RESEARCH ON TEACHERS' PEDAGOGICAL THOUGHTS, JUDGMENTS, DECISIONS, AND BEHAVIOR

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June 1981

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I. INTRODUCTION

The purposes of this review are to assess the progress made by research on teachers' pedagogical thoughts, judgments, and decisions over the past decade and to identify areas of substantive and method- ological research needed to improve the practice of teaching. These purposes are realized, in part, by formulating several "schema" or "models" which are consistent with the conceptual underpinnings and the findings of this research and, in part, by a set of recommendations for future research.

The need for research on teaching to examine teachers' intentions and the link between intentions and behavior, and not just behavior alone, has been justified on several grounds. One justification is that a solely behavioral model is conceptually incomplete. It cannot account for predictable variations in teachers' behavior arising from differences in their goals, judgments, and decisions. A second justi- fication often cited in the literature is that research linking teachers' intentions to their behavior will provide a sound basis for educating teachers and implementing educational innovations. That is, this re- search models segments of the broader experience of teachers and so clarifies coherent prototypes for important teaching activities.

Before undertaking the review, several caveats are in order. First, since this research grew out of research on human decisionmaking (Shavelson, 1973, 1976; Shulman & Elstein, 1975; for reviews see Einhorn & Hogarth, in press; Slovic, Fischhoff & Lichtenstein, 1976) and problem- solving (e.g., Shulman & Elstein, 1975), its initial orientation was psychological (e.g., National Institute of Education, 1975; Shavelson, 1973). Hence, this review is largely psychological in orientation. However, the research has become increasingly interdisciplinary and this will be evident in the review.

Second, the review focuses on the teacher and those teaching acti- vities--preactive, interactive, and evaluative--that pertain to class- room instruction. In order to delimit the review, we do not focus directly on students or the organizational context of classrooms and

schools but rather only examine these factors as they affect teachers. Third, the review is limited to studies primarily from 1976 to the present. Literature prior to this date has already been reviewed (e.g., National Institute of Education, 1975; Shavelson, 1976; Shulman & Elstein, 1975). Finally, this review does not cite all relevant background literature. Rather, secondary sources are cited for those seeking this background and references to primary sources.

The remainder of the review is divided into six sections. The second section sets forth the assumptions and methods of research on teachers' thoughts and decisions. Section III provides a conceptualization of the research domain and examines research on information teachers use to make judgments and decisions, the relation between characteristics of teachers and decisions, and teachers' evaluations of their teaching. The fourth section reviews research on the cognitive processes underlying teachers' judgments and decisions. Section V examines research on teachers' instructional planning, while Section VI reviews research on interactive judgments and decisions. The review is concluded by setting forth recommendations for future research (Section VII).

II. ASSUMPTIONS AND METHODS

ASSUMPTIONS

Research on the thought processes of teachers rests on two funda-
mental assumptions. The first assumption is that teachers are rational
professionals who, like other professionals such as physicians, make
judgments and carry out decisions in an uncertain, complex environment
(e.g., Clark, 1978-79; National Institute of Education, 1975; Shavelson,
1973, 1976; Shulman & Elstein, 1975). This assumption of rationality
actually refers to teachers' intentions for their judgments and deci-
sions rather than to their behavior for at least two reasons.

The first, most obvious reason is that some teaching situations
call for immediate, rather than reflective, responses that probably pre-
clude rational processing of information in making an informed judgment
or decision.

The second reason is that the capacity of the human mind for formu-
lating and solving complex problems such as those presented in teaching
is very small compared to the enormity of some "ideal" model of rational-
ity, i.e., some normative model. In order to handle this complexity, a
person constructs a simplified model of the real situation. The teacher,
then, behaves rationally with respect to the simplified model of reality
that he has constructed. This conception of teachers with "bounded
rationality," i.e., rational within the constraints of their information
processing capabilities, leads to a modification of the first assumption:
Teachers behave reasonably in making judgments and decisions in an un-
certain, complex environment.[1] This modified assumption seems preferable
to previous behavioral models. "Though it is possible, and even popular,
to talk about teacher behavior, it is obvious that what teachers do is
directed in no small measure by what they think....To the extent that
observed or intended behavior is 'thoughtless,' it makes no use of the
human teacher's most unique attributes. In so doing, it becomes mechani-
cal and might well be done by a machine." (National Institute of Edu-
cation, 1975.)

The second assumption is that a teacher's behavior is guided by his thoughts, judgments and decisions. If this is not true, "then teachers are automata of some kind" (Fenstermacher, 1980, p. 36). Hence the question of the relationship between thought and action in teaching becomes crucial yet problematic as Nisbett and Ross (1980, p. 11) pointed out:

> We also say little about precisely how people's judgments affect their behavior. This is neither an oversight nor a deliberate choice. We simply acknowledge that we share... psychology's inability to bridge the gap between cognition and behavior, a gap that in our opinion is the most serious failing of modern cognitive psychology.

Fortunately or unfortunately, researchers studying teachers' thoughts, judgments, decisions and behavior do not have such an easy out since in order to understand teaching, we must understand how thoughts get carried into actions.

METHODS

Research on the cognitive processes and behavior of teachers has a characteristic set of methods which differs somewhat from the correlational and experimental studies characteristic of previous research. These methods attempt to collect data on mental processes and so use more or less direct probes of teachers' thoughts and judgments. They include policy capturing, lens modeling, process tracing, stimulated recall, case study and ethnography (for discussions of one or more of these methods see Einhorn, Kleinmuntz & Kleinmuntz, 1979; Ericsson & Simon, 1980; Erickson, 1979 a, b; Shulman & Elstein, 1975).

