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ABSTRACT

Research on teacher thinking generally has failed to take into account teacher beliefs and understandings in both research methodology and in interpretation of data. Two models prevail in research on teacher thinking. The decision making model, which has undergone several modifications, tends to focus on explaining and understanding deliberate teacher activity. The second model for research on teacher thinking is the cognitive information process model, which focuses on how the teacher limits and structures the complex environment into what are called "problem spaces," which essentially are simplifications of environmental components. A review of research dealing with teacher thinking reveals that inadequate attention to the beliefs of both the teacher and the researcher can seriously weaken the inferences drawn. Problems arise when assumptions are made about teacher perceptions, when inadequate survey instruments are used, and when it is not recognized that teachers can have several widely varied and complex types of beliefs. An alternative methodology is being used to understand the various beliefs that drive teachers to plan and teach in different ways. The technique involves the identification, through interviews with teachers, of constructs or beliefs that form a grid that can be analyzed factorially. After discussion and analysis with the teacher, patterns of underlying factors emerge and lead to understanding of relationships and significant behaviors. This methodology could be used with lesson observation and stimulated recall to produce an effective research tool on teacher thinking. (FG)

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The Place of Teachers' Beliefs in Research on Teacher Thinking and Decision Making, and on Alternative Methodology

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Introduction

The importance of research on teacher thinking, planning and decision-making is frequently averred and remains uncontested in recent literature. Everyone seems to agree that this field (which will be referred to as teacher thinking in this paper) needs study because it should give insight into classroom events, and that the latter are worth understanding because of their connection to student learning and so forth. The present paper will leave that view unchallenged, too. But, it is precisely because the field is important that this paper is written, not with a view to providing justifications, but with the intent of looking closely at the two models which prevail in the research, and of pressing the theme: research or teacher thinking has paid insufficient heed to what one might call teachers' beliefs or repertories of understandings. Of course, some attention has been turned in this direction, and that research will be discussed later to make clear its insufficiency. On the whole, though, research on teacher thinking generally has failed to take full account of beliefs and repertories of understanding both in methodologies and in interpretations of data, and this will be fully argued below.

This paper consists of three major sections. The first of these begins by reviewing the two prevalent models in research on teacher thinking identified by Clark (1980): the information processing model, and the decision making model. The section closes with a glance at the importance of beliefs in thinking, and for this it draws rather heavily on the work of Nisbett and Ross (1980). The second section discusses several contemporary studies of teacher thinking. Here, there is no attempt to thoroughly review the field; instead, several

studies are examined to illustrate the manifold problems which fall from failing to take account of teachers' beliefs.

The conclusion to this point is that teachers' beliefs and repertories of understandings need to be considered and understood before much more work on ceacher thinking is pursued. The final section outlines a methodology for such study and describes a single case to reveal something of the complexities of understanding a teachers' beliefs.

Research Models and the Significance of Beliefs

The Decision Making Model

In several places, Shavelson (1976, 1978 and 1981) has described the decision making model for teacher decisions. The 1976 version of this model contained four parts: alternative acts (self-evident), states of nature (referring to student cognitive and affective scales, and to other environmental conditions), outcome and utility for teacher (referring to immediate, cognitive, affective and social student learning), and goals for students. (p. 375). While Shavelson acknowledges the origins of this model in decision theory, he avers that, "most situations in teaching do not readily correspond to statistical models" and that his interpretation treats statistical models as a heuristic for examining teachers' decision making. (p. 376).

The major portion of Shavelson's (1976) discussion discloses the questions that are in need of answers and the problems associated with these questions:

> To what extent can teachers identify alternative acts? Can they estimate accurately the probability that each state of nature characterizes the learner? Can they estimate the probable outcomes of a particular teaching act under a particular state of nature? (p. 386)

After Kahneman and Tversky (1974), Shavelson suggests that three heuristics might be invoked in decision making: representativeness (an estimate of the probability that A belongs to B depends on the degree to which A resembles B), availability (the ease with which instances can be brought to mind), and adjustment and anchoring (an estimate by starting from an initial value that is adjusted to yield the final answer). (p. 289-390) These heuristics, he continues might be expected to generate bias errors in estimates of learning states. Neither does Shavelson's evident concern for the place of bias in teacher decision making end here. Concerning estimates of learning states he wonders that "Some evidence available to the teachers may conflict with perceptions of their teaching ability. In this case, they might ignore the information, discount it, or distort it to maintain a consistent self-image." (p. 401) And, again:

> Inconsistencies in goal setting may arise from inconsistencies in teachers' beliefs about the nature of children, beliefs about themselves and their roles as teachers, and beliefs about the aims of education and how to achieve them. (p. 404)

At this stage, Shavelson appears committed to viewing beliefs as integral components of the decision making model, and the models presented by Shavelson (1978) and by Borko, Cone, Russo and Shavelson (1979) characterize these as "individual differences between teachers,

such as educational beliefs and cognitive styles" and "beliefs and attitudes about education" respectively and show them as inputs both to inferences or estimates about students and to instructional decisions. These representations are amended in Shavelson (1981), as shown in Figure 1, possibly because they inadequately reflected the complexity of the matter.

Shavelson labels this diagram as a "overview of the domain of research on teachers' judgments, decisions and behaviors" (p. 51), but the basic elements of his initial version of the decision making model are present.

Clark (1980) finds that research guided by this model seems to focus on explaining and understanding deliberate teacher activity, probably when the teacher has sufficient time (as in lesson preparation) to deliberate. A typical question for research might be "Given a particular situation, how do teachers decide what to do?" (p. 42). The example given by Clark is of a study by Peterson, Marx, and Clark (1978) in which 12 teachers taught "3 different classes of 8 randomly assigned junior high students on different days. All classes were video-taped, and at the end of each day, researchers interviewed each teacher using a stimulated recall technique to elicit self-reports of cognitive processes during instruction." (p. 43) The following questions were asked:

1. What were you noticing about the students?
2. How were the students responding?
3. Were you thinking of any alternative actions or strategies at that time?

