle, or to the special case of the pronoun "none."

2. **Curriculum: When is pronoun/verb agreement taught?** Knowing when pupils are likely to be taught about subject/verb agreement, and about special cases, is part of interpreting this question. The question presents elementary teachers with the case of a second grader; secondary teachers a tenth grader. The follow-up probe asks whether their response would be different for a different grade. To the extent that responses to this probe change over time, we learn what kinds of curricular knowledge people acquire from their school and everyday life, what develops in teacher education, and what develops once they are teaching.

3. **Learners: Knowledge and assumptions about pupils of different ages.** Closely related to curricular knowledge is knowledge about pupils. We want to know people's notions about pupils of different ages. For example, some elementary teachers would *tell* second graders the answer but open the question up for discussion with sixth graders. This response may reflect the assumption that second graders need things to be straightforward and definite. Some people see this question as a simple request for factual information and therefore respond similarly no matter what the age of the pupil, even though age might dramatically affect their approaches to other issues in teaching writing—helping a pupil construct a rough draft, for instance.

We are interested in this for two reasons. On one hand, we want to know what people know and believe about different pupils—in this case, different ages. On the other hand, our framework also assumes that, in teaching, teachers' choices are shaped by the interaction of their ideas about students, about how students learn to write, about what they need to learn, as well as about what writing and learning to write entail. This two-part question offers the opportunity to change just one feature of the situation and to examine what effect, if any, this change has on the weaving of teachers' judgments and choices.

E. Structured Exercise in Teaching Writing

This final section of our interview presents interviewees with an opportunity to integrate many teaching tasks—evaluating textbooks, planning an instructional unit, responding to student difficulties, and evaluating student work—into a coherent instructional strategy. We focus this exercise on planning and organizing for writing, in the hope that the discussion would give interviewees who would teach writing through a process approach an opportunity to describe how they would do this. In addition, we include questions about the interviewee's own experience learning to write and their experiences writing. We included these questions to elicit the consistencies and inconsistencies in interviewees' understanding of writing and of learning to write. We expected to encounter two kinds of inconsistencies. On one hand, interviewees may espouse a very particular set of procedures for writing, such as outlining or using note cards, yet concede that they do not use these procedures themselves. On the other hand, interviewees may want to teach an iterative writing process, yet describe instruction that is more prescriptive. Such inconsistencies are particularly valuable when studying teacher learning, for they represent unstable areas, areas likely to change over time.

In the secondary exercise, a writing text is included; in the elementary exercise no text is examined.

E. Secondary Writing Exercise: Essay Structure

E1. **Here's a section from a writing textbook. I'd like you to take a few minutes to look it over and then we'll talk about it.**

Show passage on structure from Lively Art of Writing (See Appendix for passage).

What kinds of writing would a passage like this help prepare students to do?

What do you think of this excerpt? What are the main strengths of this excerpt? What are the main weaknesses?

Probes: **This chapter seems to be based on the premise highlighted with an "A" in the first paragraph. Do you agree with this premise?**

If a person asks for clarification of the premise, ask them to tell you what it means to them.

In this chapter, a solution to this problem has been proposed and is illustrated in Figure 1, highlighted with a "B" in the excerpt. Do you see this as an effective solution to the problem? Why or why not?

E. Secondary and Elementary Exercise: Teaching Organization in Writing

The next series of questions deal with something that often causes students problems--organization.

E2. Do you remember learning anything about organizing your writing?

If yes and the person does not mention what was learned, ask: What did you learn?

If yes and the person does not mention where this was learned, ask: Where did you learn this?

How do you try to organize your writing now? Do you find anything difficult about organization?

Now I'd like to ask you about how you might help students learn about organization in their writing. Let's use the grade you teach (or hope to teach) as the context for thinking about this.

E3. In teaching this grade, would you deal explicitly with organization?

If yes: How and when?

If no: Why not?

For the purpose of the next few questions, let's say you were in a school where this was part of the curriculum.

E4. What do you think students already need to know before they can learn about organizing their writing?

Keep a list of the skills/ideas/etc. the person mentions. After s/he finishes, ask for each skill/idea/etc.: Why is _____ important?

E5. Is there anything about learning to organize that you would believe [is] difficult for students at this grade? If so, why?

E6. How would you decide whether your approach to helping students organize their writing was successful?

E7. If you found that your approach to helping students organize their writing wasn't working, what would you do?

E8. Students often make remarks such as, "This is boring--why do we have to do this?" If a student in your class made such a remark when you were working on organization in writing, how would you respond, and why?

E9. **Here is a paper a fourth (or eighth) grade student wrote in response to an assignment that asked him to read about dolphins and fish and to write a report about them.**

[Hand the person the paper]

Dophins are really not fish. Other fish have gill to breath in air and blow out again. Dophins have something that is called a blowhole. Dophins can only stay onder water for apramitly six or senven minutes.

Dophins are like other big, big water animals they eat other small water animal.

The ocen is the only place that Dophins can live.

The reason that the Dophins can only live in the ocen is because the Dophins have to live in salt water. Dophins are somewhat reladed to sharks and whles. There are only one kind of Dophins. There are very few places that have Dophins.

Matter of fact there are only two place that have Dophins.

The two places that have Dophins are the coast of Maine and Alaska are the only two places that have Dophins. The Dophins can weigh up to three tuns. In 1963 a man was killed by a Dophin.

The Dophins name was Julie. The way they can tell is the markins on the Dophins tale.

How would you respond to this piece of writing?

How could this piece be improved?

If the person does not mention helping the student *revise* the paper, **ask: Would you have the student revise this paper?**

If yes: How would you go about getting the student to revise it?

If no: Why not?

If the person does not mention the *organization of the student's paper*: **What would you do to help this student with the organization of this paper?**

If the person does not mention the student's *use of supporting details*: **Looking at the paper again, does the student use specific details to support his or her main point? Can you show me in the paper?**

Suppose this were a _____ (use a grade four years higher or lower). **Would your approach differ?**

If yes: How? Why would you change your approach?

If no: Why not?

A. **What is revealed about subject matter:**

1. **The Nature of Writing.** How people think about organization in writing depends in part of their assumptions about the nature of writing—whether it is a process of encoding ideas already developed, an aid to thought and understanding, an opportunity for self-expression, a utilitarian tool, or a combination of these things. Four main viewpoints about writing dominated our responses.

Organizing as a prescribed set of procedures. Some interviewees talked at length about the importance of outlines. Typically, they thought there was a single best way to organize, that one "ought" to produce an outline. For these interviewees, organization = an outline, a set of note cards, or a combination of the two. They often described teachers or classes in which they were taught to write outlines for text. Reflecting the language of writing process theorists, some interviewees identify organization with "prewriting." These interviewees often discuss processes such as "brainstorming" as necessary precursors to writing in the same way that others might identify outlines for this role.

Organizing as an iterative process. Another group is less inclined to see the outline as the defining feature of organization. They emphasized instead the need to work out their ideas as they write. For them, organization is a more iterative process that occurs as they refine their idea in writing.

Organizing as an interactive process. A third point of view tends to emphasize the role of interactions with others as an integral part of organization. That is, part of getting organized is discussing one's ideas with others and perhaps even trying out your argument or storyline in conversation with others.

2. **The importance of organization as content for students to learn.** An important part of subject matter knowledge has to do with knowing why particular content is important for students to learn. To learn what our interviewees valued about organization we presented the problem of a bored student, asking them how they would respond. Our intent was to get at our respondents' understanding of why organization is important. Do they see organization as principally a utilitarian skill that everyone needs in life? Do they see it as primarily a medium of self-expression? Do they see it as a pre-requisite skill for further schooling? Or do they see writing as a way to develop and refine one's ideas and thinking?

The majority of our interviewees perceived organization to have a utilitarian value. Some argued that it was important to learn to organize for future success in school. A related response is that organization skills were essential to pupils' eventual success in the job market. A smaller

group say organization as enhancing one's ability to communicate with others, and a smaller group still saw organization as enhancing one's general intellectual capacity.

3. **The concept of paragraphs.** We also include sequence of questions in this section asking interviewees whether and how they would teach paragraphs to their students. We focus on the paragraph because of the central role it plays both in writing and in the writing curriculum of many schools. It is also a writing problem that students tend to have difficulty with, and to which all teachers must attend. We are interested in how respondents would go about helping pupils learn this difficult and highly judgmental aspect of writing, and in the extent to which they are inclined to give students rules of thumb for creating paragraphs or are inclined, on the other hand, to convey to students the judgments involved in forming paragraphs.

Responses varied tremendously. For example, some respondents defined paragraphs by their surface features, concentrating, for instance, on indentation. Others offered a variety of prescriptions for paragraphs: each must contain a topic sentence followed by three additional sentences, or each must contain a main idea and some supporting details. Still others struggled to explain how paragraphs help readers follow your thinking, and the idea that writers should start new paragraphs when they start new ideas.

B. **What is revealed about Teaching and Learning the Subject Matter.**

1. **How organization is learned.** Our interviewees held three distinctly different views about how students could learn to organize their writing. One point of view say learning as a process of accumulating new knowledge, continually adding new building blocks to those already in place. People who held this additive model of how students learn to write often suggested that pupils should first learn to write words, then sentences, then paragraphs, then essays, and so on. They believe not only that organization should be taught at a particular level but also that it should be taught as a particular procedure—for instance, by teaching pupils to use note cards or to outline.

The second point of view was that pupils should not be taught organization explicitly but that they should struggle with organization and thereby learn how best to organize their own work to express ideas that are of value to them. From this point of view, when to teach about organization depends on when pupils need to know about organization in order to get across their ideas.

The third point of view holds that helping pupils to express themselves in writing is a social process. By discussing their ideas, beliefs, experiences, and feelings with classmates, pupils are organizing their thoughts for writing.

2. **How teachers can gauge their success.** One of our probes asks interviewees how they would know if their efforts were successful. The focus of this question is how respondents would go about evaluating their pupils understanding of organization. The evidence they rely on provides further indications of their understanding of the nature of writing as a school subject and of what is important for students to learn about organization in particular. For some, evidence of success is revealed when students produce outlines on notecards that conform to the teachers' prescription. For others, the only reliable indicator is the clarity and organization of the final paper. For still others, evidence of learning resides in the behaviors of students as they move through successive drafts in their projects.