Policy Capturing and Lens Modeling

In a policy capturing study, teachers would be given (say) descriptions of 32 hypothetical students. These students might vary as to achievement, gender, class participation, ability to work independently, and classroom behavior. This variation between students would be systematically manipulated in (say) a 2^5, within subjects design where each

teacher would judge each student's chance of (say) earning a B average or better at the end of the school year. Teachers' judgments would then be regressed on the students' characteristics and the resulting multiple regression equation would be interpreted as a model of the teachers' policy for judging students' probable success. Such models turn out to be quite simple in form--typically a simple additive model seldom with more than three variables often accounts for most of the variance in judgments--even though the model may represent fairly complex judgmental strategies (Einhorn et al., 1979).

There are, however, several problems in the application of this approach. The first is that typically policy capturing studies are carried out in a laboratory with hypothetical judgmental tasks, although this need not be the case. Hence, a question of generalizability arises. (Einhorn et al., 1979, and Shavelson & Borko, 1979, provide evidence supporting the generalizability of this method to more realistic situations.) Second, regression analyses typically aggregate data from all of the teachers in a study. However, in doing so with ordinary least squares regression programs, the tacit assumption is made that each teacher has exactly the same policy. Cadwell (1980) has shown both theoretically and empirically that this usually is not the case. Rather, subsets of teachers may share the same policy or perhaps each teacher may have a unique policy. Third, great care must be taken in interpreting the results of the policy capturing study. A regression model might indicate the teacher(s) judgments could be predicted from information about a student's achievement, participation and classroom behavior. However, this is an "as-if" model; it does not mean that teachers actually take a weighted sum of the variables.

In a lens modeling study, three pieces of information are required: (a) a criterion measure of the event being judged (say, students' preferences for reading materials), (b) a list of cues predictive of the criterion measure (say, presence or absence of fantasy, animals, danger, and humor), and (c) teachers' judgments of students' preferences (i.e., predictions of each student's reading preference). The correlation between a teacher's predictions of students' reading preferences and students' actual preferences provides a measure of overall judgmental

accuracy. And a regression of a teacher's judgments on the cues pro-
vides a model of the teachers' policies for reaching their judgments.
The problems in this approach are similar to those of policy capturing.

Process Tracing and Stimulated Recall

In a process tracing study, typically subjects are asked to "think
aloud" while performing a task, solving a problem, or reaching a deci-
sion. For example, Peterson, Marx and Clark (1978) asked teachers to
think aloud while they planned a social studies lesson. The resultant
verbal protocol becomes the data to be analyzed. The analysis may take
the form of a traditional content analysis where the researcher counts
the number of times a teacher refers to behavioral objectives while
planning a lesson. Or it might take the form of a flow chart modeling
the teacher's thought processes (e.g., Fig. 4). This flow chart would
then serve as the basis for computer simulations.

Stimulated recall is typically used where the process tracing
technique would interfere with the subject's performance on a task.
For example, asking a teacher to "think aloud" while conducting a
lesson usually is not feasible. So, the researcher either audio- or
videotapes the lesson. After the lesson (or after school, depending
on scheduling), the tape is played back to the teacher by the researcher
and the teacher is assisted in recalling the covert mental activities
that accompanied the overt behavior.

Both process training and stimulated recall use verbal reports as
data bearing on the cognitive processes of teachers, and they assume
that teachers are able and willing to articulate their thought processes.
This assumption of introspection has a long and controversial history
culminating in Nisbett and Wilson's (1977) review discrediting verbal
reports as data. However, Ericsson and Simon (1980) pointed out that
Nisbett and Wilson did not have an adequate model for predicting whether
or when verbal reports would be accurate or inaccurate.

Ericsson and Simon developed such a model. The model predicted
that verbal reports would be accurate when subjects "think aloud" and
doing so does not require restructuring of the information provided.

When information being processed is not in verbal form, a subject's performance may be slowed down and his verbalization may be incomplete, but the report will be accurate. However, "inconsistent retrospective reports can be produced as a result of probes that are too general to elicit the information actually sought, and as a result of subjects' use of inferential processes to fill out and generalize incomplete or missing memories" (Ericsson & Simon, 1980, p. 247). With respect to the Nisbett and Wilson (1977) review, Ericsson and Simon (1980, p. 247) concluded that, of the studies analyzed, instances "of inconsistency between verbal reports and data all refer to experimental situations and procedures where our model would predict that veridical reports could hardly be expected." With respect to verbal report data, they (Ericsson & Simon, 1980, p. 247) concluded that:

> It is time to abandon the careless charge of "introspection"
> as a means for disparaging such data. They describe human
> behavior that is as readily interpreted as any other human
> behavior. To omit them when we are carrying the "chain and
> transit of objective measurement" is only to mark as terra
> incognita large areas on the map of human cognition that we
> know perfectly well how to survey.

Case Study and Ethnography

A case study is a narrative account of an object of social inquiry such as a classroom, a school system or any other bounded system (cf. Stake, 1978). Essentially ethnography is a narrative study (usually more descriptive than theoretical) of a bounded system in its cultural context. The more psychologically and cognitively oriented ethnographers assume that "individuals have meaning structures that determine much of their behavior...[and] that they seek to discover what these meaning structures are, how they develop, and how they influence behavior, in as comprehensive and objective a fashion as possible" (Wilson, 1977, p. 254). Qualitative research, then, "is predicated upon the assumption that an 'inner understanding' enables the comprehension of human behavior in greater depth than is possible from the study of surface behavior, from paper and pencil tests and from standardized interviews" (Rist, 1979, p. 20).