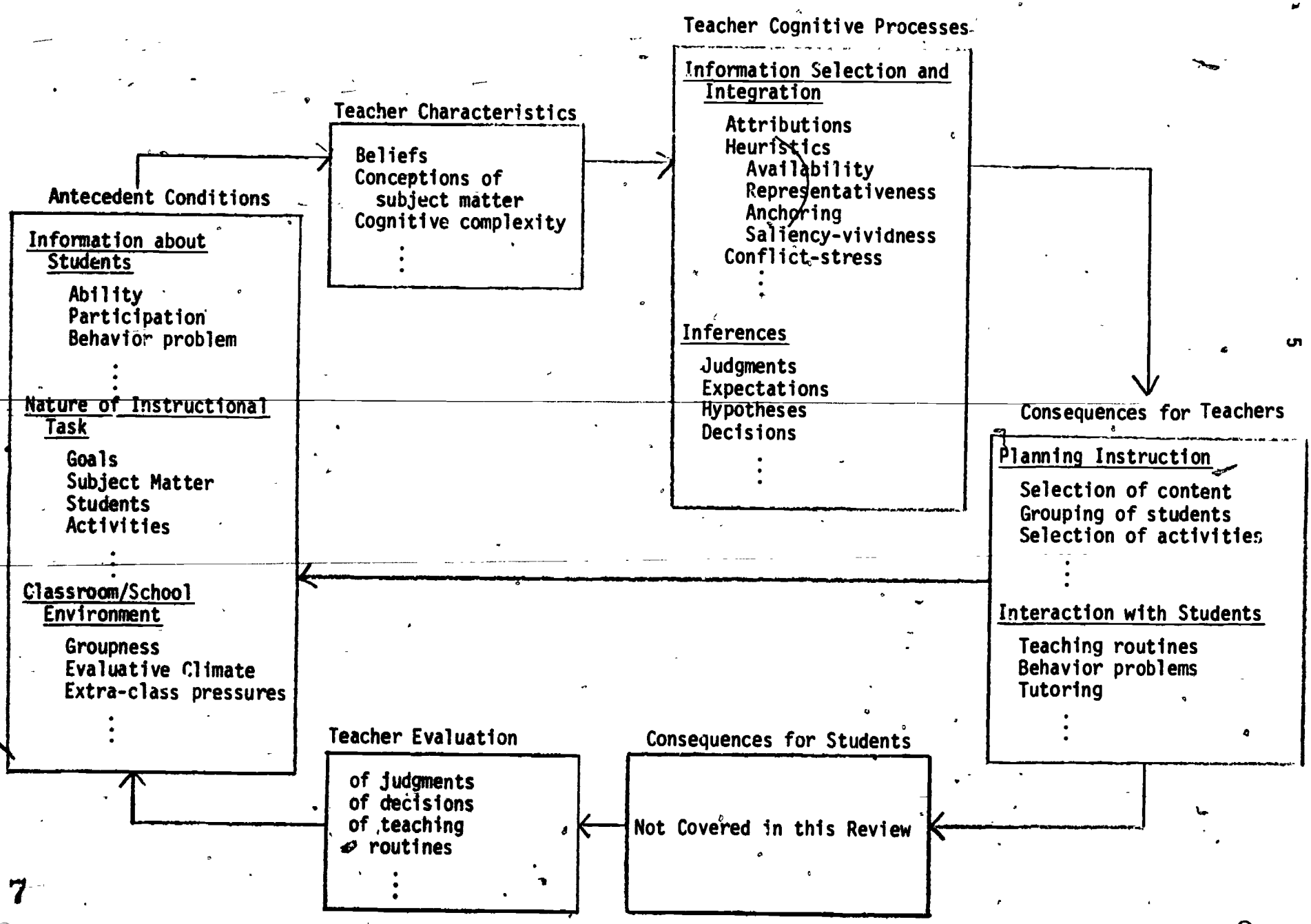

Figure 1. "Overview of the domain of research on teachers' judgments, decisions and behavior."

4. Did any student reactions cause you to act differently than you had planned?

The Cognitive Information Process Model

Clark's view of the decision making model may be contrasted with his description of the cognitive information processing model in which the teacher is depicted as one who copes with a complex environment by simplifying it into portions called problem spaces:

> The central question in the information processing approach are:
> (a) How does the teacher's information processing capacity limit and influence the ways in which complex task environments are simplified into problem spaces?
> (b) How do the definitions of particular kinds of problem spaces influence subsequent teacher thinking, classroom interaction and student learning? (Clark, 1980, p. 42)

The focus, then, is upon how the teacher limits and structures the environment, and this leads to the question: "How does a teacher define a teaching situation, and how does the teacher's definition of the situation affect his or her behavior?" (p. 42) The study given as an example is by Marland (1977) in which an open-ended approach to stimulated recall was used, the teachers controlling the video-tape recorder and being asked to stop the tape where they wished and to report on their thoughts, feelings, moment-to-moment reactions, conscious choices, alternatives considered and reasons for choices." (Clark, 1980, p. 44)

Newell and Simon's Human Problem Solving (1972) is frequently cited as a major source for the cognitive information processing model.

This text describes the groundbreaking work and its elaboration into a sophisticated model of human thinking which depends basically upon serial processing and searching. The model's rapid advance has been greatly assisted by computer technology, and programs have been constructed which mirror the "highly selective trial-and-error search of solution possibilities" (Simon, 1977, p. 277) that characterize human problem solving in such diverse areas as discovering proofs for theorems in logic, playing chess and bridge, harmonizing a musical theme, and making investment decisions. Human thinking in this model is viewed as operations performed on symbols and structures of symbols and as the search for patterns, the processes being organized hierarchically and executed serially.

A possible difficulty with this model is that its range of application in human problem solving may be regarded as limited. Simon (1977) has stated, "in real life there is not a single static, well defined problem, but a constantly changing problem whose definition is being altered by information that the actors recover from memory and by other information obtained from the environment's response to actions taken." (pp. 239-240) Yet this limitation is more properly ascribed to human problem solving itself than it is to the human problem solving model, and to see why this is so, one must look carefully at the complexity of problem space which is central to the information processing system. (Newell & Simon, 1972, pp. 810-811) Some of these components are very definitely affected by human perception and memory, and thus by their inherent weaknesses. For example, the "initial state of knowledge" (which is defined as "the knowledge about the task that the problem solver has at the start of problem solving") and the total

knowledge available to the problem solver are clearly dependent on the problem solver's perception and on the content of long term memory. Further, what gets stored in long term memory is also affected by perception.