3. **Responding to student disorganization.** The closing sequence in this section of the interview presents respondents with another sample of student writing. As with our other writing samples, we offered many different things for interviewees to focus on. including a failed attempt at paragraphing. This time, in part because the sample was located in the context of a lengthy sequence on organization and paragraphing, most interviewees focused on the students' paragraph structure. Even within this narrower range of issues, though, interviewees differed considerably in their orientation to this text. Some, for instance, concentrate on the physical appearance of paragraphs and would prescribe for this student a rule of thumb such as starting the paragraph two finger widths in. Others prescribe an entire outline, suggesting how the student should re-arrange the sentences to form a more coherent essay. Still others offered procedural definitions of paragraphs for the student. Finally, some attended to the student's intentions, and noticed that this student showed some evidence of grasping the concept of paragraphs but had not yet learned to implement it. That is, the student often began a new idea at the end of a paragraph and then began a new paragraph.

C. **What is revealed about teaching and learning to teach**

1. **Adjusting one's teaching.** Closely related to the important task of evaluating the success of a lesson is responding to student difficulties identified through such evaluations. We therefore asked our interviewees what they would do if they found that their approach to teaching organization was not working. We were interested in how and where respondents thought they could get new ideas needed for teaching. This, in turn, informs us of their views of the nature and sources of teacher knowledge.

When confronted with failure, some respondents said they would look in composition or language arts texts for other approaches. Others already had alternative approaches to helping pupils organize their writing. For instance, they would get pupils who were good at outlining

to help those who weren't so good. Still others thought they would ask a colleague how they help their pupils with organization. Finally, some thought they might revisit earlier steps such as prewriting to get pupils to think through what they want to say to say and to whom.

As was the case with other writing samples, we also found many interviewees whose response was largely limited to searching out all possible errors, and who seemed to lack an ability to sort these many errors into a coherent instructional plan.

THE OBSERVATION GUIDE

Interview and questionnaires are useful in trying to examine teachers' knowledge—what they know about the subjects they teach, what they believe about students and about how students learn, what they think about good ways to teach. Only in the classroom, however, is it possible to understand how teachers' ideas and commitments are blended in action—what they are both *able* and *inclined* to do. For example, watching a teacher conduct a conference with a student about a piece of writing and having an opportunity to talk with the teacher afterwards affords a rich opportunity to explore influence on as well as the rationale for the teacher's practice. What does the teacher know about the student's writing and why? What does the teacher consider to be the purposes of such conferences? Observation of actual practice reveals how the different things that a teacher knows and believes come together in making decisions and pedagogical moves.

Our observation instruments are relatively unstructured guidelines for what to attend to and how to write up the notes. A set of broad analytic questions (see section D) to be answered by the observer afterwards helps to guide the observations further. Similarly, the pre- and post-observation interview guides are flexible, directing the exploration of specific issues as they fit the situation. The reason for using more open-ended instruments rather than, for example, a checklist, is to be able to examine a wide range of kinds of teaching—from whole group lectures to independent work.

One drawback of observation (unless the observer is able to visit the classroom very frequently) is the inherent sampling problem: the observer sees whatever it is that the teacher happens to be teaching. The teacher may be reviewing the use of semicolons, introducing the concept of factors, meeting with individual students about their story drafts, or conducting a discussion about a geometry problem. The particularity of these occasions, while providing precisely the concreteness that makes observation uniquely helpful, also bounds the sorts of things that can be learned about the teacher's knowledge and ways of thinking. This randomness also affects comparability across cases of teachers. Conducting a multiplication facts drill is a different sort of pedagogical occasion than is orchestrating small group work on a probability problem and assessing the representativeness of what is observed is difficult.

Still, observations contribute importantly to the analysis of the different things that teachers know and believe—about subject matter, students, learning, and context—and how those come together in their teaching. Observations also provide a sense for the physical environments as well as the social contexts in which teachers interact with students. These afford the opportunity to appreciate both the possibilities and constraints under which teachers operate, within which to understand better the social interaction between students and the teacher. Studying interactions between teachers and their students provides a window on what teachers

think about the differences among learners. How they conceive, recognize, and accommodate diverse learners can be best learned in the context of their particular classrooms, instead of in a formal interview which often elicits answers constructed to be socially appropriate.

The actual observation shapes the post-observation conference discussions. When we observe teachers working with students, we can probe what we see them do in ways that give us insight into their beliefs—what they mean by "letting kids figure it out for themselves" or "problem solving," for example. We also learn about the kind of discourse they promote in their classrooms and why. The general set of questions we have developed for our pre- and post-observation interviews help us probe what we see the teachers do. These conversations help us to get inside their practice and, thus, to gain another view of what they know and can do.

A. **Pre-Observation Interview**

This should be done briefly. You may have to conduct the interview the night before you observe, since arranging time to talk to a teacher during the school day, even for ten minutes, is difficult.

Record teachers' comments verbatim. If at all possible, tape record these interviews. If the interview is conducted over the phone, a Lavalier microphone can be strapped to the earpiece of the phone. Use the tapes as source material to get quotes for writing up the pre-observation interview. (Of course, you must always receive permission from the person being interviewed.) The reason we want to tape the interviews is that for some analyses, we may need to know exactly what teachers said. We will not transcribe these taped interviews.

Summarize the information about curricular materials together with the rest of your write-up of the pre-observation interview.

A. PRE-OBSERVATION INTERVIEW

Teacher _____

Observer _____

Date _____

A. The Session

1. Could you tell me a little about what you are planning to do when I observe your class?

2. Can you give me more detail about what the students will actually be doing?

3. Why did you decide to do that?

   How does it relate to the rest of your work in mathematics?

4. Is there anything in particular you are hoping to have happen today?

5. How likely is it that (the specifics mentioned in q. 4) will happen?

   What will it depend on?

   What might upset your plan?

6. Will this be difficult for any of your students?

   Why?

7. Is there anything I should especially pay attention to while I'm observing?

B. Observation

1. Observing and taking notes:

   a. Arrive about half an hour before the scheduled observation time. Find a comfortable place to sit where you can see and hear well. Sketch a map of the physical arrangement of the classroom, labeling areas and displays.

   b. At the front of the observation guide is a checklist to help you record features of the class. Summarize this information at the beginning of the write-up of your fieldnotes (see below).

   c. Section D of this observation guide contains a set of questions you will answer after your observation. Study these beforehand so that they can guide your observation and note-taking.

   d. Tape record the classroom sessions. While we will not be transcribing these tapes, there will be times when you will need exact quotes. Completed field notes should stand by themselves as a record of the session.

   e. As you take notes, try to get as many direct quotes as possible, especially when the teacher talks about the subject matter (e.g., when s/he gives explanation, answers, or asks questions, or gives directions).

   f. Refer to the teacher as T, and students as G1, G2, B1, etc. Assign students numbers as they are called on or speak in class.

   g. Note the time every few minutes, or when something (e.g., task, activity) changes.

   h. If you lose concentration, or miss something, note this. Later it may be helpful in understanding why something in the field notes is unclear.

   i. Write up your notes as soon as possible after the observation while your memories are still fresh. Use the tape to supplement your handwritten notes.

2. Writing up field notes:

   a. Write the teacher's code number and name and the date of the observation at the top of the field notes.

   b. In your written field notes, begin by describing the context:

      * A description of the classroom (taken from the checklist, see (b) above).

      * A description of the task(s) in which pupils and teacher are engage during the session.

   c. Conventions for write-up:

      * When quoting dialogue, use "T:" or "G1:," followed by whatever the teacher of student said. Double space between speakers.

      * Bracket observer's interpretive comments.

      * At the end of the field notes, make a section called "Attachments" and list all the documents collected that accompany this observation (e.g., worksheets, map of the classroom). These documents should be copied and turned in with your completed field notes.

3. Answer the questions in Section D of this observation guide. These are meant to integrate and be interpretive. Be sure to specify the evidence for your assertions giving the source and location of the data that support them.

National Center for Research on Teacher Education

OBSERVATION

Code _____

SITE: _____

OBSERVER: _____

DATE: _____

GRADE: _____

OBSERVATION # _____ for this teacher

TIME: Begin _____ End _____ Total length: _____ hrs. _____ min.

MAP OF THE CLASSROOM

CLASSROOM DESCRIPTION

Teacher _____ Grade and subject _____

Observer _____ Date _____

Part I: The Physical Classroom

A. Seating Arrangement:

_____ students have assigned seats
_____ seating appears to be random
_____ desks arranged in rows and columns
_____ desks arranged in semi-circles
_____ desks arranged in clusters
_____ tables are used, not desks

B. Walls:

_____ student art work
_____ student math assignments (nature, teacher's comments)
_____ rules of behavior posted
_____ rules of math posted
_____ illustrations of mathematical concepts posted
    _____ number line
    _____ pictures
    _____ graphs or charts
    _____ other:

Make notes here of the things you see and describe them later in your narrative account.

Part II: The Students

A. Number of students _____

B. Ethnicity

_____ mostly white
_____ mostly black
_____ mostly Hispanic
_____ mostly one other type (specify): _____
_____ a mixture of: _____

C. Gender

_____ about 50% girls, 50% boys
_____ skewed (describe): _____

Part III: Narrative

C. Post-Observation Interview

Try to do this interview as soon as possible after observing. After morning observations, you may be able to eat lunch with the teacher. Following afternoon observations, a 20-minute session after school could be arranged. Follow the same guidelines as for the pre-observation interview. In addition to the questions on the interview schedule, ask any questions that arose while you were observing the class. (Your tone should be interested and curious, not challenging.)

Post-Observation Interview

1. **How did you feel things went in class?**

   - **How did things compare with what you had expected?**
     Did anything surprise you?

   - **Was there anything you were particularly pleased about?**
     What; why?

   - **Did anything disappoint you?**
     What; why?

2. **How did you decide whom to call on?**
   (To work at the board, to answer questions, etc.)
   Probe about any particular pattern of calling you noticed.

3. **One thing we're interested in is how teachers select the activities, tasks, explanations, examples, that they use or how they decide to explain thing to children.**

   I noticed that you said/did _____.