The assumptions of qualitative research are quite consistent with a major premise of research on teachers' decisionmaking, viz., in order to understanding teaching, teachers' goals, judgments and decisions must be understood, especially in relation to teachers' behavior and the classroom context. The potential contribution of qualitative research to research on teaching is that fieldwork methods (e.g., participant observation, focused interviewing) and analytic techniques (e.g., development of conceptual and categorical systems from the data themselves) have been developed by qualitative researchers and have their canons of methodological rigor just as quantitative methods do (e.g., Cohen, 1972; Erickson, 1979a, b; Filstead, 1970; Wilson, 1977).

The fact that qualitative methods have their own canons of methodological rigor is often blurred by the misuse of these methods by researchers (Rist, 1980). Erickson (1979b) pointed out a number of limitations and potential problems with ethnographies, some of which arise when the methodological canons become blurred: (a) Timing—by the time the ethnology is written up, it is too late for use in the short run. (b) Validity—ethnographers may not have been intensive enough, or they may be inept; the informants may not be articulate, or they may have concealed information. (c) Superficiality—description stopped at surface appearances. (d) Evidentiary adequacy—the level of inference about overall trends may not be supported by the data. To Erickson's list might be added the demands of journals for concise reporting of the results of ethnographies and case studies. This requirement makes it virtually impossible for the reader to evaluate the study.

Methodological Adequacy of the Studies Reviewed

The studies examined in this review have used a wide variety of research methods. The methodological adequacy of the findings of some types of studies (e.g., experiments with standard psychometric instruments) are easier to evaluate than other types of studies (e.g., short reports of ethnographies, stimulated recall data). One major finding of the review is that researchers studying teachers' thought, judgments, and decisions often do not: (a) provide adequate descriptions of their methods, (b) incorporate methodological checks in their studies, or

(c) systematically study methods used in this field of research. Given these limitations, it was virtually impossible to critically evaluate some of the individual studies examined in the review. In this case, replicability was used as a criterion for including the study. If studies which, individually, could not be evaluated adequately on methodological grounds produced consistent results, they were included. However, a caveat is in order. The consistency may tell us more about the researchers' shared conceptions than about empirical reality. The remaining studies included in the review were evaluated on the basis of their methodological adequacy (e.g., design, procedures, instrumentation, and data analysis). However, due to space limitations, detailed descriptions of the methods of most studies are not presented; this overview of methods will have to suffice. The exception to this rule is that methodological considerations will be discussed where interpretations of findings depend on methods.

III. CONCEPTUAL UNDERPINNINGS OF RESEARCH ON TEACHER THOUGHT, JUDGMENT, AND DECISIONS

INTRODUCTION

In this section, the conceptual underpinnings of research on teachers' thoughts, judgments, and decisions are set forth. In doing so, the psychological basis of this research is briefly sketched and then research on teaching arising from this orientation is reviewed here and in subsequent sections.

An overview of this conceptual domain is presented in Fig. 1. This figure is intended to show that this research focuses on how teachers integrate information about students, the subject matter, and the classroom and school environment in order to reach a judgment or decision on which their behavior is based. The figure is circular in order to show that the conditions that inform a decision will, in all likelihood, be changed somewhat by the consequent behavior of the teacher.

Underlying Fig. 1 is the psychological fact that the ability of teachers, and people in general, to process all of the information in their environment is limited. More specifically, people tend to process information sequentially (i.e., step by step) rather than simultaneously (Newell & Simon, 1972). This active processing goes on in a very limited capacity, short-term memory (STM; Newell & Simon, 1972; Simon & Newell, 1971). To the extent that the environment is predictable (i.e., consistent patterns), information can be chunked into more abstract units and hence the amount of information processed in STM can be transferred, rather slowly, to a relatively permanent, long-term memory (LTM). By using LTM in conjunction with the active processing in STM, the capacity to process information also is increased (Ericsson, Chase, & Faloon, 1980). As a consequence of these information processing limitations, people selectively perceive and interpret portions of the available information (Bruner, 1957) with respect to their goals, and construct a simplified model of reality (Newell & Simon, 1972; Simon & Newell, 1971) using certain heuristics (Tversky & Kahneman, 1974; Nisbett & Ross, 1980), attributions (Nisbett & Ross, 1980) and other psychological mechanisms (Janis & Mann, 1977). People then make judgments and decisions,
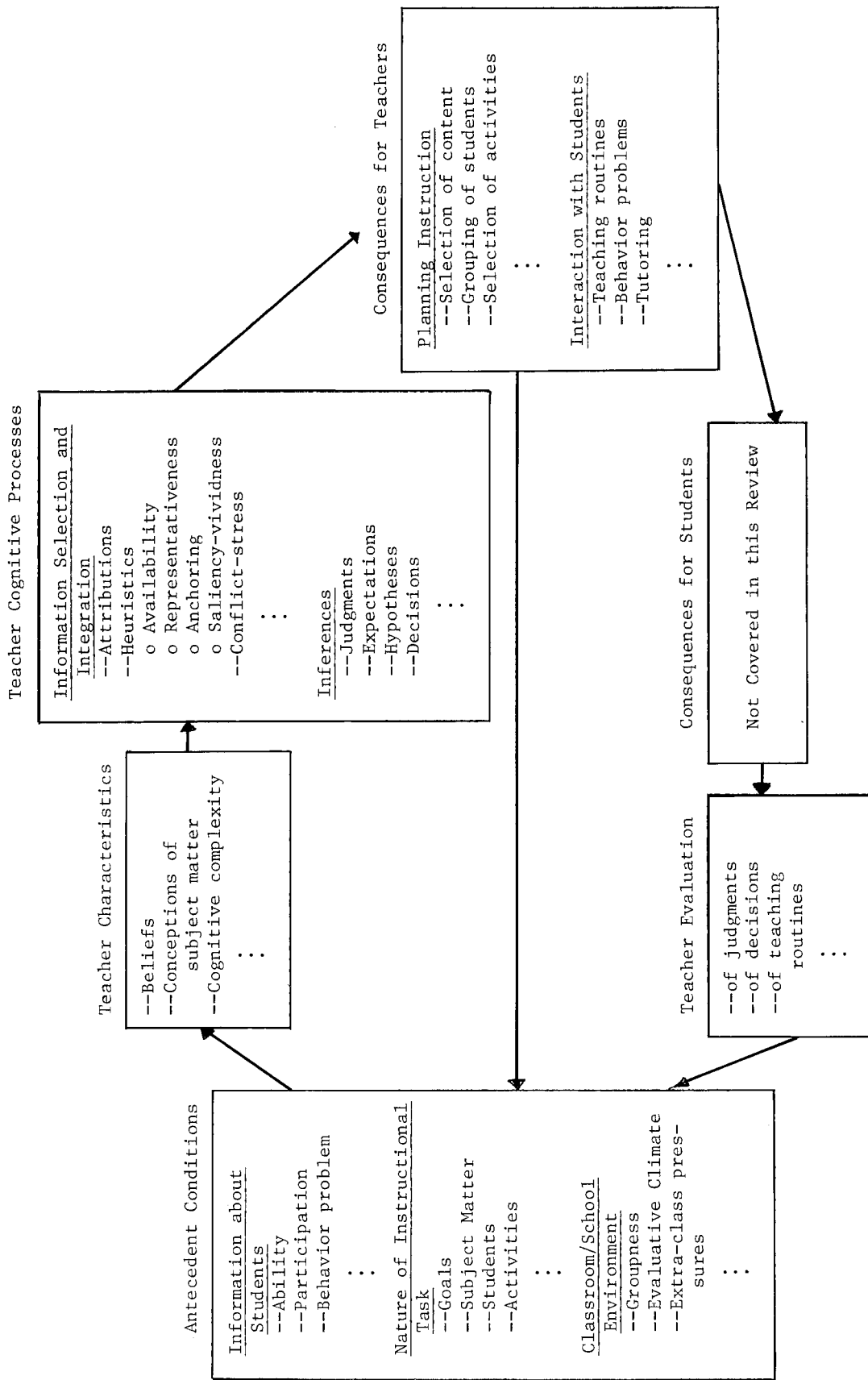
Fig. 1. Overview of the domain of research on teachers' judgments, decisions and behavior.