This brief account of the cognitive information processing model suffices to establish the significance of human perception to it. And because perception is a function of the perceiver, it is evident that beliefs or repertories of understanding are as crucial to this model as they are to the decision making model. Accordingly, the following subsection sketches something of the influence that such understandings and theories have upon human thinking.

Thinking and Beliefs: Clear Interactions

In a recent volume, Nisbett and Ross (1980) present considerable evidence of the fallibility of human reasoning: in description we tend to be at the mercy of what can be sampled in memory; we frequently commit the "fundamental attribution error" of attributing behavior to the actor's disposition rather than to situations; we are greatly influenced by the vividness of information (that which is concrete, has emotional interest for us, or is temporally, spatially, or sensorily proximate); and so the list our deficiences as lay social scientists continues. The extent to which teachers are culpable is not the question here, although it would seem that there is insufficient information for a sound inference on that point. Rather, the intent is to emphasize the importance of beliefs (understandings and theories) to our general inferential ineptitudes.

For Nisbett and Ross, following an established view of recent philosophy and psychology, all human perception is influenced by the

perceiver's schema, constructs, existing beliefs and understandings. But, they note, these "knowledge structures themselves are not infallible guides to the nature of physical and social reality" (p. 7); and their book presents weighty evidence that such is the case. Beliefs, they show, influence the way in which events are characterized, and how we estimate covariation (especially in cases of stereotyping). Even the testing of our beliefs against experience is influenced by the beliefs themselves for they interact with how we perceive the data. So it is that our earlier theories and beliefs about social and physical reality are less likely to change -- first or early evidence tends to give rise to less tractable conceptions and views. Neither is this the sole difficulty we have in altering our beliefs for they bias our interpretation and recall of evidence, leading us to recognize more readily confirming evidence than disconfirming evidence. (We sometimes fail to ignore evidence even when told that it is false.)

The catalogue of improprieties in our reasoning is large and, in this light, it is barely surprising that Nisbett and Ross cite from Bacon's "Idols of the Tribe": "The human understanding when it has once adopted an opinion draws all things to support and agree with it." (Bacon, 1620-1960, p. 50). What is surprising, though, is that relatively little attention has been paid to beliefs in research on teaching thinking as compared to their obvious importance.

A Review of Selected Studies

The intent of this section is to review selected studies on teacher thinking to show how inadequate attention to beliefs (either the teachers' or the researchers') can seriously weaken the inferences

drawn. Some studies, reviewed later in this section, deal explicitly with teachers' beliefs, but here too there are problems. A thematic problem arises from assuming that teachers and researchers share perceptions. That is, their beliefs and understandings are thought to be such that they attach equal significance to and derive identical meanings from such things as "cues about students" which teachers are sometimes given in studies, and from statements offered in stimulated recall techniques.

Put another way, as a researcher, I might see in a cue one thing which I take to be functionally important by virtue of the way the world looks to me, whereas a teacher might fasten on to something quite different in the cue in which case my cue is essentially different from the teacher's cue. Or, to take a trite fiction, if I have found in all my experiences as a teacher that left-handed students are more musical than their right-handed peers, then I am unlikely to be very impressed by an instance you might present to me of a tone-deaf southpaw. I may fleetingly note the anomaly, but the power of my beliefs will easily outweigh the single case. The assumption of shared perception is, then, an elementary matter of assuming that what is seen by two people is the same; it is kin to the doctrine of immaculate perception, which ignores the coloring of perception by a knowing perceiver, and which has long been recognized in philosophy of science and in theories of perception.

Of course, the opportunities for running educational research upon the rails of the assumption of shared perception are legion. Responses children make to attitude and achievement tests are taken by us as having the meaning we attach to these; we assume that when we code a

teacher's utterance to a class as a management one, then it was delivered as one and heard as one; and we traditionally accept that the meaning we retrieve from a statement in a transcribed interview is consistent with and equal to the meaning intended by its author. All of these problems are familiar to researchers in the social sciences.

But, as we see below, the snare of the assumption of shared perception tends to live rather closely to methodologies which use interviews and cues to help us better understand teacher thinking.

Cues and the Teacher's Perception

In a study involving descriptions of hypothetical students, Russo (1978) had 31 elementary school teachers make decisions about student competence and classroom behavior, grouping students, and planning reading and mathematics instruction. In addition, teachers' educational beliefs ("traditional" or "progressive") were measured -- a matter taken up later. While the study is thorough and elegantly designed, it is less clear that the results are very informative, and this needs to be investigated rather carefully.

Russo reports that "the student cue most relevant to the estimate under consideration accounted for substantially more variance than any other effect" (p. 6). For example, the reading achievement cue accounted for 27% of variance in estimates of reading competence, with similar results for mathematics; and the classroom behavior cue accounted for 30% of the variance in estimates of problematic classroom behavior. From this Russo concludes that the results "suggest that teachers relied on the most relevant information provided about students in making their estimations" (p. 7). Not the least of the problems here is the extent to which estimating laboratory conditions

reflects estimating in the classroom, of course. But there is a further difficulty. Assuming that teachers have reasons for attending to the cues then, without knowing the reasons, we cannot say that the most relevant information was relied upon, for relevance is connected to reasons. Thus, if the teachers use what there is to use they could be doing so either because it would be silly not to or because they think the information is credible. Put another way, Russo's conclusions suggest that she views her way of perceiving the cues (as relevant) as equal to and consistent with the teachers' ways, which may or may not be the case depending on the participants' beliefs.

It is useful to compare the shared perception assumed in Russo's study with the assumptions of a recent study by Morine-Dershimer (1981). While the substance of the latter is not germane to the present view, the attempt to understand how pupils perceive classroom language is a novel and necessary extension of the work on classroom discourse, and underlies the significance of probing the assumption of shared perception.