   For each representation probed:

   - **Where did this (example, story, task, explanation, etc.) come from?**

   - **Why did you decide to do this?**

   - **Does it have any particular advantages or disadvantages (benefits or drawbacks)?**

   If only advantages are listed, probe for disadvantages; and vice versa.

   Repeat for each representation identified.

4. **I noticed the children (were; were not) divided into groups.**
   Why? (or why not?)

   Do you avoid or rely on groups most of the time?
   Why?

   If groups: **How were these groups formed?**

   If groups: **Do you ever move students from one group to another?**

5. **As usual, I've only been able to observe this one day.**
   Was this session typical of what you're doing (in math, language arts, etc.) these days?

   If yes: **Did you do anything special because you knew I would be here?**

   If no: **How was today's session different from usual?**

6. **I noticed _____. Why is that, or why did that occur?**
   This is a space for observer to ask about anything s/he finds curious during the observation.

7. **Are you talking with any other teachers who are in the program?**

   How frequently?

   Think of a recent conversation you had. What did you talk about?

   Is this conversation typical of the conversations you have with the other teachers in the program?

8. **Are there any questions that I haven't asked you that you think I should have?**

Thank you for all your time today. I have enjoyed visiting your class and talking with you.

D. Observer's Comments

These questions are *interpretive* and intended to *integrate*. Researchers should draw on their notes from the pre- and post-observation interviews in answering these questions, and should state clearly the evidence for their assertions. Other researchers should be able to use this interpretive section as *one* possible analytic index to the field notes.

Questions to be Answered by the Observer after the Observation

These questions are *interpretive* and intended to *integrate*. Researchers should draw on their notes from the observation and from the pre- and post-observation interviews in answering these questions, and should state clearly the evidence for their assertions. Other researchers should be able to use this interpretive section as *one* possible analytic index to the field notes.

1. (Agreement) To what extent did the observed lesson agree with what the teacher said in advance (i.e., in the pre-observation interview)?

2. (Advance Organizer) Did the teacher set up the lesson in any particular way? Did s/he use an advance organizer? (Where in the field notes is the teacher's advance organizer?)

3. (Classroom Management) What is the teacher's approach to classroom management? (Sources of evidence?)

4. (Questions) What kind of questions did the teacher ask, and was there a particular pattern to the questions?

5. (Awareness of Learners) How aware did the teacher seem to be of his/her learners' strengths and weaknesses? How did the teacher find out what students knew or could do?

6. (Student Errors) What kinds of errors were made (what seemed to count as an error in this classroom)? How did the teacher respond to them?

7. (Student Diversity) How did the teacher respond to student diversity?

8. (Subject Matter) How well did the teacher seem to know the subject matter at hand? (Draw your inferences from the teacher's stated goals, the analogies, stories, and explanations used, questions asked, and responses given.)

9. (Content Difficulty) Does the teacher seem to be aware of any particular difficulties inherent in the content itself?

10. (Other Comments) Are there any other comments you have about this observation?

THE QUESTIONNAIRE

A questionnaire has many advantages. It presents all respondents with identical items and options, affording a high level of control and comparability across respondents. It can also be administered to a large number of respondents, enabling more stable measures of population differences (e.g., between prospective and practicing teachers, or between liberal arts and teacher education students). The closed-ended format does, however, limit respondents' latitude in expressing their ideas. Making inferences about teachers' ideas is more difficult when their responses cannot be probed to know what they mean or how they are interpreting a particular item. For example, interpreting midpoint responses on Likert scale items is impossible: A respondent choosing the midpoint may mean any of the following: (1) "I don't know what I think," (2) "I have no opinion," or (3) "This is a very complicated matter and depends on the situation." These three responses are all important from the point of view of understanding teacher change over time, but they are different. Here the interview data can complement and fill out what is learned from the questionnaire.

Our questionnaire was designed to examine teachers and prospective teachers' ideas and understandings about mathematics and writing, about teaching, learning, and the teacher's role, about learning and learners, and about the contexts of schooling. Some questions are multiple choice, others are seven-point Likert scale items. The seven-point scale was selected on the advice of survey experts, who recommended that, given the longitudinal design of the study, the form should allow respondents to "move" in one direction or another over time. The questionnaire also includes a section on demographics and personal academic history of the respondents.

As we used it, the questionnaire had four sections. The first section elicited demographic and background information about the respondents. Since the study was longitudinal, this section only appeared the first time someone responded to the questionnaire. Thereafter, we only administered the remaining three sections. These three sections addressed mathematics and the teaching of mathematics, writing and the teaching of writing, and general ideas about teaching and learning.

To develop these latter three sections of the questionnaire, we first developed a "conceptual map" of the various issues we wanted to address. We then developed several items that we thought would tap each issue. In the questionnaire itself, these items were randomly arranged.

One problem with designing a questionnaire, especially for a comparative, longitudinal study such as ours, is that we could not know in advance how well it would function in different

sites and over time. After it had been used, we could then analyze the items and see whether they were functioning in the way we had intended. Instead of presenting the questionnaire as it was originally administered, we group the items here conceptually.

Below we first present our conceptual map of the questionnaire in which all the items are indexed according to the dimensions of teacher knowledge they were designed to tap. Following that map, we list all the items we used reliability coefficients for these items are available upon request to the Center. For those readers who wish to recreate our questionnaire with the time sequence that we used, we also provide the item numbers (see the first column) as they appear in our questionnaire.

Beliefs and Knowledge Measured on the Questionnaire

I. SUBJECT MATTER

1. **Personal attitudes and behaviors**

a. Enjoyment	A1, 4; B2
b. Confidence	A3; B3, 4, 5
c. Avoidance	A2; B1
d. Behavior	A6, 7, 8, 9, 10, 11

2. **Beliefs about the subjects and about teaching them**

Ideas about good writing

a. Effective communication	A14, 66, 76, 101
b. Mechanics & grammar	A5, 23, 37, 66, 68, 69, 76, 97, 99, 120, 121, 126, 127
c. Nice or correct product form	A31, 34, 92, 111, 124, 130
d. Logical organization	A30, 109
e. Audience, voice, purpose	A32, 98, 123, 125, 129, 131
f. Creative	A67
g. Revised product	A33, 73
h. Separate subject or integrated with others	A12, 36, 106
i. Connection with reading	A16, 36
j. Neatness	A38, 77, 122, 128

Ideas about mathematics

k. Rules/procedures	B8, 19, 23, 31, 38, 69, 76, 85, 94, 104-106
l. Body of knowledge	B14, 18, 25, 35, 92
m. Way of thinking	B15, 20, 25, 26, 68, 76, 92, 93, 97
n. Linear, step-by-step	B7, 24, 65, 76
o. Arbitrary, abstract	B8, 9, 104-106
p. Creative	B6

Purposes for teaching writing

q. Job skill	A22
r. School skill	A13, 20
s. Tool in life/communication	A14, 19
t. Express thoughts & feelings	A18
u. Way of thinking	A17, 26, 68, 74
v. Be literate	A15, 21, 23, 24

Purposes for teaching math

w. Think better	B10
x. School skill	B12, 16
y. Tool in life/jobs & careers	B11
z. Be educated	B13

3. Knowledge of the subjects	
a. Writing (structure)	A112, 113-114, 115
b. Composition	A83, 86, 87
c. Syntax	A84, 85
d. Voice, audience	A88
e. Punctuation	A116
f. Writing process	A72, 91, 118
Mathematics (topics)	
g. Proportion/ratio	B77
h. Division	B78, 79, 81, 84
i. Rectangle	B98-102
j. Place value	B82, 92
k. Negative numbers	B80
l. Slope	B103
m. Equations	B83, 107-111
n. Fractions	B78, 84

II. TEACHING AND LEARNING

4. Tasks (activities)	
a. Explaining, showing how, modeling	A89, 90; B108, 109, 110
b. Responding to students	A71, 101, 112, 117-119; B94-97, 98-102, 107, 111
c. Evaluating students	A66, 68, 70, 95, 96, 100, 102-107, 132; B65, 68, 77, 92, 103; C15
d. Planning: Developing curriculum	B73; C19
5. Teachers role (approach)	
a. Directive	A70, 81, 89, 90, 92, 93, 99, 111, 116, B63, 67, 74, 75, 94-96, 98, 107-111
b. Facilitative	A71, 89, 90, 91, 101, 109-110, 116, 119; B64, 74, 75, 97, 99, 100; C13
c. Modeling	A89, 90, 99; B34, 74, 75
6. Teachers role (goal)	
a. Transmit values	C20
b. Foster inquiry	C21
c. Teach subject matter	C22
7. Curricular decisions	B73, 86-91; C10, 18, 19
8. How learning occurs	
a. Development	A44, 45, 47-50; B37, 42-45
b. Constructing knowledge	A36, 100; B63, 64; C13
c. Additive	A40, 72, 75, 93, 99; B32, 36, 38, 66

9. Social dimensions	
a. Interaction with others	A35, 46, 73, 80; B35, 95
b. Individual	A78; B71, 72; C1
10. What to do to learn	
a. Practice[1] (repetition, drill)	A99, 116; B32, 33, 66; C12
b. Practice[2] (engagement in the craft of doing_____)	A45, 46
c. Memorize	B8, 85, 100, 104-106, 111
d. Incentives	C3

III. LEARNERS

11. "Ability"	
a. Sources of failure	C27
b. Sources of success	C26
c. Native ability	A31, 41, 42; B3, 28, 40; C26, 27
d. Effort	B5, 29; C26, 27
e. Self-confidence	B27
f. Interest	B30
g. Anyone can achieve	A43
12. Diversity	A15, 41
a. Social class	A23-29; B18-22; C16, 26, 27
b. Handicaps/gifted	A79; C9
c. Gender	A39; B39
d. Students having difficulty	B76; C14
e. Age	A44, 47-50, 77; B41-45
f. Visual learners	B17
13. Kids' interests & difficulties	A43, 94; B31, 60; C4

IV. CONTEXT

14. Classroom context	
Organizing students	
a. Whole group	B71; C11, 16
b. Small group	C15
c. Individual	A71; B70, 72
Opportunities to learn	
d. Universal:	C2, 7
e. Differentiated, based on ability	B70, C5, 9, 11, 16, 17
f. Classroom management	A80; C4; D4, 10

15. **Community, cultural context**	A15, 23-29; B18-22; C23, 26, 27

V. LEARNING TO TEACH

16. **What teachers need to know**	B46
a. Subject matter	A51-57, 62, 82; B47-52, 55
b. Skills of teaching	A58, 63; B58; D3
c. What other teachers do	A59, 60; B53, 54; D3
d. About students	A64; B60
e. Experience	A65; B62
f. Patience	B51
g. Curriculum	A63; B61
h. How authors/mathematicians work	A61; B56, 57
17. **How teachers learn**	A55-65; B52-62; C6, 8; D3
18. **Expectations and feelings about the job**	A82; C24, 25; D1, 2, 4-13

CODE NUMBER _____ _____

NAME (Please print): _____/ _____/ _____
Last Name First Name Initial

National Center for Research on Teacher Education

QUESTIONNAIRE

The National Center for Research on Teacher Education is conducting a study to investigate what students and teachers think about teaching mathematics and writing. Writing and mathematics are subjects that everyone has studied at some point in school. We are interested in your views about learning them and teaching them.