and carry them out on the basis of their psychological model of reality (Nisbett & Ross, 1980; Newell & Simon, 1972; Simon & Newell, 1971). In order to understand the behavior of teachers, then, it is essential to know (a) their goals, (b) the nature of the task environment confronting them, (c) their information processing capabilities, and (d) the relationship between these elements.

In order to show, briefly, that this psychological characterization of man speaks to teachers in particular, we have to jump ahead of the review considerably. One of the major findings of research on teacher planning is that teachers do not follow the traditional model for instructional design by specifying objectives, creating step by step procedures for moving students with certain entry skills and knowledge to those objectives, and evaluating the effectiveness of instruction after implementing it. Rather, teachers focus on the activities--content, material--with which students will be involved (Clark & Yinger, 1979; Mintz, 1979). Activities are formulated such that, during interactive teaching, student participation in the activity makes their behavior predictable. Hence, research on interactive teaching shows that teachers' primary concern is maintaining the activity flow. They monitor--i.e., have to attend to--only indicators that the activity is not going as planned. Hence, a rather complex environment is rendered predictable and simplified in order for the teacher to handle its complexity.

Domain of Research

In this section, the components of Fig. 1 are defined. Research on antecedent conditions, teacher characteristics and teachers' evaluation of their own teaching are reviewed. Literature pertaining to teachers' cognitive processes, instructional planning and interactive teaching is reviewed in subsequent sections.

Antecedent Conditions

Antecedent conditions refer to those categories of information that impinge, either with or without awareness, on teachers' classroom decisions.

Information about Students. Teachers attend to a variety of infor-
mation about students in planning and carrying out instruction. The
findings from a number of studies are summarized in Table 1 along with
the type of judgment or decision under consideration, the grade level
taught, and the method of investigation in the study. The following
types of information were important in the majority of studies: stu-
dents' general ability or achievement, sex, class participation, self-
concept, social competence, independence, classroom behavior, and work
habits.

Nature of the Instructional Task. An instructional task consists
of three elements: (a) a goal or goals; (b) a set of givens, e.g.,
student characteristics, availability of materials; and (c) a set of
operations necessary to achieve the goals (cf. Doyle, 1980). Tasks,
then, may be viewed as instructional treatments. Accomplishing a task
can have two consequences.

> First, a person will acquire information--facts, concepts,
> principles, solutions--relevant to the demands of the parti-
> cular task that is accomplished. Second, a person will prac-
> tice operations--memorizing, classifying, inferring, analyz-
> ing--used to obtain or produce the information demanded by
> the task....Students and teachers will learn what a task leads
> them to do, i.e., they will acquire information and operations
> which are necessary to accomplish a task....Different tasks,
> then, will have different effects depending on the goals and
> the operations which are defined by the tasks. (Doyle, 1980,
> p. 78.)

For teachers, tasks are comprised, in large part, of content,
materials and activities (e.g., Morine-Dershimer, 1978-79b; Morine-
Dershimer & Vallance, 1975; Peterson et al., 1978; Zahorik, 1975).
Much of teachers' planning is focused on creating tasks and much of
interactive teaching is focused on the smooth implementation of the
task (cf. Morine-Dershimer, 1978-79b; Joyce, 1978-79).