The use of fictional cues was the principle methodology of an earlier study in teacher decision making (Shavelson, Cadwell, & Izu, 1977). Here teachers were given the same general story about "Michael" with some "reliable" and "unreliable" information inserted, some of the inserts having a positive valence, others a negative one. For instance:

A reliable and negative insert:

> In an interview with his parents, his father gave his occupation as a machinist for an aerodynamics firm. In the

interview his parents also noted that Michael never did any homework, but spent two hours each evening watching television. On an individual intelligence test, Michael scored quite low. (p. 89)

An unreliable and negative insert:

In an interview a classmate stated that while he did not know Michael well, he thought Michael's father worked on airplanes. He also thought Michael never did any homework, spent a lot of time watching television, and was not very smart. (p. 90)

The subjects, 164 graduate education students, were required to make predictions about "Michael" by answering four questions: The first on his future achievement, the second on suitable grade levels of reading and mathematics materials, the third about responding to Michael in class, and the fourth about the use of praise with Michael. The results showed that subjects exhibit a sensitivity to the reliability of the information when answering the first two questions, but did not seem to use the information when answering the last two questions. What is crucial to this review is that the labeling of the information inserts as reliable or unreliable (and as having a positive or negative valence) is from the perspective of the researchers rather than from the perspective of the subjects. Presumably, it is assumed that teachers and researchers equally attach more credence to parental reports of employment and hours of television viewing, though there is no necessary reason to suppose that peer reports are less credible. Interestingly, although the assumption of shared perception is operating here, it is sustained by the results, but only for the first two questions. Given general beliefs about the predictability of grade

placement and achievement by intelligence test scores, this is not surprising. Importantly, the inserts are not used consistently in answering the third and fourth questions, and this could be construed as a consequence of the subjects' perceiving the information as possessing different significance and meaning, depending on their established beliefs and theories about the teaching tactics that work optimally for them. Without knowledge of these beliefs, little more can be said of the results.

The work of Byers and Evans (1980) and Byers (1980) provides a further illustration of how a focus on the researchers' perspective can lead to alternative interpretations of the data. The researchers employ the Brunswick lens model to assess the judgemental accuracy of teachers as they predict the reading interests of their students from cues provided. The researchers conclusions are instructive:

> The present study illustrates that a lens model analysis may be used to identify those factors which contribute to teacher judgemental accuracy for specific problems. The specific finding suggests that, although student reading preferences are predictable, they are also unstable, and teachers do not have sufficient knowledge of individual student interests to accurately predict the books a student will prefer. The analysis also suggests that teachers are highly individualized in their judgement patterns for this task, which may indicate the lack of a specific professional format for approaching this task. (Byers and Evans, 1980, p. 16)

The suggestion that teachers have insufficient knowledge of the children is particularly dubious. First, of course, reading interests

may seem to the subjects to be so transient that the notion of ever having sufficient knowledge of the child may seem absurd. In such cases, we can expect that the beliefs and theories of teachers will simply override the information in the cues when it comes to selecting reading materials for youngsters. Next, while teachers may well be highly individualized in their judgment patterns, to suggest that this comes from a lack of a specific professional format seems to ignore the significance of individual theories and the idiosyncratic ways in which these are developed and confirmed.

Varying Perceptions in Planning and Stimulated Recall

The problems of assuming a shared perception are also evident in studies in which varieties of stimulated recall and other techniques are used. As often as not, while the researcher's view of the meaning in the transcript is plain to the reader, that the teacher meant what was said in the way that the researcher takes it is not necessarily plain and is usually unexamined.

An example of the difficulties we might encounter can be found in Ben-Peretz' (1981) intriguing study of the lesson plans composed by 54 teachers around the theme "the short story." In part of the study, Ben-Peretz analyses the verbal content of the plans by coding sentences for the frequency of professional terms, subject matter terms, and those terms coming from theories of instruction. It is to her credit that Ben-Peretz does not attempt extensive inferences from her findings, for it would be very hard to know precisely that when a teacher used a term which we think is professional he or she is also using it as a professional term. Indeed, terminology in education and

psychology (as in many disciplines) is not found exclusively in these areas but is frequently available in regular speech albeit the precise meaning might change from context to context. For example, typical terms in educational psychology, such as reinforcement, memory, enquiry, retention, and creative thinking, may be used meaningfully outside of the discipline. On the other hand, terms such as retroactive inhibition, correllative subsumption, and concrete operations, are possibly more recognizable as professional and as belonging to the discipline of psychology. Of course, what we need to know is how teachers view these terms and what is intended by their use.

In an early study of teacher decision making, Marx and Peterson (1975) examined both the preactive and interactive decision making of 12 experienced teachers, teaching three groups of eight students. Interactive decisions were tapped using a stimulated recall technique, and the ensuing interviews were taped and then coded according to the "teacher decision making coding system." Initially the major categories of this system were Factual, Conceptual, Theoretical, Affective-Personal, and Affective-Social. Quite apart from the actual use of this system, it is not hard to imagine the difficulties of distinquishing whether a theoretical statement (a statement referring to generalizing or synthesizing and including statements of principles, laws or relationships) is intended by the teacher as being a statement of a principle, law or relationship. However, this particular difficulty did not arise, for the frequency of statements in these categories was too low for analysis with the exception of those falling in the category of Factual. Accordingly the coding system was revised

with the following subcategories: Productivity, Objectives, Subject matter (lower order, and higher order), Instructional process, Materials, Learner, and Miscellaneous. The only decision-making variable proving to be significant in interactive decision making was Productivity (the total number of codes from a tape). Marx and Peterson explain:

> Apparently the coding system is not as sensitive to differences in teacher decision making when the protocols are obtained in a structured manner, i.e., the stimulated recall interview. This does not necessarily invalidate the procedure, but points to difficulties in data reduction and analysis. (p. 9)

While this is true, it is also true that the imposition of any coding system developed by a researcher upon someone else's language will result in data which should always be treated tentatively, not because of difficulties in data reduction and analysis but because the meanings ascribed to these statements by the researcher may be at variance with those intended by the utterer.