Please answer all the questions. We need your responses to all of the questions in order to understand as much as possible about what you think.

We are not connected with your educational program, nor are we doing an evaluation of it. The information we collect will not be used in any way that would reflect on you personally. What you say will be held in confidence, and we will not use your real name in any reporting of data. This cover page with your name will be removed from the questionnaire when you complete it.

PLEASE NOTE: ALL INFORMATION ON THIS SURVEY WILL BE KEPT STRICTLY CONFIDENTIAL BY THE CENTER. NO INFORMATION REGARDING NAMED INDIVIDUALS AND THEIR RESPONSES WILL BE GIVEN OUT.

CODE NUMBER _____ _____

Today's Date _____/ _____/ _____
Month Day Year

1. Date of Birth

_____/ _____/ _____
Month Day Year

For each of the following questions, please circle the response that describes you.

2. Gender

1. Male
2. Female

3. How would you describe yourself?

1. Asian
2. Black
3. Caucasian
4. Hispanic
5. Native American
6. Other (*please specify*): _____

4. Which of the following settings best describes where you spent the majority of your pre-college life?

1. Small town/Rural (pop. less than 25,000)
2. Town (pop. 25,000 to 100,000)
3. City (pop. 100,000 to 500,000)
4. Urban (pop. more than 500,000)
5. Overseas (*specify where*): _____

5. Educational Status

a. Student:

0. Not a student
1. Freshman
2. Sophomore
3. Junior
4. Senior
5. Graduate student in a non-degree program
6. Masters candidate
7. Ed. Specialist candidate
8. Ed.D/Ph.D candidate

9. Other:_____

b. What is the highest degree you have earned?

1. High School Diploma or G.E.D.
2. B.A./B.S.
3. Masters
4. Ed. Specialist
5. Ed.D/Ph.D.

c. Major field

1. English
2. Other humanities
3. Mathematics
4. Science
5. Professional program (e.g., business, engineering, architecture)

6. Other (*specify*): _____

d. Teacher Education specialization

0. I am not in teacher education.
1. Elementary
2. Secondary mathematics
3. Secondary English
4. Other secondary (*Please specify area*): _____

5. Other:_____

6. Which of the following mathematics courses did you complete in high school? (*Circle all that apply.*)

    1. General mathematics
    2. Algebra I
    3. Algebra II
    4. Geometry
    5. Trigonometry
    6. Precalculus
    7. Advanced Placement calculus
    8. Other math (*please specify*):_____

7. Which of the following English courses did you take while in high school? (*Circle all that apply.*)

    1. American literature
    2. English literature
    3. Advanced Placement English
    4. Drama
    5. Journalism
    6. Expository writing
    7. Creative writing
    8. Other English (*please specify*):_____

CAREER PLANS

8. If you are teaching or plan to teach, what level of certification did you/will you receive? (*Circle all that apply.*)

    0. I do not teach/plan to teach.
    1. Preschool
    2. Early elementary (K-3)
    3. Elementary (K-8)
    4. Middle school/Junior high school
    5. Secondary English
    6. Secondary mathematics
    7. Administration
    8. Other (*please specify*): _____

9. Which of the following best describes your career plans? In the next five years, I intend to . . .

    1. Become/remain a teacher
    2. Become/ remain an education specialist (e.g., math, reading, library, media resources, etc.)
    3. Become/remain a school administrator
    4. Find a job outside the education field
    5. Leave the work force to care for a family
    6. Leave the workforce for another reason

10. How certain are you that you will realize your career plans?

    1. Uncertain
    2. Fairly certain
    3. Sure

11. Which grade levels would you prefer to teach?

    0. I would not want to teach any grade level.
    1. Preschool
    2. Lower elementary (K-3)
    3. Upper elementary (4-6)
    4. Middle school/Junior high (7 & 8)
    5. High school (9-12)
    6. College

12. Which subject area is/would be your **favorite** to teach?

    0. I would prefer not to teach any subject.
    1. English/Language arts
    2. Reading
    3. Mathematics
    4. Natural science (biology, chemistry, physics)
    5. Social science (psychology, sociology)
    6. History/Social studies
    7. Fine arts (art, music, drama)
    8. Physical education

13. Which subject area is/would be your least favorite to teach?

0. I would prefer not to teach any subject.
1. English/Language arts
2. Reading
3. Mathematics
4. Natural science (biology, chemistry, physics)
5. Social science (psychology, sociology)
6. History/Social studies
7. Fine arts (art, music, drama)
8. Physical education

14. In which of the following settings would you prefer to teach?

0. I would prefer not to teach.
1. Public school
2. Private non-sectarian school
3. Private religious school

15. In which of the following settings would you prefer to work?

1. Small town/Rural (pop. less than 25,000)
2. Town (pop. 25,000 to 100,000)
3. City (pop. 100,000 to 500,000)
4. Urban (pop. more than 500,000)
5. Overseas

FAMILY BACKGROUND

Please circle the responses that best describe your parents at the time you were in high school.

16. Father's education

1. Less than a high school degree
2. High school graduate or GED certificate
3. Some college
4. College degree
5. Post-graduate or professional degree

17. Mother's education

1. Less than a high school degree
2. High school graduate or GED certificate
3. Some college
4. College degree
5. Post-graduate or professional degree

18. Which of the following best described your father's occupation at the time you were in high school?

0. Not employed
1. Unskilled (e.g., fast-food worker)
2. Semi-skilled white collar (bank teller, secretary)
3. Semi-skilled blue collar (assembly line)
4. Skilled (certified trade, electrician, plumber)
5. Owner or operator of a small business
6. Teacher (elementary or secondary)
7. College or university professor
8. White collar public service (social worker, minister)
9. Blue collar public service (police, fireman)
10. Manager (public/private corporation, administrator)
11. Other Professional (dentist, lawyer)
12. Farmer
13. Other (*specify*):_____

19. Which of the following best described your mother's occupation at the time you were in high school?

0. Not employed
1. Unskilled (e.g., fast-food worker)
2. Semi-skilled white collar (bank teller, secretary)
3. Semi-skilled blue collar (assembly line)
4. Skilled (certified trade, electrician, plumber)
5. Owned or operated a small business
6. Teacher (elementary or secondary)
7. College or university professor
8. White collar public service (social worker, minister)
9. Blue collar public service (police, fireman)
10. Manager (public/private corporation, administrator)
11. Farmer
12. Other Professional (dentist, lawyer)
13. Other *(specify)*:_____

EXPERIENCE WITH CHILDREN

20. How many children do you have? (*Circle one.*)

    1. 0
    2. 1
    3. 2
    4. 3 - 5
    5. 6 or more

21. Have you ever worked with young people in any of the following ways (*Circle all that apply.*)

    1. Religious-school teacher or aide
    2. Camp counselor
    3. Teacher's aide
    4. Preschool aide
    5. Tutoring (including piano, etc.)
    6. Sports coaching
    7. Babysitting
    8. Parent
    9. Other (*specify*):_____
    10. I have no experience working with young people.

22. If you are or have been a teacher in a school setting, please give the number of years teaching experience at each level.

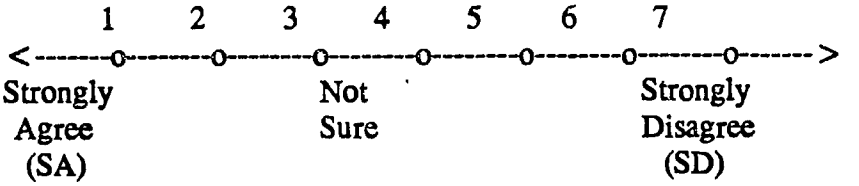
    1. Preschool
    2. Elementary
    3. Middle school or junior high
    4. High school math
    5. High school English
    6. High school—Other subject(s) (*specify*):_____
    7. College

23. If you are or have been a teacher in a school setting, please give the number of years teaching experience in each setting.

    1._____Small town/Rural (pop. less than 25,000)
    2._____Town (pop. 25,000 to 100,000)
    3._____City (pop. 100,000 to 500,000)
    4._____Urban (pop. more than 500,000)
    5._____Overseas

A. The Teaching and Learning of Writing

First we'll focus specifically on writing and the teaching and learning of writing. For the statements below, indicate your agreement or disagreement by circling the number that best expresses what you think about the statement. Your replies to these statements can range from **strongly agree (SA or 1)** to **strongly disagree (SD or 7).**



1 = strongly agree
2 = moderately agree
3 = slightly agree
4 = not sure
5 = slightly disagree
6 = moderately disagree
7 = strongly disagree

I. Your feelings toward writing:	**SA**	**SD**
1. Writing is an enjoyable activity for me.	1 2 3 4 5 6 7	
2. I really only write when I have to.	1 2 3 4 5 6 7	
3. I am a pretty good writer.	1 2 3 4 5 6 7	
4. In my own life I have to do a lot of writing that I don't enjoy.	1 2 3 4 5 6 7	
5. Conventions of mechanics and grammar are critical for effective writing.	1 2 3 4 5 6 7	

6. Below are some different kinds of writing. Which of the following do you do? (*Circle all that apply*)

   1. Poetry
   2. Letters
   3. Journal
   4. Essays
   5. Reports
   6. Short stories
   7. Other (specify):_____
   8. I don't write frequently.