Once a task has been formulated, it operates as a plan (cf.
Shavelson, 1973), mental image (cf. Morine, 1978-79b), or script
(Abelson, 1976; Schank & Abelson, 1977) which the teacher carries out
in the classroom. The task guides the teacher's behavior during

Table 1

Studies of Student Cues Used by Teachers in Forming Estimates and Making Decisions
(based on Shavelson, 1979)

Study	Type of Estimate or Decision	Grade Level Taught	Method of Investigation	Salient Cues
Albro & Haller (1972)	Tracking decisions	6th	Questionnaire	Disruptiveness General ability Motivation Self confidence Work habits
Barr (1975)	Preinstructional	1st	Interview Observation	Anecdotal records from kindergarten teacher Reading readiness classwork Standardized readiness tests Student behavior
Borko (1978)	Planning	Elementary	Laboratory	Ability
Borko et al. (1979)	Planning Interactive	Elementary	Laboratory	Ability Behavior
Brophy & Good (1974)	Varied	Varied	Varied	Sex
Caplan (1973)	Promotion/retention Decisions	Elementary	Analysis of report card marks	Considerate of others Determination Independent in thinking Receptive to the ideas of others Sense of humor
Clark & Elmore (1979)	Planning		Classroom	Knowledge/ability
Clark & Peterson (1979)	Interactive decisions	7-9th	Stimulated recall interview	Global state/mood of group Student participation/involvement

Table 1 continued

Study	Type of Estimate or Decision	Grade Level Taught	Method of Investigation	Salient Cues
Clark & Yinger (1979)	Planning		Laboratory	Involvement
Cone (1978)	Interactive	Elementary	Laboratory	Ability Behavior
Connors (1978)	Interactive	Elementary	Stimulated recall	Ability Participation
Everhart (1979)	Classroom	Junior High	Ethnography	Ability
Good & Brophy (1972)	Work-related & behavior management interactions	Elementary	Observation	History of deviant behavior
Long & Henderson (1972)	Prediction of school performance	Elementary	Interview	Activity level Attentiveness Standardized readiness test
MacKay & Marland (1978)	Interactive	Elementary	Stimulated Recall	Ability Participation
Marland (1977)	Interactive	1st, 3rd, & 6th	Stimulated Recall	Ability Participation
McNair (1978-79)	Interactional	Elementary	Stimulated Recall	Ability Attitudes Behavior Learning
Mintz (1979)	Preinstructional	Elementary	Simulation	Ability
Morine (1976)	Preinstructional decisions about reading	2nd, 5th	Experimental simulation task	Family background Health & attendance record Previous reading programs Previous teacher comments Standardized achievement tests

Table 1 continued

Study	Type of Estimate or Decision	Grade Level Taught	Method of Investigation	Salient Cues
Morine-Dershimer (1978-79a)	Categorizing task	Elementary	Interview	Ability/achievement Involvement in instruction Peer relations Personality
Morine-Dershimer & Vallance (1976)	Interactive decisions	2nd, 5th	Interview & sorting task	Behavior Comprehension Participation in lesson
Morrison & McIntyre (1969)	Most important student characteristics	Primary	Questionnaire	Ability to use language Carelessness Cooperativeness Courtesy General ability Laziness Originality Persistence Talkativeness
Peterson et al. (1978)	Preinstructional	Junior High	Laboratory	Ability
Peterson & Clark (1978)	Interactive	Junior High	Laboratory	Participation & involvement
Russo (1978)	Planning	Elementary	Laboratory	Ability
Schafer (1973)	Describe the "ideal" pupil	Emotionally disturbed, ages 6-14; 4th & 5th	Checklist	Considerate of others Determination Independent in thinking Receptive to the ideas of others Sense of humor
Shavelson et al. (1977)	Planning	5th	Laboratory	Ability

Table 1 continued

Study	Type of Estimate or Decision	Grade Level Taught	Method of Investigation	Salient Cues
Silberman (1969)	Work-related & behavior management interactions	Elementary	Observation Questionnaire	History of deviant behavior
Smith & Geoffrey (1968)	Prestructional & interactive decisions	6th, 7th	Ethnography	Ability Appropriate classroom behavior Cooperativeness
Stern & Shavelson (1980)	Grouping for reading	Elementary	Ethnography	Ability
Willis	Impressions of achievement	1st	Interview	Ability to work without constant teacher supervision Attentiveness Class participation Maturity Self-confidence
Yamamoto (1969)	Characterize the "ideal" pupil	All levels, (student, teachers)	Checklist	Considerate of others Courteous Desire to excell Disturbs class organization Does work on time Industrious Obedient Unwilling to accept others

instruction until something goes terribly wrong (e.g., Joyce, 1978-79; Morine, 1978-79b; Yinger, 1977; see Section VI, below). It is at this point that teachers judge the criticality of the situation and perhaps consider alternative courses of action.

The nature of the instructional task indirectly affects judgments and decisions by influencing the information about students to which the teacher attends. For example, teachers group students for reading primarily on the basis of their reading ability. However, they tend not to group students for math instruction, in some cases ignoring information about mathematics ability and in other cases individualizing according to this ability.

The Classroom and School Environment. The classroom and school environment comprise a social context which influences what happens in the classroom (cf. Cohen, 1979). Classroom environment refers to the social and physical context of the classroom. It is, to a large degree, under control of the teacher (cf. Joyce, 1978-79), but achievement of control involves a continual process of negotiation of goals with students (e.g., Cohen, 1980; Everhart, 1979; Janesick, 1978). Hence, the classroom environment influences teachers' judgments and decisions and, in turn, is influenced by them.