A similar form of study was undertaken by Mackay and Marland (1978). Here six teachers taught two one-hour periods. Prior to the stimulated recall interview teachers were invited to provide a detailed account of their thoughts, feelings, and moment-to-moment reactions, their conscious choices, alternatives considered, and reasons for making a choice. The researchers developed the "system for the analysis of teachers' interactive thought" which consisted of 11 categories. Many of these categories are quite straightforward, for example, "Perceptions" codes "units in which the teacher reports a

sensory experience," and "Interpretations" are "units in which the teacher attaches subjective meaning to his perceptions." Two of the other categories are less clear: "Prospective Tactical Deliberations" are "units in which tne teacher is thinking about what he plans to do at some future point in the lesson," and "Anticipations" are "speculative thoughts or predictions made interactively about what could, or is likely to occur in future phases of the lesson." It is quite conceivable that what a researcher believes to be an Anticipation might well have been intended by the teacher as a Prospective Tactical Deliberation. Finally, the category Fantasies (a unit in which the teacher is expressing fanciful, bizarre, or extravagant thoughts) seems peculiarly susceptible to the assumption of shared perception.

Among other things, Mackay and Marland found that decision making during instruction was not as prevalent as they expected, with the number of alternatives considered rarely exceeding two. Anent to the present discussion is their statement: "Numerous teaching principles were cited by teachers in the stimulated recall protocols." (p. 20) Here it is not clear that the principles were stated in the form reported by the researchers or whether the researchers labeled certain statements as derivatives of what they themselves considered principles of teaching. In other words, it is not clear that these principles were discovered by the researchers within the transcripts or whether they were imposed on the substantive content of the transcripts. (The principles are: the principle of compensation, the principle of strategic leniency, the principle of power-sharing, the principle of progressive checking, and the principle of suppressing emotions.) A clue to this quandary is available in three very short segments from

transcribed interviews. The following excerpt from the second teacher's transcript can be assumed to represent the principle of suppressing emotions which, the authors note, was sometimes coupled with the maxim of protecting students' self concepts:

> I try a lot of times not to say yes and no or right and wrong. I'm very conscious of that all the time. I think you have to use the word, in an academic sense, very carefully. Especially with the particular children I have . . . some of the children I have. (p. 24)

It is noteworthy that, not only is there no mention of the term self concept here, the teacher makes no explicit reference to the maxim of protecting students' self-concepts, nor to the principle of suppressing emotions. Certainly, these terms may have arisen at other points during the interview. Yet, from this fragment, we can legitimately raise the question of whether or not these particular descriptions come from the perception of the researchers.

A further example of the pitfalls which inhere in stimulated recall and analyses therefrom is available in the report by Mackay (1978). The following is written of a stimulated recall study conducted in 1977:

> The data from stimulated recall interviews with 11 of the 12 teachers in the study were examined to see how frequently references were made to attention. Attention was defined as (1) use of the word "attention," (2) describing thoughts about children's behavior as indications of paying attention, (3) reference to behavior that was not demonstrating attention

paying, (4) thoughts about how to improve or increase attention paying.

Usefully, Mackay provides pieces of the transcripts to illustrate references to attention. But notice in the following samples from these transcripts who is making the reference to attention.

Interviewer: Do you concentrate upon the kiddies at all? (p. 30)

Interviewer: But when she said that you were conscious that she hadn't been listening or paying attention? (p. 30)

Interviewer: Were you conscious then that "Oh," he hasn't been listening or he's lost? (p. 32)

Interviewer: And you were aware that she wasn't looking at the paragraph. (p. 33)

Interviewer: Do you think he's paying attention? (p. 44)

Admittedly, these are small samples of long interviews whose transcriptions are sampled further in Mackay's report. But, it is not unjust to suggest that the interviewer's comments lead the teacher, and that the teacher's responses might well be meeting the perceptions of whomever coded the transcripts for the frequency of references to attention.

We see then that the selection of questions and the analyses of the responses in stimulated recall is a particularly difficult matter. For example, Clark and Peterson (nd) asked five preselected questions in a stimulated recall situation of 12 experienced teachers. When asked, "What were you doing in this segment and why?" the teachers "were able to describe in general terms what they were doing in each segment and put it into context but seemed less able to articulate why." (p. 4) Possibly, the teachers' apparent difficulty with the

second part of this question may have resulted from the enormous scope which they perceived the question to be addressing. Uncertainty about the interviewer's perspective may similarly have confounded teachers when faced with the question, "Did you have any particular objectives in mind during this segment, and, if so, what were they?" Responses appeared to be more in terms of organizational objectives, which the researchers suggest are saying, "My objective was to do what I was doing." (p. 6) Again, if the question is believed to have vast scope this particular response is not unsurprising if "doing what I wanted to do" was indeed in the forefront of the teacher's thinking. The researchers conclude:

> A general observation about the responses to the question about objectives is that the teachers did not ever mention individual students. Objectives were apparently thought of as goals for the entire class as a group. Furthermore, the statements of student cognitive and affective objectives were global and general rather than specific and behavioral. This finding is consistent with previous research (Popham & Baker, 1970) that indicates that without specific training teachers rarely establish behavioral objectives that are tied closely to either instructional activities or evaluation devices. (p. 7)

This is a very difficult conclusion because the failure of teachers to state specific and individual objectives for particular students ought not to be taken as evidence that these teachers did not have such objectives in mind. Indeed, such objectives may well be in mind though somewhat lower in priority to the more general objectives of having students learn as a group the task at hand, and to the yet more

pressing objective a teacher may reasonably hold of executing the lesson as planned. Accordingly, we may explain the particular results obtained by this question of Clark and Peterson in terms of the great scope that the teachers may have perceived within the question. The obverse to this coin is that the researchers may have perceived, rightly or wrongly, that the question was sufficiently open as to thwart any charges that it was leading the teachers to respond in any particular direction.

The final question in these interviews was, "Did any student reactions cause you to act differently than you had planned?" (p. 10) Apparently 22 of the 31 responses were negative and in five of the nine cases where changes were reported, "It was unclear what the nature of the change was." (p. 10) The researchers continue, "The teachers gave the impression that they had been influenced in some way by student reactions, but they were unable to articulate the specific results of that influence." (p. 10) It seems rather difficult to travel from this finding to the conclusion, "Third, the teachers rarely changed their strategy from what they had planned even if instruction was going poorly." (p. 11) Of course, that instruction was "going poorly" is a judgment made by the researchers. But more significantly, it is quite possible that teachers have other reasons for overriding the evidence which the researchers see. For example, what the researchers see as strong evidence that the instruction is "going poorly" may be viewed by the teacher as evidence that some students are behaving consistently throughout a particular period of say a month or a term. In other words, some evidence presented to teachers may have less significance than it does to the researchers, and this is yet a further illustra-

tion of the problem of assuming a shared perspective. Alternatively, teachers may simply not see that their teaching is going poorly.