7. Which of these types of writing do you enjoy most? (*Circle one.*)

   1. Poetry
   2. Letters
   3. Journal
   4. Essays
   5. Reports
   6. Short stories
   7. Other (specify): _____

Remember — 1 means strongly agree (SA) and 7 means strongly disagree (SD)

8.	I often figure out what I want to say in the process of writing.	1 2 3 4 5 6 7
9.	I rarely outline my ideas before I start writing.	1 2 3 4 5 6 7
10.	For most of the things I write, I only write one draft.	1 2 3 4 5 6 7

II. The importance of writing

11.	Writing should be taught through other subjects rather than as a separate school subject.	1 2 3 4 5 6 7
12.	Writing is something students need in order to succeed in school.	1 2 3 4 5 6 7
13.	In some situations, presenting one's ideas in writing can be a more effective way of conveying information than presenting them verbally.	1 2 3 4 5 6 7

14. Most people don't really need highly developed writing skills. 1 2 3 4 5 6 7

15. Being able to read is more important than being able to write. 1 2 3 4 5 6 7

16. Writing helps you learn to think better. 1 2 3 4 5 6 7

It is important that pupils learn to write so that they:

17. Can keep track of their own thoughts and feelings. 1 2 3 4 5 6 7

18. Can share information with others. 1 2 3 4 5 6 7

19. Can take notes in class. 1 2 3 4 5 6 7

20. Won't be considered illiterate. 1 2 3 4 5 6 7

21. Will qualify for careers which require a lot of writing. 1 2 3 4 5 6 7

Some people argue that the importance of writing depends on the type of student or school. We're interested in your ideas about teaching in different kinds of settings. Here are descriptions of two schools, followed by some questions about each:

> **School C** is located in a low-income inner city neighborhood. Many members of the community are unemployed. **School S** is located in a suburban community, in which parents are college educated and hold professional positions.

Imagine you have been offered two teaching jobs, one in **School C** and one in **School S.**

For each of the following statements, circle the letter which represents the school to which the statement is <u>most likely</u> to apply:

(C) School C (S) School S (B) Both schools (N) Neither school

23. Students should learn grammar, spelling, and mechanics of writing. C S B N

24. Students should be acquainted with the major forms and works of literature. C S B N

25. I would expect students to enjoy writing. C S B N

26. I would expect students to use writing as a way to learn or understand new ideas. C S B N

27.	I would expect students to have many experiences to draw upon in their writing.	C S B N
28.	I would expect students to do well in writing competitions.	C S B N
29.	Which teaching position would you prefer?	C S B N

III. Being good at writing

Remember 1 means strongly agree (SA) and 7 means strongly disagree (SD)

To be good at writing, you need to . . .		SA						SD
30.	Present ideas logically.	1	2	3	4	5	6	7
31.	Produce polished prose with ease.	1	2	3	4	5	6	7
32.	Consider the particular audience for whom you are writing.	1	2	3	4	5	6	7
33.	Write more than one draft.	1	2	3	4	5	6	7
34.	Be able to write in a variety of genres or forms (e.g., letters, reports, poems).	1	2	3	4	5	6	7
35.	Discuss ideas with others while work is in progress and seek feedback on drafts.	1	2	3	4	5	6	7
36.	Read widely.	1	2	3	4	5	6	7
37.	Know the parts of speech and the terms people use to describe writing conventions.	1	2	3	4	5	6	7
38.	Pay attention to the quality and appearance of the final product.	1	2	3	4	5	6	7

IV. Learning to write

39.	In general, girls tend to be naturally better than boys at writing.	1	2	3	4	5	6	7
40.	Students should not begin cursive writing until they have mastered printing.	1	2	3	4	5	6	7
41.	There are some students who can simply never be good at writing.	1	2	3	4	5	6	7

42.	Some people are naturally able to organize their thoughts for writing.	1 2 3 4 5 6 7
43.	All students have something important to write about.	1 2 3 4 5 6 7
44.	Young children lack too many skills to be able to do much writing.	1 2 3 4 5 6 7
45.	Students get better at writing by having opportunities to write.	1 2 3 4 5 6 7
46.	Students get better at writing by having opportunities to discuss their ideas with classmates and respond to one another's writing.	1 2 3 4 5 6 7

Which of the following is probably within the capability of most seven- to eight-year-olds? For each item use the following code and circle the letter which most clearly expresses your view.

(Y) Yes, they can probably do this.

(N) No, they probably can't do this.

(D) I don't know if they can do this.

47.	Choose the appropriate words to fill in blanks in sentences.	Y	N	D
48.	Write a sentence to accompany a picture the pupil has drawn.	Y	N	D
49.	Write a report on a problem in the school and proposing a solution.	Y	N	D
50.	Write a poem with a prescribed meter and rhyme.	Y	N	D

V. Prerequisites to teaching writing

		SA						SD
51.	Teachers must write a lot in order to teach writing effectively.	1	2	3	4	5	6	7
52.	Being a good writer oneself has very little to do with being a good teacher of writing.	1	2	3	4	5	6	7
53.	To teach writing effectively, teachers need to know parts of speech and terms people use to describe writing conventions.	1	2	3	4	5	6	7
54.	To teach writing effectively, teachers need to know terms people use to describe the writing process.	1	2	3	4	5	6	7

Which of the following would help <u>you</u> teach writing? Circle the number that best represents your view.

1	2	3	4
This would be very helpful to me	This would be of some help to me	This would be of little help to me	This wouldn't help me at all

55.	Do more writing myself.	1 2 3 4
56.	Review grammar.	1 2 3 4
57.	Read a variety of kinds of writing.	1 2 3 4
58.	Improve general teaching skills—like how to motivate students.	1 2 3 4
59.	Be observed by other teachers of writing and get their comments.	1 2 3 4
60.	Observe or talk to other teachers of writing.	1 2 3 4
61.	Interview writers about how they write.	1 2 3 4
62.	Take a course on writing.	1 2 3 4
63.	Take a course on teaching writing.	1 2 3 4
64.	Study samples of student writing and see how others have evaluated student writing.	1 2 3 4
65.	Get some (or more) experience teaching writing.	1 2 3 4

VI. Strategies for teaching writing

Remember **1 means strongly agree (SA) and 7 means strongly disagree (SD)**

66.	A piece of writing should be judged more for how well it conveys the writer's message than for how technically correctly it is written.	1 2 3 4 5 6 7

67.	The most important criterion in evaluating creative writing is originality.	1 2 3 4 5 6 7
68.	In evaluating students' reports or papers, it is important to assign considerable weight to technical correctness.	1 2 3 4 5 6 7
69.	Students shouldn't be asked to write long reports or stories until they know fundamentals of grammar, punctuation, and structure.	1 2 3 4 5 6 7
70.	If students are to improve their writing, it is important for teachers to grade most student papers.	1 2 3 4 5 6 7
71.	Teachers should meet regularly with individual students to talk about writing.	1 2 3 4 5 6 7
72.	Students need to learn specific strategies for composing and revising text, such as how to get ready to write and how to revise what they have written.	1 2 3 4 5 6 7
73.	Students should not be asked to share their written work with others until they think it is in final form.	1 2 3 4 5 6 7
74.	After students conduct science experiments, writing a lab report is a good way for students to learn to organize and present ideas.	1 2 3 4 5 6 7
75.	There is a logical progression to be followed in teaching particular punctuation skills to students (e.g., students should learn to use periods before they are taught about semi-colons).	1 2 3 4 5 6 7
76.	Spelling errors are less important in letters to friends than in reports for school.	1 2 3 4 5 6 7
77.	The writing curriculum in the early elementary grades should emphasize handwriting.	1 2 3 4 5 6 7
78.	It is not a good idea to have students help each other with writing assignments because the brighter students will do all the work for the others.	1 2 3 4 5 6 7
79.	Planning writing instruction for gifted writers is easier than for students with language-related learning disabilities.	1 2 3 4 5 6 7

80. Giving each child a chance to read aloud something s/he has written is impractical in a class of 25-30 students. 1 2 3 4 5 6 7

81. A major responsibility of teachers in school is to correct students' nonstandard English. 1 2 3 4 5 6 7

82. As a teacher, I would feel embarrassed if I misspelled a word on the board or on a student assignment sheet. 1 2 3 4 5 6 7

Some teachers give students "rules of thumb" to follow in writing reports or essays. *For each rule of thumb given below, indicate your agreement by circling the appropriate number.*

Remember **1 means strongly agree (SA) and 7 means strongly disagree (SD)**

83. A report or essay should always be divided into an introduction, body and conclusion. 1 2 3 4 5 6 7

84. Sentences should never begin with "and" or "because." 1 2 3 4 5 6 7

85. Sentences should never end with prepositions. 1 2 3 4 5 6 7

86. Paragraphs should always begin with a topic sentence. 1 2 3 4 5 6 7

87. Whenever you introduce a new idea, you should start a new paragraph. 1 2 3 4 5 6 7

88. You should avoid using the first person ("I") when writing formal reports. 1 2 3 4 5 6 7

Three teachers—Lou, Chris, and Terry—describe their role as teachers in helping their students in writing.

Lou: "I mainly see my role as a facilitator. I try to provide opportunities and resources for my students to write about the things they are interested in."

Terry: "I think it's most important to model writing. I write in class so that they see me struggling to express my ideas in writing too. I show them my rough drafts and try to get their response."

Chris: "I see my role as more directive than either of you does. I try to provide my students with lots of directions and specific information that will improve their writing."

89. Which teacher is most likely to help students learn to write? (*Choose one.*)

    1. Lou
    2. Terry
    3. Chris

90. Which teacher is least likely to help students learn to write? (*Choose one.*)

    1. Lou
    2. Terry
    3. Chris

Suppose that the required curriculum for your grade level includes teaching students to write poetry and five-paragraph essays. *For each of the following statements, indicate whether the statement is most likely to apply to:*

(P) Poetry (F) Five-paragraph essays

(B) Both types of writing (N) Neither type of writing

91.	Brainstorming as a class is a good way for students to get ideas for this type of writing before beginning to write.	P F B N
92.	For this type of writing, there are conventional formats to follow.	P F B N
93.	I would have students practice various parts of the task separately at first.	P F B N
94.	Students seem to have difficulty with this type of writing.	P F B N
95.	Evaluation is troublesome.	P F B N
96.	When evaluating this type of writing, I would emphasize originality.	P F B N
97.	Correct use of conventions such as punctuation and capitalization is important.	P F B N
98.	Audience must be taken into account.	P F B N

Below are some hypothetical examples of teaching situations. Read each and then answer the questions as if this had happened to you.