The importance of establishing a sense of community in classrooms is shown by two ethnographic studies of individual teachers and their classrooms (Florio, 1979; Janesick, 1978). Janesick (1978) reported that the teacher's primary goal was to establish a sense of "groupness" in the classroom from the outset of the school year. To this end, he considered himself the group leader and modeled and emphasized cooperation and respect for other members of the group. Most classroom activities were group activities and were evaluated, during instructional planning, as to their impact on groupness. An important aspect of the study was the fact that, in midyear, the teacher had to leave the classroom to attend to other duties. Hence, the sense of "groupness" established at the beginning of the school year began to fade under a substitute teacher. When the teacher returned to his teaching duties, he had to renegotiate "groupness" in order to return the class to the work environment he had left.

Florio (1979) studied the teaching of writing in a second grade classroom. The teacher went beyond creating a sense of community in terms of norms and behavior and actually created a physical community which served as the basis for instruction.

> The classroom literally spills out into the corridor with bright colors and activity. Upon entering the classroom, you encounter yet another small community, one that the children have dubbed, 'Betterburg.' The child-sized, cardboard building of Betterburg dominates the physical space of the classroom. We have found that Betterburg dominates as well the social life and the attendant writing that is done in that physical space. (Florio, 1979, p. 3.)

The reward structure of the classroom is often an integral part of the classroom community (Cohen, 1979; Doyle, 1980). Judgments about students' responses are made frequently (Sieber, 1979, estimated about 87 times a day!). "By being either a recipient or witness to these evaluations, students can build an evaluative map of a classroom environment" (Doyle, 1980, p. 94). This evaluative climate connects academic tasks to a reward structure. Doyle (1980) argued that those student responses that the teacher accepts (a) "define the real task in classrooms" (p. 95); define the "allowable routes to answers" (p. 95) and so affects the nature of the tasks; and (c) define the "strictness of criteria a teacher uses to judge answers [which] has consequences for task accomplishment" (p. 96).

Embedding academic tasks in a reward structure also influences teachers' decisions about their instructional tasks. Doyle (1980, p. 98) reported that teachers chose explicit specific tasks involving a single correct answer. The reason for this choice is that,

> A correct answer in a comprehension task can take several different surface forms and, indeed different answers may be equally correct. This situation requires a considerable amount of interpretation by both teachers and students in order to judge the correctness of answers. Teachers would appear, on occasion at least, to reduce this interpretive load by defining a single answer as acceptable when several answers would be legitimate...aside from reducing the interpretive load, specificity would also seem to increase student involvement, even more perhaps than extrinsic incentives....

The school environment, including those extra-classroom pressures in the school such as administrators and policies (Barr, 1980) and in the community (especially parents), sets boundaries on teachers' pedagogical decisions. For example, one of the most critical decisions affecting what students learn is the choice of content for instruction (Floden, Porter, Schmidt, Freeman, & Schwille, 1980). Floden et al. (1980, p. 21), noted that:

> Teacher decisions about...content may be influenced by the actions of other individuals in the education system, as well as by the teacher's own beliefs...(Schwille, Porter, & Gant, 1979). Some individuals may make a conscious effort to affect teacher content decisions, as when a district curriculum director promotes the use of a list of objectives to be achieved. ...In other cases, the impact on content decisions may be unintended. For example, a district superintendent may mandate administration of a standardized test to assess teacher effectiveness. Teachers may tend to restrict instruction to topics on the test--'teaching to the test'--although the superintendent had not desired such a shift in content coverage (Floden, Porter, Schmidt, & Freeman, 1980).

Floden, et al. (1980) studied teachers' decisions about content as a function of external pressures. Fourth grade teachers (N = 66) were asked to indicate whether they would incorporate new topics in their mathematics curriculum on the basis of six external pressures: "[1] Textbooks supplied to your class, [2] publication by the central administration of a set of objectives which all teachers have been directed to follow,...[3] publication in the local newspaper of standardized test results by building and grade level...and discussions with [4] the principal, [5] the fifth- and sixth-grade teachers, or [6] the parents of children in your class" (Floden et al., 1980, p. 6). Schwille, Porter & Gant (1979) aptly summarized the results of the study: The most notable aspect of their response to the vignettes was a willingness to change content, whatever the pressure for change. Before reaching the conclusion that teachers are responsive to many external pressures, note that this was a laboratory study in which teachers did not have to face the consequences of the decisions. The generalizability of this finding to practice still needs to be examined.

One possible approach to studying the effects of classroom and school environments on teachers' judgments and decisions is suggested by Cohen (1980, pp. 4-51):

> Teachers and students...have their own goals. In the context of a classroom, presumably, a teacher's goals include desired changes in students (i.e., learning goals), desires for certain levels of order and predictability in classroom life, etc., each of which may impinge on teacher behavior and decisions. Similarly, each student presumably has long range goals and ambitions, preferences for learning about some things rather than others,...in the company of certain individuals rather than others....Individuals are purposive actors, seeking to further their own ends--whatever those might be. The social order of the classroom then is in part a function of negotiations between classroom participants over the use they will make of their common space and time. This perspective suggests that we take into account individual student goals as well as teacher goals, and that we attend to this existence of multiple goals for each actor, some subset of which may be directly related to the content of instruction in the classroom.

Several ethnographic studies point to the potential explanatory power of Cohen's proposal. With respect to the classroom environment, Everhart (1979) reported that teachers focused on instructional goals and differentiated among their students on the basis of effort, ability, and personal-social characteristics. In contrast, students used "criteria in classifying those in their peer network, focusing on behavior that affected social interaction among each other....Such a particularistic system of stratification seemed natural because social interaction among friends was so important and visible to students, and its pervasiveness displaced any universalistic criteria such as classroom performance" (p. 154).