While the above studies tend to ignore teachers' beliefs, other studies have not overlooked them. For example, Shavelson, Cadwell and Izu (1977) observe in their conclusions that teacher decision making may have been distorted by the lack of thorough information about the fictitious child, Michael. They suggest "subjects may have resorted to their own theories of teaching or beliefs about teaching in order to reach a decision. Thus the subjects' beliefs may have been the overriding factor in the decision" (p. 95). Samples of research on teacher's beliefs so far as they interact with teacher thinking are discussed below.

Some Research on Teachers' Beliefs

There have recently been a number of studies on teacher beliefs and decision making, some of them possibly following on the heels of Shavelson's suggestions cited above. Russo (1978), for example, found that the educational beliefs of teachers exerted little influence over the preinstructional decisions of teachers, while at the same time acknowledging that the measure of teacher beliefs used may have failed to discriminate beliefs relevant to the study. This is an important point to note, especially since two of the studies discussed in the chapter by Borko, Cone, Russo, and Shavelson (1979) used the same instrument with similar results, with the exception of finding that teachers having progressive beliefs "tended to select alternatives involving an inquiry approach while more traditional teachers tended to favor lecture or recitation approaches" (p. 150). Yet, so far as

interactive decisions about management are concerned, "teacher beliefs, the organizational structure of the classroom, and the sex of the deviant child do not appear to be significant factors" (p. 152). This finding seems so unusual as to merit some attention. Since it is so obviously the case that the perspective we hold influences what we see and do, it is extraordinary to think teachers are in some way exempt from this human failing. Either the instrument is inappropriate or the model is, or both.

The instrument used in this series of studies is an attitude-toward-education scale developed by Kerlinger (1967), references in the research cited being given to Kerlinger and Pedhazur (1968). This instrument measures attitudes or beliefs on a continuum from traditionalism to progressivism. That the instrument may be unsuited to research on teacher decision making, as Russo suggests, is evident from a sample of items in the instrument itself. Some traditionalist items are:

> Children need and should have more supervision and discipline than they usually get.
>
> Learning is essentially a process of increasing one's store of information about the various fields of knowledge.
>
> Teachers should keep in mind that pupils have to be made to work.
>
> Since life is essentially a struggle, education should emphasize competition and a fair competitive spirit.

Some progressive items are:

> Subjects like Communism and Capitalism should be studied in the public schools.

The American public school should take an active part in stimulating social change.

The healthy interaction of pupils one with another is just as important in school as the learning of subject matter.

Teaching should be based on the present needs of the child.

(Kerlinger, 1967, pp. 200-201)

There are reasonable grounds for doubting that beliefs represented by these types of statements bear upon the immediacy of teachers' preactive and interactive decision-making. And so, as Russo has suggested, it is quite possible that the lack of a relationship between teachers' beliefs so measured and their decision making is an artifact of the instrument used. So, part of the problem may be the instrument, but another problem may lie in the assumption that teachers' beliefs wield the same influence as information about students. Whatever the culprit, it is not at all clear which beliefs do influence teacher decision making.

Of course, not all studies of teacher thinking and beliefs have used the Kerlinger instrument. For example, a series of studies have been done on conceptions of subject matter within the area of reading. Of these, the fullest is by Duffy (1977) who examined beliefs about reading generally and then selected eight teachers who evidenced strong patterns, finding that only four of these "consistently employed practices which directly reflected their beliefs." (p. 54). This study is especially interesting for the use of the Repertory Grid Technique for focusing on beliefs, and for the obvious relationship between teaching and the beliefs in question. Nevertheless, it does raise the question of the influence that others sorts of beliefs might have.

That is, while it is remarkable that some teachers do not teach reading in a manner consistent with their beliefs about reading, it might be the case that quite different and weightier beliefs are responsible for the ways in which these teachers act in their classrooms.

That teachers hold several different sorts of beliefs (or implicit theories) as they go about their work, and that these are very varied are clearly revealed in the extensive interview study of 60 elementary teachers conducted by Bussis, Chittenden, and Amarel (1976). The interviews are guided by standard questions covering such topics as an overall view of teaching/learning activities, physical settings and materials, children in the classroom, and perception of teaching requirements and rewards. (Further topics were concerned with specific curriculum projects.) The authors coded interviews to determine what constructs appeared to be operating and how these seem to be organized. While the findings are too complex to summarize here, it can be said that they show a great diversity of constructs which map understandings of the curriculum and of children. And, so far as the study of teacher thinking goes, this ambitious and intensive work clearly demonstrates the large and complex range of teachers' beliefs as well as providing some unusually rich language for depicting them. (The study never set out to establish which beliefs might be salient in planning and decision making, of course.)

The significance of teachers' beliefs or implicit theories to our understanding of teacher decision-making and teacher thinking cannot be overemphasized. Yet, it would seem that these are inadequately treated in the current research. As Shavelson (1981) offers, "unfortunately, the sequence of elements considered (in a teacher's planning a task)

and the compromises that have to be made are, as yet, unknown. They probably depend upon the particular task at hand as well as the proclivities of the particular teacher." (p. 22). Quite clearly, more attention needs to be directed specifically at teachers' beliefs, theories and repertories of understandings, and to ways in which these might be understood.

Development and Trial of an Alternative Methodology

The purpose of this section of the paper is to describe a methodology which is presently being used in a study designed to obtain some understanding of the variety of principles (beliefs or repertories of understandings) which drive teachers to plan and to teach in the ways that they do. Since the methodology is adapted from Kelly's Repertory Grid Technique, a brief summary of this technique is provided. This is followed by a detailed account of how the Repertory Grid was adapted for the present study. A single case has been drawn arbitrarily from the cases collected thus far to illustrate the procedures.