In the first month of school, you notice that sentence fragments appear frequently in one of your student's writing and obscure his meaning. In thinking about what to do, which one of the following would shape your decision? *For each alternative, circle the number that best expresses your inclination.*

1	2	3	4
I definitely would do this	I might do this	I probably wouldn't do this	I definitely would not do this

99. It is important that he review the elements of a complete sentence, see appropriate examples, and practice writing complete sentences. 1 2 3 4

100. It is important that he continue with his writing. The problem with fragments will work itself out as he strives to express his ideas clearly. 1 2 3 4

101. I would point out to the students that I am confused when I read these fragments, and try to show him how to make his message more coherent with better sentences. 1 2 3 4

102. Ask the students to write stories for me. 1 2 3 4

103. Consult with last year's teacher. 1 2 3 4

104. Examine students' language arts workbooks. 1 2 3 4

105. Give a standardized test of written language. 1 2 3 4

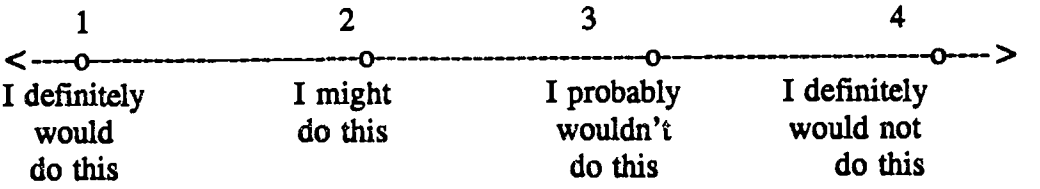
106. Examine students' social studies, science, and/or book reports. 1 2 3 4

107. Other (*please specify*): _____

Your second-grade students are writing about their trip to the airport. One of your pupils shows you the following:

We took a bus to the airport it was nis. We got to [redacted] see a helucoptr. Ons I tok a plan ride to see my grama. I was fun the stewrds gave me a cok.

What would you do? *For each alternative, circle the number that best expresses your inclination.*



108. I would use the misspelled words for spelling practice. 1 2 3 4

109. I would help the student reorder the ideas. 1 2 3 4

110. I would ask the student for more detail and request a rewrite. 1 2 3 4

111. I would make the needed corrections and have the student copy it over. 1 2 3 4

112. A student asks you whether to use is or are in the following sentence.

Neither of the books _____ in the library.

What would you say?

1. Use is in this case.
2. Use are in this case.
3. This is one of those cases where either is or are would be appropriate.
4. I'm not really sure about this.

One of the most difficult things for students to learn is how to alter the structure of a sentence while retaining its original meaning. The sentences below are followed by proposed alterations, but each requires a second alteration in order to retain its meaning. Circle the alteration you would recommend to your students if they were high school seniors.

113. Some people recommend a diet of fish and chicken, but most Americans still prefer beef.
Begin the sentence with <u>although</u> and change the transition to:

    1. chicken, most

    2. chicken, while

    3. chicken, even though

    4. chicken, yet

    5. I'm not sure

114. The new graduation requirements provoked several students into changing their majors. If you replace <u>provoked</u> with <u>caused</u>, you should replace <u>into changing</u> with:

    1. with changing

    2. to the changing of

    3. to change

    4. I'm not sure

Three English teachers are arguing about the use of a semicolon.

Bill: "I used a semicolon here to separate two main ideas."

Jim: "But you can do that with a comma. You should save semicolons for when you want to separate complete sentences without using a period."

Steve: "I think you are both wrong. Semicolons are obsolete. You shouldn't use them at all."

115. Who is right? (*Choose <u>one</u>.*)

1. Bill
2. Jim
3. Steve
4. I'm not sure about this.
5. All of them.
6. None of them. Semicolons are used: _____

_____

A high school senior comes to you for help on her mystery. She is on the final draft and wants it to be just right. But she has a sentence with quotes within quotes, and does not know how to punctuate it. Please add the necessary quotation marks to the sentence below:

> The prosecutor argued vehemently, pointing out that, "The defendant said, I did not see the movie, Dark Riders."

116. If this was your student, what would you do? (*Choose <u>one</u>.*)

1. I would punctuate the sentence for her. She doesn't need to know such detailed grammatical rules.
2. I would refer her to a grammar text. She should know how to find these things when she needs them.
3. I would explain the system of rules governing the use of quotation marks. She needs to understand the concept.
4. I would give her some work sheets to practice using quotation marks. She needs to practice using them.
5. Other (*please specify*): _____

Suppose you had promised your sixth-grade students that they would begin writing poetry today. Since many of the students wanted to write poems about their pets, you began the unit today by having them generate images of pets. Students wrote words like "jumpy," "warm," "soft," and so on. At the end of the session, one student expressed disappointment, saying that she thought they would begin writing poetry today.

What would you do? *For each alternative, circle the number that best expresses your inclination.*

1	2	3	4
I definitely would do this	I might do this	I probably wouldn't do this	I definitely would not do this

117. Apologize to her because the session took so long, and promise to let them write poetry tomorrow. 1 2 3 4

118. Explain to her that she actually did start writing and tell her about the state of writing called "pre-writing." 1 2 3 4

119. Use her question to introduce a class discussion on what it means to write poetry. 1 2 3 4

Below are writing assignments followed by samples of students' written responses. Following each the assignment and student responses are questions for you to answer.

Situation 1:

For the past several weeks, you have had a student teacher, Ms. Wexford, in your fifth grade class. She has one more week of student teaching left. While Ms. Wexford is out of the room, you passed the following note to each student:

> As you know, Ms. Wexford will finish her student teaching on Friday. Between now and then, I would like each of you to write a letter to Ms. Wexford telling her good-bye and thanking her for something special she did for you. We will bind all of the letters into a book for her and give it to her at the party on Friday. Please try to get your letter to me by Thursday afternoon. And remember, this project is a secret!! Please don't tell Ms. Wexford.

Here are the letters that two of your students wrote.

Dear Ms. Werfort
It was nice working with you this year have a nice summer
Best wishes and
God luck with your job. We'll miss you very much.
thanks for every thing and thank

Dear Miss Wexford.

Hi this is Jessie, its been grate having you with us. I wish you wold come next year. I am really glad you were my Teacher cuz I really liked coming to schole when you was gonna be here. Lots of time the other kids teased me at ..... but not since the day you was watching us and talking to me about how good I done in sience class and you made them -- stop, whin they called me something

Examine these two letters. Please evaluate each student's writing and choose the number that best expresses your judgment of the student's performance in different areas.

1 = Successful

2 = Adequate

3 = Poor

4 = Unsuccessful

Lee:

120.	Demonstrated grammatical competence.	1	2	3	4
121.	Spelled correctly.	1	2	3	4
122.	Wrote carefully and neatly.	1	2	3	4
123.	Thanked Ms. Wexford for something special.	1	2	3	4
124.	Used the appropriate form for a letter.	1	2	3	4
125.	Used a tone and mood appropriate for a friendly letter.	1	2	3	4

Jessie:

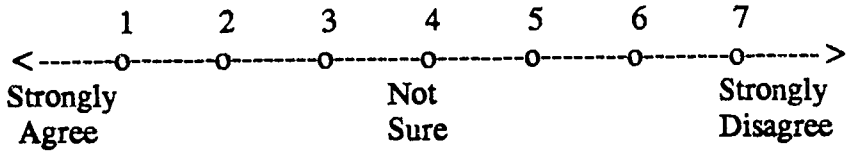
126.	Demonstrated grammatical competence.	1	2	3	4
127.	Spelled correctly.	1	2	3	4
128.	Wrote carefully and neatly.	1	2	3	4
129.	Thanked Ms. Wexford for something special.	1	2	3	4
130.	Used the appropriate form for a letter.	1	2	3	4
131.	Used a tone and mood appropriate for a friendly letter.	1	2	3	4

132. Overall, which student wrote the better letter? (*Choose <u>one</u>.*)

1. Lee
2. Jessie
3. One is not better than the other.

B. The Teaching and Learning of Mathematics

In this section, we focus specifically on the teaching and learning of mathematics. For the statements below, indicate your agreement or disagreement by circling the number that best expresses what you think about the statement. Your replies to these statements can range from **strongly agree (SA or 1)** to **strongly disagree (SD or 7)**.



I. Your views about mathematics

		SA						SD
1.	Math just isn't my strength and I avoid it whenever possible.	1	2	3	4	5	6	7
2.	I'm pretty good at math and I enjoy the challenge of it.	1	2	3	4	5	6	7
3.	I can handle basic math, but I don't have the kind of mind needed to do advanced mathematics.	1	2	3	4	5	6	7
4.	I feel okay about math. While I'm not especially strong as it, I'm not fearful of it either.	1	2	3	4	5	6	7
5.	If I would give it full effort, I know I could learn advanced math.	1	2	3	4	5	6	7
6.	Doing math allows room for original thinking and creativity.	1	2	3	4	5	6	7
7.	Doing math is usually a matter of working logically in a step-by-step fashion.	1	2	3	4	5	6	7
8.	A lot of things in math must simply be accepted as true and remembered; there aren't explanations for them.	1	2	3	4	5	6	7
9.	High school algebra is totally unlike anything presented to students in the lower grades.	1	2	3	4	5	6	7

II. The importance of mathematics

10.	Math helps you learn to think better.	1 2 3 4 5 6 7
11.	Math is needed for many jobs and careers.	1 2 3 4 5 6 7
12.	To succeed in school, you need to be good in math.	1 2 3 4 5 6 7
13.	To be a well-educated person, it is just as important to study major areas of math as it is to read classic literary works.	1 2 3 4 5 6 7

The value of learning geometry is:

14.	So pupils will learn the theorems and how to apply them.	1 2 3 4 5 6 7
15.	So pupils will understand how to make mathematical arguments.	1 2 3 4 5 6 7
16.	So pupils will be prepared for later courses such as trigonometry, calculus, and number theory.	1 2 3 4 5 6 7
17.	So pupils whose preferred mode of learning is visual will experience success in math.	1 2 3 4 5 6 7

Some people argue that the importance of math depends on the student or the school. We're interested in your ideas about teaching in different kinds of settings. Here are descriptions of two schools, followed by some questions about each:

> School C is located in a low-income, inner-city neighborhood. Many members of the community are unemployed. School S is located in a suburban community. Many of the parents are college-educated and hold professional positions.