With respect to the school environment, McNeil (1980) reported that, while high school teachers in her study were knowledgeable about and interested in economics topics, the presentation of topics was reduced to simplistic, teacher-controlled information requiring no reading or writing, little student discussion, and very little use of the school's resources. Teachers' fear of management problems derived from the goals of the school administration "which expected them to

enforce rules of discipline, but which rarely backed them on that en-
forcement; as a result, they wanted to avoid as many inefficient changes
as possible in order to get through the day" (McNeil, 1980, p. 10).

Teacher Characteristics

Most research posits one or more characteristics of teachers that
influence their judgments, decisions and behavior. Shavelson, Cadwell
and Izu (1977) found in a policy capturing study that, when relevant
information was available for decisions, teachers (and graduate students
in education) used that information to make a decision. However, when
the information was not relevant for a decision, Shavelson et al. sur-
mised that subjects' beliefs about education and teaching guided their
decisions. A series of studies by Borko (1978), Russo (1978) and Cone
(1978) examined the effects of teachers' traditional-progressive beliefs
(cf. Kerlinger & Pedhazur, 1968) on teachers' decisions. Russo (1978)
reported that teachers' beliefs were not related to teachers' decisions
about grouping students for reading and math, and were not related to
their decision about lesson plans. Cone (1978) reported that beliefs
were not related to teachers' decisions for handling classroom behavior
problems. However, Borko (1978) found that: (a) teachers with stronger
traditional beliefs decided to give students less responsibility for
planning their instructional program than teachers with weaker tradi-
tional beliefs; (b) teachers with stronger progressive beliefs were
more likely to use peer tutoring than teachers with weaker progressive
beliefs; (c) teachers with stronger traditional beliefs were more likely
to refer students for testing and/or special class placement than were
teachers with weaker traditional beliefs; and (d) teachers with stronger
progressive beliefs judged social competence and emotional growth goals
for students as more important than teachers with weaker progressive
beliefs. However, all teachers judged basic academic skills to be im-
portant goals regardless of their beliefs.

Teachers' conceptions of a subject matter also are expected to
influence their judgments, decisions, and behavior (e.g., Barr, 1975;
Bawden, Burke, & Duffy, 1979; Duffy & Metheny, 1979; Harste & Burke,
1977; Metheny, 1980; Pearson & Kamil, 1978). Pearson & Kamil (1978)

described three informal models of reading: (1) bottom-up models which assume that the reading process begins with the printed word and goes to meaning, (2) top-down models which assume that the reading process begins in the mind of the reader with an hypothesis about the meaning of the printed word, and (3) interactive models which assume that these two types of information processing models work simultaneously to mutually facilitate reading.

These models suggest different instructional methods and strategies (e.g., a decoding emphasis for the bottom-up model versus a meaning emphasis for the top-down model). Further, they suggest that teachers make different instructional decisions based on the particular instructional model to which they adhere. For example, the teacher who holds the bottom-up model would decide to remediate a reading problem by teaching the student the basic decoding skills on which he is weak. In contrast, a teacher who adheres to the top-down conception would teach a child to generate meaningful hypotheses by capitalizing on the components of the reading process in which the child showed strength.

Barr's (1975) survey and case study found that teachers varied considerably in their decisions on whether to group and when to group for basal reading and phonics instruction. She speculated that one factor in these decisions was the teachers' conceptions about good reading instruction (cf. Shavelson & Borko, 1979). For example, teachers who favored comprehension activities over decoding activities would be more likely to group students for basal reading than for phonics instruction.

Bawden, Burke and Duffy (1979) conducted a survey and follow-up case studies of 23 teachers. They reported that older teachers with more teaching experience held a skills-oriented conception of reading, while younger, less experienced teachers held more child-centered conceptions. And approximately 90 percent of the first grade teachers professed a skills-oriented conception, while teachers of other grade levels held a more student-oriented conception of reading. They also found that all teachers held one belief about reading and approximately 83 percent of the teachers possessed two or more (in most cases related) conceptions of reading. Overall, teachers' instructional activities and time allocation to certain reading activities reflected their conception(s).

Metheny (1980) replicated the Bawden et al. (1979) findings of the relation of grade level to conception. He also found that teachers had conceptions of two groups of students: low SES, low ability students and high SES, high ability students. Teachers espoused, for example, different instructional strategies, teacher roles and instructional materials for these two groups of students.

Several other studies have shown that teachers' decisions and/or behavior are related to a cognitive style variable, cognitive complexity (Hunt, Greenwood, Noy & Watson, 1973; Hunt & Sullivan, 1974). For example, Peterson, Marx and Clark (1978, p. 426) found that:

> Teachers low on conceptual level (CL)...tended to be more productive and had more planning statements dealing with Lower Order [factual] Subject Matter. In contrast, teachers high on CL directed more planning statements to the Instructional Process and the Learner. These findings support the notion that teachers whose cognitive processing was more differentiated (high CL) were more likely to be differentiated in their planning. In addition, by focusing on the Instructional Process and the Learner, high CL teachers were going beyond the information given (e.g., the objectives and the text material) and were planning at a more abstract level than were low CL teachers.

Finally, Clark and Yinger (1979) identified teachers who were incremental planners--those who proceed in a series of short steps, based on day-to-day information, focusing on activities; and comprehensive planners--those who develop an abstract, general scheme over the long run. Clark and Yinger reported that both types of planning strategies seemed adaptive for the teachers using them.