The Emergence of a Methodology

The immediate response to the question "How shall we determine what teachers believe?" ought to be "Ask them!" But, for the following reasons, this alluringly simple approach is unsuited. First, the fact that the question is worth asking implies a commitment to the view that people have different beliefs and thus perspectives. To honor this is to comprehend the awkwardness of asking a question which gives no hint of the perspective from which it might be answered. To be sure, the perspective ought to be that of the teacher, but it is difficult to grasp this perspective before asking a question about what it is. Next, while subscribing to the view that our beliefs construct our experience, it is necessary to recognize that individually we may not be the best people to clearly enunciate our beliefs

and perspectives since some of these may lurk beyond ready articulation. There are possible a large number of techniques available which would would minimize these hazards, but one which initially seems to hold particular promise for maintaining the integrity of a teacher's beliefs while at the same time revealing them is the Repertory Grid Technique, developed originally be Kelly (1955) for his Personal Construct Theory. Components of the theory are consistent with the general view of personal beliefs and principles which underlies this paper; but since the theory is discussed in several sources (e.g., Kelly 1963, Bannister and Mair 1968, and Fransella and Bannister, 1977) only the briefest of summaries is needed here. Fundamental to the theory is the assumption that people process events according to a finite number of dichotomous personal (that is, idiosyncratic) constructs which, while individually serving to construct a limited range of experience, are organized to provide a person's unique construction of the world.

For Kelly and later workers, the delicate matter of determining how someone construes segments of his world is tackled by presenting the subject with cards upon which are written "elements" (such as: a teacher you liked, a teacher you disliked, your wife or present girl friend, etc.) representing the range of experience of interest to the investigator. As these "elements" are presented, the subject is invited to indicate which are alike or not alike and to say why. These discussions lead to the identification of constructs, such as "strong in character" and its pole "weak in character" (Fransella and Bannister, 1977, p. 11). A grid with elements and constructs as axes, is completed during the interview to record the associations provided by the subject. The grid may be analyzed factorially to show the relationships among constructs. This basic procedure has few rules, and has been modified in many ways. Sometimes the constructs are not elicited but

provided. In other cases the grid becomes a rating grid. In a study of teachers' constructs within the the context of curriculum innovation, Olson (1980) used the technique to elicit five constructs and prepared a grid with the five elicited constructs and five given constructs. Responses to this grid became the basis for a second and more searching interview with the subject.

The desire to tap teachers' beliefs and principles in the present study led to recognition of two possible difficulties with existing varieties of grid teachnique. First, the elements had to be connected to each teacher's immediate and personal experience for, without this connection, one has less assurance that the discussions of constructs in some fashion reflect the beliefs and principles underlying that teacher's professional activity as he or she sees it. (Generally the elements in grid technique are prepared prior to an interview.) Second, special efforts were needed to minimize a teacher's offering up either "socially acceptable" constructs or ones which are superficial. (An overly hurried attempt to identify constructs is particularly susceptible to this.) The methodology would have to limit these difficulties while simultaneously providing opportunities for the subjects to offer their own constructs in their own terms.

Early in the study, the decision was taken to use the grid as the vehicle for identifying the constructs (beliefs or principles in this case) following completion of the grid. Accordingly, the first interview terminated in completion of a grid, while a second interview used the factor analysis of the grid to probe for the beliefs or principles which give the best voice to the factors. (Both interviews are recorded.) Also, it was decided that the phrases on both axes of the grid ("elements" and "constructs" in Kelly's terminology) should be the teacher's so far as

possible -- reflecting an approach by Ingvarson and Greenway (1981) just recently brought to the present author's notice.

The Methodology in Use

The case used here to give life to the methodology concerns an experienced female teacher of seventh-grade Language Arts in a Texas suburban middle school. At the beginning of the first interview, Fran (not her real name) was asked to provide me with brief statements describing what I would observe were I to visit one of her classes in the next week, assuming that the teaching represented her best or most representative teaching. The statements, listed in Figure 2, were written on cards, numbered in the order they were given. (These become the "elements" of the grid.)

Next, Fran was invited to group the cards in any way that she wished. When the grouping was complete, Fran was asked to explain why each group was composed as it was. During this portion of the interview, the interviewer wrote down those phrases and statements which Fran used in describing the composition of the groups. This list, in Figure 3, became the items entered in the "construct" axis (to use Kelly's term) of the grid. Then, with the cards as elements, Fran was asked to complete the grid, a portion of which is shown in Figure 4, by coding the association in each cell. The interview, including completion of the grid, took approximately ninety minutes.

At this stage, there has been no attempt to probe for Fran's beliefs or principles. The grid, though, is a matrix of associations and can be subjected to factor analysis to see how Fran's phrases and statements group together. A principal components analysis with varimax rotation was performed using a "packaged" program (Veldman, 1978) resulting in the factors listed in Figure 5.

1. Teacher calls the role
2. Students are very attentive
3. Students get materials together to be on task
4. Teacher writes on overhead
5. Teacher initiates a point of beginning for the class
6. Teacher works one to one with students
7. Teacher makes an assignment
8. Teacher listens to responses and ideas
9. Teacher asks a lot of questions
10. Students work together in groups on preparations
11. Students respond to questions
12. Students brainstorm ideas
13. Students write paragraphs and poetry
14. Students read poetry aloud
15. Students give group and individual presentations
16. Teacher talks to the class and gives information
17. Teacher makes jokes with students
18. Students talk when they should be working
19. One student reads a book in addition to working
20. Students and teacher work silently and individually

Figure 2. "Elements" elicited for the grid.

1. Distracting from task
2. Business that has to be done
3. Teacher needs humor and fun
4. Response to academic need or problem
5. Done for a specific reason
6. Response to something else
7. Doing it together
8. Physical and vocal activity
9. Student and teacher give and take
10. Students need to listen
11. Teacher negotiates assignment
12. Teacher judges what is interesting
13. Teacher forces their hand
14. Teacher needs to be flexible
15. Taking feelings into consideration
16. Students need exposure to poets

Figure 3. The "Construct Axis" elicited for the grid.