Imagine you have been offered two teaching jobs, one in School C and one in School S.

For each of the following statements, circle the letter which represents the school to which the statement is <u>most likely</u> to apply:

(C) School C (S) School S (B) Both schools (N) Neither school

18.	Students should learn fundamental mathematical concepts reflected in geometry, probability and number theory.	C S B N

19. Students should learn math skills that relate to everyday life, such as percents, multiplication, and other basic computational skills. C S B N

20. I would expect students to come up with alternative mathematically sound solutions to problems. C S B N

21. I would expect students to use math and mathematical reasoning outside of school. C S B N

22. I would expect students to do well in mathematics competitions. C S B N

III. Being good at mathematics

Remember 1 means strongly agree (SA) and 7 means strongly disagree (SD)

To be good at mathematics, you need to . . .

23. Remember formulas, principles, and procedures 1 2 3 4 5 6 7

24. Think in a logical step-by-step manner. 1 2 3 4 5 6 7

25. Have basic understandings of concepts and strategies. 1 2 3 4 5 6 7

26. Be able to think flexibly. 1 2 3 4 5 6 7

27. Have confidence you can do it. 1 2 3 4 5 6 7

28. Have a kind of "mathematical mind." 1 2 3 4 5 6 7

29. Work hard at it. 1 2 3 4 5 6 7

30. Be interested in mathematics. 1 2 3 4 5 6 7

IV. Learning mathematics

Remember 1 means strongly agree (SA) and 7 means strongly disagree (SD)

31. When students can't solve problems, it's usually because they can't remember the right formula or rule. 1 2 3 4 5 6 7

32. For students to get better at math they need to practice a lot. 1 2 3 4 5 6 7

33.	If elementary students use calculators, they won't learn the math they need to know.	1 2 3 4 5 6 7
34.	One can learn a lot by watching an expert mathematician "think aloud" while solving problems.	1 2 3 4 5 6 7
35.	If students get into arguments about ideas or procedures in math class, it can impede their learning of math.	1 2 3 4 5 6 7
36.	In learning math, students must master topics and skills at one level before going on.	1 2 3 4 5 6 7
37.	A teacher should wait until pupils are developmentally ready before introducing new ideas and skills.	1 2 3 4 5 6 7
38.	It is important for pupils to master the basic computational skills before studying topics like probability and logic.	1 2 3 4 5 6 7
39.	In general, boys tend to be naturally better at math than girls.	1 2 3 4 5 6 7
40.	Math is a subject in which natural ability matters a lot more than effort.	1 2 3 4 5 6 7
41.	Since older students can reason abstractly, the use of models and other visual aids becomes less necessary.	1 2 3 4 5 6 7

Which of the following is probably <u>within</u> the capability of most seven- to eight-year-olds? For each item, indicate your view using the following code:

(Y) Yes, they probably can do this.

(N) No, they probably cannot do this.

(D) I don't know if they can do this.

42.	Deciding exactly how many cookies each child in their class of 24 would get if someone brought in 5 dozen cookies and they were trying to share them equally.	Y N D
43.	Figuring out the number of possible ways to sequence four objects.	Y N D

44. Proving that the set of counting numbers and the set of even numbers are equivalent. Y N D

45. Determining the probability of rolling a 7 with two dice. Y N D

V. Prerequisites for teaching mathematics

Remember **1 means strongly agree (SA) and 7 means strongly disagree (SD)**

46. If a student asks a question in math, the teacher should know the answer. 1 2 3 4 5 6 7

47. Being good at mathematical problem solving personally has little to do with being a good math teacher. 1 2 3 4 5 6 7

48. Understanding math as a discipline is important for teaching math at any level. 1 2 3 4 5 6 7

49. In order to teach problem solving, teachers have to do a lot of math problem solving themselves. 1 2 3 4 5 6 7

50. It is important for teachers to know mathematical terminology. 1 2 3 4 5 6 7

51. Basic computational skill and a lot of patience are sufficient for teaching elementary school math. 1 2 3 4 5 6 7

Which of the following would help <u>you</u> teach mathematics? Circle the number that best represents your view.

1	2	3	4
This would be very helpful to me	This would be of some help to me	This would be of little help to me	This wouldn't help me at all

52. Review basic skills, such as factoring or operations with fractions. 1 2 3 4

53. Observe other math teachers and get their comments. 1 2 3 4

54. Be observed by other teachers and talk with them. 1 2 3 4

55. Take a math course. 1 2 3 4

56. Find out more about how mathematicians work. 1 2 3 4

57. Read about great mathematicians and the history of mathematics. 1 2 3 4

58. Improve general teaching skills—such as how to motivate students. 1 2 3 4

59. Take a course of teaching math. 1 2 3 4

60. Look at examples of student work in math. 1 2 3 4

61. Learn more about the school's math curriculum. 1 2 3 4

62. Get (some or more) experience teaching math. 1 2 3 4

IV. Strategies for teaching mathematics

Remember **1 means strongly agree (SA) and 7 means strongly disagree (SD)**

63. Students should never leave math class (or end the math period) feeling confused or stuck. 1 2 3 4 5 6 7

64. Teachers should not necessarily answer students' questions but should let them puzzle things out themselves. 1 2 3 4 5 6 7

65. Students should "show their work" when they solve math problems. 1 2 3 4 5 6 7

66. If students are having difficulty in math, a good approach is to give them more practice in the skills they lack. 1 2 3 4 5 6 7

67. If a student is confused in math, the teacher should go over the material again more slowly. 1 2 3 4 5 6 7

68. The most important issue is **not** whether the answer to any math problem is correct, but whether students can explain their answers. 1 2 3 4 5 6 7

69. To do well, students must learn facts, principles, and formulas in mathematics. 1 2 3 4 5 6 7

70. The range of ability in most classes makes whole group teaching in math virtually impossible.	1	2	3	4	5	6	7
71. It is not a good idea to have students work together in solving math problems because the brighter students will do all the work.	1	2	3	4	5	6	7
72. Because every student is different, it's best to let students progress at their own individual pace in math.	1	2	3	4	5	6	7
73. Teachers should follow the math textbook that is used in their school.	1	2	3	4	5	6	7

Four teachers—Cass, Jay, Sam and Randy—describe their role as teachers in helping their students learn mathematics.

Cass: "I mainly see my role as a facilitator. I try to provide opportunities and resources for my students to discover or construct mathematical concepts for themselves."

Jay: "I think I need to provide more guidance than that. I try to lead my students to figure things out by asking pointed questions that I hope will get them to the answer without my telling them."

Sam: "I emphasize group discussion of math in my classroom. We talk about concepts and problems together, exploring the meaning and evaluating the reasoning that underlies different strategies. My role is to initiate and guide these discussions."

Randy: "That's all nice, but students really won't learn math unless you go over the material in a detailed and structured way. I think it's my job to explain, to show students how to do the work, and to give them practice doing it."

74. Which teacher is most likely to be successful in helping students learn math? (*Choose <u>one</u>.*)

1. Cass
2. Jay
3. Sam
4. Randy

75. Which teacher is least likely to be successful in helping students learn math? (*Choose one.*)

1. Cass
2. Jay
3. Sam
4. Randy

76. If you were teaching a group of students who tend to have difficulty with mathematics, which one of the following would you do first? (*Choose one.*)

1. Stress basic computational skills
2. Work with logic games, problems and puzzles
3. Teach steps to follow in solving problems and provide practice
4. Make students feel comfortable with math and see that it can be fun
5. Focus on the underlying math theories
6. Other (*please specify*):_____

Your seventh-grade students have been learning how to write math statements expressing proportions. Last night you assigned the following:

> A one pound bag contains 50 percent more tan M & Ms than green ones. Write a mathematical statement that represents the relationship between the tan (t) and green (g) M & Ms, using t and g to stand for the number of tan and green M & Ms.

Here are some responses you get from students:

Kelly	$1.5\ t = g$
Lee	$.50\ t = g$
Pat	$.5\ g = t$
Sandy	$g + \frac{1}{2}\ g = t$

77. Which of the students has represented the relationship best? (*Choose one.*)

1. All of them
2. Kelly
3. Lee
4. Sandy
5. Pat
6. None of them. It should be: _____

78. Which of the following is a good story problem to illustrate what 1 ¼ divided by ½ means? (*Circle all that apply.*)

1. You want to split 1 ¼ pies evenly between two families. How much pie should each family get?
2. You have $1.25 and may soon double your money. How much money would you end up with?
3. You are making some homemade taffy and the recipe calls for 1 ¼ cups of butter. How many sticks of butter (each stick = ½ cup) will you need?
4. It takes 1 ¼ hours to fly 300 miles. How far can you fly in ½ hour?
5. I don't know.
6. None of these. Instead:_____

Some teachers give students "rules of thumb" to follow when doing math. For each rule of thumb listed below, indicate your view using the following code:

(T) It's true.

(F) It's false.

(NS) You are not sure whether it's true or false.

79. When you're setting up a division problem, the greater number always goes inside the bracket. T F NS

80.	You can't subtract a larger number from a smaller one.	T	F	NS
81.	Any number divided by itself is 1.	T	F	NS
82.	When you multiply any number by 10, just move the decimal point one place to the left.	T	F	NS
83.	Always do the same thing to both sides of an equation.	T	F	NS
84.	To divide fractions, invert and multiply.	T	F	NS

85. Generally, what do you think about teaching students "rules of thumb" in mathematics? (*Choose <u>one</u>.*)

1. I think these rules help students to remember basic principles that they need to have at their fingertips.
2. I think these are a bad idea—they give the impression that mathematics is a set of procedures to be memorized.

In looking through your school's new math textbook, you notice a chapter on probability and statistics. Which of the following would you do?

For each alternative, please circle the number that best expresses your inclination.

1	2	3	4
I definitely would do this	I might do this	I probably wouldn't do this	I definitely would not do this

86.	I would begin the year with this chapter.	1	2	3	4
87.	I would not bother with this chapter.	1	2	3	4
88.	I would save it and see if I had time for this chapter at the end of the year.	1	2	3	4
89.	I would plan to weave this content in across the year.	1	2	3	4
90.	I would cover this chapter when I came to it.	1	2	3	4
91.	I would not cover it unless I got help—an inservice session or an article on teaching probability and statistics.	1	2	3	4

Your students are working on subtraction with "borrowing." You have given them the problem

$$\begin{array}{r} 36 \\ -19 \end{array}$$

One of your pupils says she has come up with a much simpler method. Here is what she shows you:

$$\begin{array}{r} 36 \\ 19 \\ -\ 3 \\ +20 \\ 17 \end{array}$$

She explains that 6 - 9 equals -3, and 30 - 10 equals 20, and -3 + 20 equals 17.

92. What do you think about this? (*Choose one.*)

1. I think it makes sense mathematically.
2. It works in this case, but I'm not sure it would work in general.
3. This doesn't make any sense mathematically.

If you were the teacher, what would you say or do? For each option, select the one that most closely matches your view.

1	2	3	4
I definitely would do this	I might do this	I probably wouldn't do this	I definitely would not do this

93.	I'd let her do subtraction this way.	1	2	3	4
94.	I'd tell her that I'd like her to concentrate on learning the standard way of doing it.	1	2	3	4
95.	I'd discourage her from using it because it would confuse the rest of the class.	1	2	3	4

96.	I'd praise her, but point out that while her method works in this case, it might not always work.	1	2	3	4
97.	I'd ask her to explain how she figured this out and why she thinks it works.	1	2	3	4

A student in your first grade class identifies a square as a rectangle.

What would you say or do? For each option, select the response that most closely matches your inclination.

1	2	3	4
I definitely would do this	I might do this	I probably wouldn't do this	I definitely would not do this

98.	I'd remind the child that rectangles have two sides longer and two sides shorter, while squares have sides of equal length.	1	2	3	4
99.	I'd ask the child why s/he is calling it a rectangle.	1	2	3	4
100.	I'd ask the child, "What's a rectangle? What's a square?" and try to get the child to remember the difference.	1	2	3	4
101.	I'd check to see whether this is okay.	1	2	3	4
102.	I'd praise the child.	1	2	3	4

103. If you asked your students to write what "slope" is, which of the following responses would you accept? (*Choose <u>one</u>.*)

Bobbie: "A ratio that tells you how fast a line is going up or down."

Sam: "A <u>slope</u> is the difference between the y-coordinates and the x-coordinates."

1. Bobbie
2. Sam
3. Both of them.
4. Neither of them.
5. I'm not sure.

Many teachers want students to understand the "whys" in math, rather than simply memorizing rules or principles. Sometimes this can be hard. *For each item below, indicate what you think using the following code*:

E = It is possible to <u>explain</u> why.

R = It is just "one of those things" in mathematics that you have to <u>remember</u>.

NS = I'm <u>not sure.</u>

104.	When you multiply two negatives together, you always get a positive.	E	R	NS
105.	The slope of a vertical line is undefined.	E	R	NS
106.	Any nonzero number to the zero power is 1. ($x^0 = 1$)	E	R	NS

How would you help your ninth graders understand that $(a^2 + b^2)$ is not the same as $(a + b)^2$? For each alternative, please circle the number that best expresses your inclination.

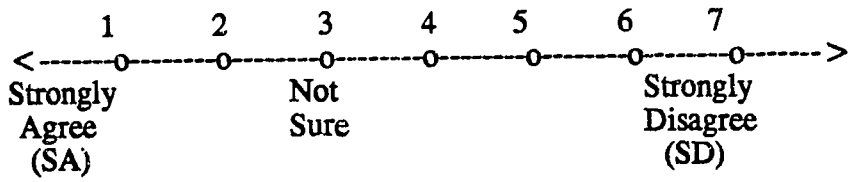
1	2	3	4
I definitely would do this	I might do this	I probably wouldn't do this	I definitely would not do this

107. I'd show them by replacing the variables with numbers and then show that the two results are different. 1 2 3 4

108.	I'd draw a picture of each one and compare them.	1 2 3 4
109.	I'd use the distributive property and multiply $(a + b)^2$ and show that the two results are different.	1 2 3 4
110.	I'd create story problems illustrating each expression.	1 2 3 4
111.	I'd tell them they simply have to remember that these are different.	1 2 3 4

C. Teaching and Learning in General

We continue with some general questions about teaching and learning. For the statements below, indicate your agreement or disagreement by circling the number that best expresses what you think about the statement. Your replies to these statements can range from **strongly agree (SA or 1)** to **strongly disagree (SD or 7)**.



		SA						SD
1.	Teachers should avoid calling on students who may not know the answer.	1	2	3	4	5	6	7
2.	Teachers should use a system for calling on students that emphasizes giving all students an equal chance to speak.	1	2	3	4	5	6	7
3.	Posting charts of students' progress is a good strategy for encouraging students to learn.	1	2	3	4	5	6	7
4.	Students are less likely to misbehave when the activities and tasks are easy enough that everyone can do them successfully.	1	2	3	4	5	6	7
5.	Teachers should avoid grouping students by ability or level of performance.	1	2	3	4	5	6	7
6.	A lot of my ideas about teaching and learning come from my own experience as a student.	1	2	3	4	5	6	7
7.	Teachers should use the same standards in evaluating the work of all students in the class.	1	2	3	4	5	6	7
8.	Since there is no "best way" to teach, every teacher has to figure out what works for him- or herself.	1	2	3	4	5	6	7

Remember **1 means strongly agree (SA) and 7 means strongly disagree (SD)**

9.	Handicapped children who are placed in regular classes should not be expected to keep up with the rest of the class.	1 2 3 4 5 6 7
10.	Teachers should make independent decisions about what to teach.	1 2 3 4 5 6 7
11.	It is impractical for teachers to tailor instruction to the unique interests and abilities of different students.	1 2 3 4 5 6 7
12.	Good teachers give their students lots of workbook practice on the skills they have been teaching.	1 2 3 4 5 6 7
13.	Students learn best if they have to figure things out for themselves instead of being told or shown.	1 2 3 4 5 6 7
14.	When working with slow learners, teachers should focus nearly all their instruction on "minimum competency" objectives.	1 2 3 4 5 6 7
15.	When students work in groups, the teacher can't really evaluate students' work.	1 2 3 4 5 6 7
16.	When working with students from low-income families, teachers should rely primarily on teacher-directed focused, whole-group instruction.	1 2 3 4 5 6 7
17.	Required high school courses should have separate classes for low-achieving and high-achieving students.	1 2 3 4 5 6 7
18.	Teachers should pace their classes so that they cover the curriculum for their grade or course.	1 2 3 4 5 6 7
19.	Good teachers create their own lessons and materials.	1 2 3 4 5 6 7
20.	The main job of the teacher is to transmit the values of the mainstream American culture.	1 2 3 4 5 6 7
21.	The main job of the teacher is to encourage students to think and question the world around them.	1 2 3 4 5 6 7
22.	The main job of the teacher is to teach subject matter.	1 2 3 4 5 6 7
23.	All students should be taught in English.	1 2 3 4 5 6 7
24.	My views about teaching have not changed substantially since I first decided to teach.	1 2 3 4 5 6 7

25. I am currently rethinking many of my ideas about teaching. 1 2 3 4 5 6 7

26. When students are successful in achieving intended goals or objectives, that success is often attributed to one of the following sources. Which do you believe is the most frequent source of success? (*Choose one*.

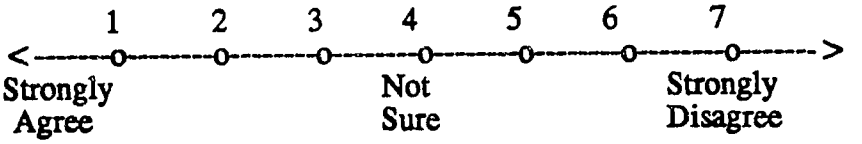
    1. Student's home background
    2. Student's intellectual ability
    3. Student's enthusiasm or perseverance
    4. Teacher's attention to the unique interests and abilities of students
    5. Teacher's use of effective methods of teaching
    6. Teacher's enthusiasm or perseverance

27. When students fail to achieve intended goals or objectives, that failure is often attributed to one of the following sources. Which do you believe is the most frequent source of failure? (*Choose one*.)

    1. Student's home background
    2. Students' lack of intellectual ability
    3. Students' indifference or lack of perseverance
    4. Teacher's failure to consider the unique interests and abilities of students
    5. Teacher's failure to use effective methods of teaching
    6. Teacher's indifference or lack of perseverance

D. Teaching as a Career

We end with some general statements about your feelings abut being a teacher. For the statements below, indicate your agreement or disagreement by circling the number that best expresses what you think about the statement. Your replies to these statements can range from **strongly agree (SA or 1) to strongly disagree (SD or 7).**



		SA						SD
1.	I am confident about my ability to teach.	1	2	3	4	5	6	7
2.	I don't think I am a very good teacher right now.	1	2	3	4	5	6	7
3.	It would be nice if others could or would come into my classroom and demonstrate teaching strategies.	1	2	3	4	5	6	7
4.	I have (or expect to have) few discipline problems with my students.	1	2	3	4	5	6	7
5.	I am not as happy about teaching as I thought I would be.	1	2	3	4	5	6	7
6.	I am sure teaching will be my life-long career.	1	2	3	4	5	6	7
7.	I have been thinking about leaving teaching in the near future.	1	2	3	4	5	6	7
8.	If I could get another job I would leave teaching.	1	2	3	4	5	6	7
9.	I find (or expect to find) teaching to be very stressful.	1	2	3	4	5	6	7
10.	I find (or expect to find) it difficult to control my classes.	1	2	3	4	5	6	7
11.	I am (or expect to be) frightened of the students in my school.	1	2	3	4	5	6	7

Answer the following questions only if you are currently teaching:

12. I usually look forward to coming to school to teach.	1	2	3	4	5	6	7
13. I often wish I didn't have to come to school to teach.	1	2	3	4	5	6	7

THANK YOU FOR COMPLETING THIS QUESTIONNAIRE