3 = Definitely associated

2 = Neutral

1 = Definitely not associated

	1.Distracting from task	2.Business that has to be done	3.T needs humor & fun	4.Response to academic need or problem	5.Done for a specific reason	6.Response to something else	7.Doing it together
1. T calls the roll	1	3	1	1	3	1	1
2. Ss are very attentive	1	3	1	1	3	1	1
3. Ss get materials together to be on task	1	3	1	3	3	2	
4. T writes on overhead	1	2	1	3	3	3	
5. T. initiates a pt. of beginning for the class	1	3	1	3	3	3	
6. T works one to one with students	1	1	1	3	3	3	
7. T makes an assignment	1	1	1	3	3		
8. T listens to responses and ideas	1	1	1				
9. T asks a lot of questions	1	1					
10. Ss work together in groups on preparations (projects, presentations)							
11. Ss respond to questions							
12. Ss brainstorm ideas (whol							
13. Ss write paragraphs							
14. Ss. read poet							
15. Ss give							
16. T							

Figure 4. Section of Fran's completed grid.

1. Taking feelings into consideration
   Response to something else
   T needs to be flexible
   Business that has to be done (-)[1]
   Response to academic need or problem
   T forces their hand
   T negotiates assignment

2. Distracting from task (-)
   Done for a specific reason

3. Doing it together
   Physical and vocal activity
   Ss need to listen

4. T needs humor and fun (-)
   S and T give and take (-)
   Ss need exposure to poets

5. T judges what is interesting

[1]Identifies negative varimax loadings

Figure 5. Factors extracted from Fran's grid.

The second interview began by explaining that the task was to explore what might lie beneath the groupings (factors). The tone of the interview, was one of working together to understand the factors and eventually to label them, and questions were designed to probe for meanings, relationships and significances. Since the interview took about 90 minutes, the following is barely a sketch.

Fran's discussion of the first factor led her to see it as representing the two principles of her work: one connected to the curriculum" -- business that has to be done," and the other rooted in her concern for providing a caring atmosphere. She said that there was a kind of "tough love" which allows her to be understanding but not to relieve the students of "the job." For Fran, this sensitivity guides her in negotiating changes in assignments according to various needs. The factor, then, appears to represent to Fran the overall directing of her student's learning, and not without reason. "The do really marvelous things ... when they know you have either literally or figuratively put your arms around them." Curriculum and feelings are importantly linked, for Fran views literature and poetry as dealing with feelings, and it is feelings of her students that carry weight. "I hope they'll love short stories ..., but before the importance of the short story is the importance of the kid and what he's feeling, and that he knows that I care about him. I hope he will like the short stories because I think he'll find more of himself there than he expected to."

The second factor seemed initially to represent a dimension which had purposefulness at one pole and distraction at the other. But the underlying principle here was not a management one, pure and simply. Instead, as Fran indicated, quickly putting aside standard talk of goals and objectives, "I'm a fairly organized person." She has reasons for assignments and for the more

spontaneous things "like an outreach to a student." Distraction, in her view, is the invasion of someone else's territory -- simply bad manners. Underlying this factor, then, seems to be a principle about general conduct in teaching: it is purposeful, orderly and mannerly -- the latter again evidencing a sensitivity to her students as well as to herself.

Fran and I came to see the third factor as a more focussed representation of the conduct of her teaching than was evident in the second factor. In the interview, she gives examples attesting to the quantity of sharing, and of vocal and physical activity which worked for her because it establishes a "sense in which we are all in it together," and here Fran seemed to be pointing to an implicitly held principle concerning the optimal strategies for her view of the curriculum: genuine opportunities for participating, responding and listening are vital to learning.

Working with the fourth factor was problematic, for Fran said she saw no reason to group the statement "students need exposure to poets" with the other two items. We agreed to move the later into the fifth factor upon Fran's suggestion. This left the factor expressing a considerable amount of Fran's personal approach to herself and her work, in the interviewer's perspective. Her love of openness and laughter in relationships with others clearly extends to her teaching. "Only in give and take can you realize a sense of relationship" and "Somehow we find a way to say funny things and to laugh at ourselves ... we laugh a lot at what we have to learn." Here Fran speaks as part of the class, as if the relationship is fully established, in its serious and its amusing entirety. She seems to possess an exquisite sense of the need for candour in her professional work, as if she's saying that what deserves to be laughed at ought to be laughed at.

Another side of Fran's professional commitment is evident in the final factor. Here the discussions focussed on a unit of contemporary poetry, in which the class was engaged at that time. For Fran the exposure to poetry is good for them: "Kind of puts them on another track that you can run on." But, she pointedly insists, "No matter how bright they are, they are not at a point in their life when they can make a valid judgment of what is or isn't good" to include in the curriculum. Accordingly, she chooses carefully, to give them a useful starting point. For her, students at this age need help in choosing responsibly, and it becomes clear that the underlying feature of this factor is not so much who controls the selection of poems, but a more thoughtful consideration of why Fran assumes this role, initially at least.

So short an account of an hour and a half of Fran's animated conversation cannot capture all that was covered. (The second interview also contained Fran's views on the origins of her present thinking, none of which is presented here.) Nevertheless, one can readily detect from the discussions several principles (beliefs or understandings) that drive her professional thinking; and while these principles are not explicitly articulated, their character and distinctiveness is evident. Five of these might be cast as follows:

1. Caring for the students genuinely is as important as is the Language Arts curriculum itself, if not more so.
2. The conduct of teaching and learning is purposeful and mannerly.
3. Learning in Language Arts requires considerable activity.
4. Teaching and learning involves developing open and candid relationships.
5. Seventh graders are insufficiently mature to make fully valid judgments.

To talk with Fran is to understand how deeply these principles influence her thinking as a teacher.

A Closing Reflection

Although the methodology described above appears to yield useful information about Fran's beliefs and understandings (and does so for others involved in this study), it has yet to be teamed with such devices as lesson observation and stimulated recall, which together might allow one to sketch the interplay between the sorts of understandings revealed here and the decisions taken during the course of planning and instruction itself. Nevertheless, if the basic principles, theories, beliefs and understandings held by teachers are as vital to their thinking as the early part of this paper has maintained, then the methodology might be pressed into productive service.

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