Teachers' Cognitive Processes

In research on teachers' cognitive processes, two related, basic processes can be identified: information selection and inference. Studies primarily with undergraduates of judgmental heuristics, (Tversky & Kahneman, 1974; Nisbett & Ross, 1980), attributions (Nisbett & Ross, 1980; Weiner, 1977), and conflict and stress (Janis & Mann, 1977) speak to the selection and integration of information.

Heuristics are implicit rules that people are unaware of and use in complex tasks in order to select information, classify objects or persons, or revise their knowledge. "In general, these heuristics are quite useful, but sometimes they lead to severe and systematic errors" (Tversky & Kahneman, 1974, p. 1124). For example, the availability heuristic refers to the "ease with which instances or occurrences can be brought to mind....One may assess the risk of heart attack among middle-aged people by recalling such occurrences among one's acquaintances" (Tversky & Kahneman, 1974, p. 1127).

Attributions refer to teachers' estimates of student ability since they deal with the processes by which people integrate information to arrive at causal explanations for events (Borko & Shavelson, 1978). To make attributions, the perceiver is assumed to know the generality of an actor's behavior across contexts (consistency information), across entities (distinctiveness information) and the generality of the reaction across other actors (consensus information) (see Kelly, 1967). Various patterns of this information give rise to different attributions (McArthur, 1972). Attributions to the actor arise when there is high consistency (Sally always passes this particular math test), low distinctiveness (Sally passes most other math tests) and low consensus (hardly any other student passes this particular math test). Under these conditions teachers would perceive Sally as a good math student. Attributions to the test (stimulus attribution) occur when Sally always passes this test (low distinctiveness), and everyone else passes the test (high consensus). When a perceiver has limited information, the individual will try to find the pattern most consistent with the information available (see Orvis, Cunningham & Kelley, 1975).

Finally, conflict-stress refers to psycho-emotional processes. These processes may affect the choice of information teachers use to construct their psychological reality (cf. Janis & Mann, 1977), even though past research in this area has not focused on teachers.

By generalization, heuristics, attributions and conflict-stress might be expected to influence the inferences (Nisbett & Ross, 1980) teachers draw about students, instructional activities, and institutional constraints on their choice of alternative courses of action. Depending

on the focus of the research, these inferences may take the form of expectations, judgments or hypotheses.

These inferences may be viewed as attempts by people and specifically teachers to reduce the complexity of the original information available to them as antecedents to their judgments, decisions and behavior (Shavelson, 1976; Shavelson & Atwood, 1977; Shavelson, Cadwell & Izu, 1977). And teachers seem to make decisions and carry them out on the basis of these judgments rather than on the basis of the original information (Borko, 1978; Cone, 1978; Russo, 1978; Shavelson & Borko, 1979). A detailed review of research on teachers' cognitive processes is the topic of the next section and so is not discussed in detail here.

Consequences for Teaching

A basic assumption is that teachers' thoughts, judgments and decisions guide their teaching behavior. Research summarized by Shavelson and Borko (1979; see also Borko, Shavelson & Stern, 1980), for example, indicates that teachers' judgments about students' reading ability directly influence their decisions about grouping for reading instruction. Once students have been grouped, the reading group and not the individual student becomes the unit for planning instruction (cf. Barr, 1980). Teachers' plans for low reading groups differ greatly from their plans for high reading groups. And these plans guide teachers' behavior when teaching reading in terms of the pace of the lesson and the activities in which students are engaged (Shavelson & Borko, 1979; Stern & Shavelson, 1980).

Research on teacher planning and interactive teaching is reviewed in detail in Sections V and VI, respectively. As a consequence, further attention to these topics is deferred.

Consequences for Students

As pointed out in the introduction, this review focuses on teachers' thoughts, decisions and behavior and not on students' cognitive processes; hence the broken lines in the figure. Nevertheless, a conception of research on teaching is incomplete without this component, and so it is included in the figure (see Doyle, 1980; see also Bossert, 1978; Cohen, 1980).

Teachers' Evaluation of Their Teaching

This component refers to the phase of teaching (cf. Shavelson, 1976) where teachers assess their plans and accomplishments and so revise them for the future. There is little evidence available on this topic (cf. McKibbin, 1978-79). However, Clark, Windfong, & Yinger (1978) found that teachers did not take into account their teaching style when evaluating language arts activities. Researchers using the method of stimulated recall (e.g., McNair, 1978-79) have reported that teachers are surprised at some of their behavior and events that they failed to pick up while teaching. Finally, Marx (1978) reported that teachers were not accurate in reporting cues that they used to judge students. There is also evidence in the broader psychological literature that the ability to learn from past experience is quite limited:

> The picture of human judgment and choice that emerges from the literature is characterised by extensive biases and violations of normative models whereas the opposite view emerges from work on lower animals. That is, in the latter, much choice behavior seems consistent with optimizing principles....The danger of such pictures is that they are often painted to be interesting rather than complete. (Einhorn & Hogarth, 1981.)

Nevertheless, research by Hammond (1976), Mondol (1973), Sherman, Weinshank and Brown (1979) and Gil, Polin, Vinsonhaler, and Van Roekel (1980) suggests that, with appropriate information feedback and training, people in general (Hammond, 1976) and teachers in particular can change their judgments and improve them.

IV. TEACHERS' COGNITIVE PROCESSES

A MODEL OF TEACHER JUDGMENT AND DECISIONMAKING

Shavelson (1973, 1976) developed a cognitive model of teachers' judgments and pedagogical decisions as a heuristic for organizing and conducting research on teaching. It suggested a set of questions and conjectures about what information teachers use in making pedagogical decisions, how this information is integrated to reach decisions, and how institutional constraints and individual differences between teachers affect these decisions (Shavelson, 1978).
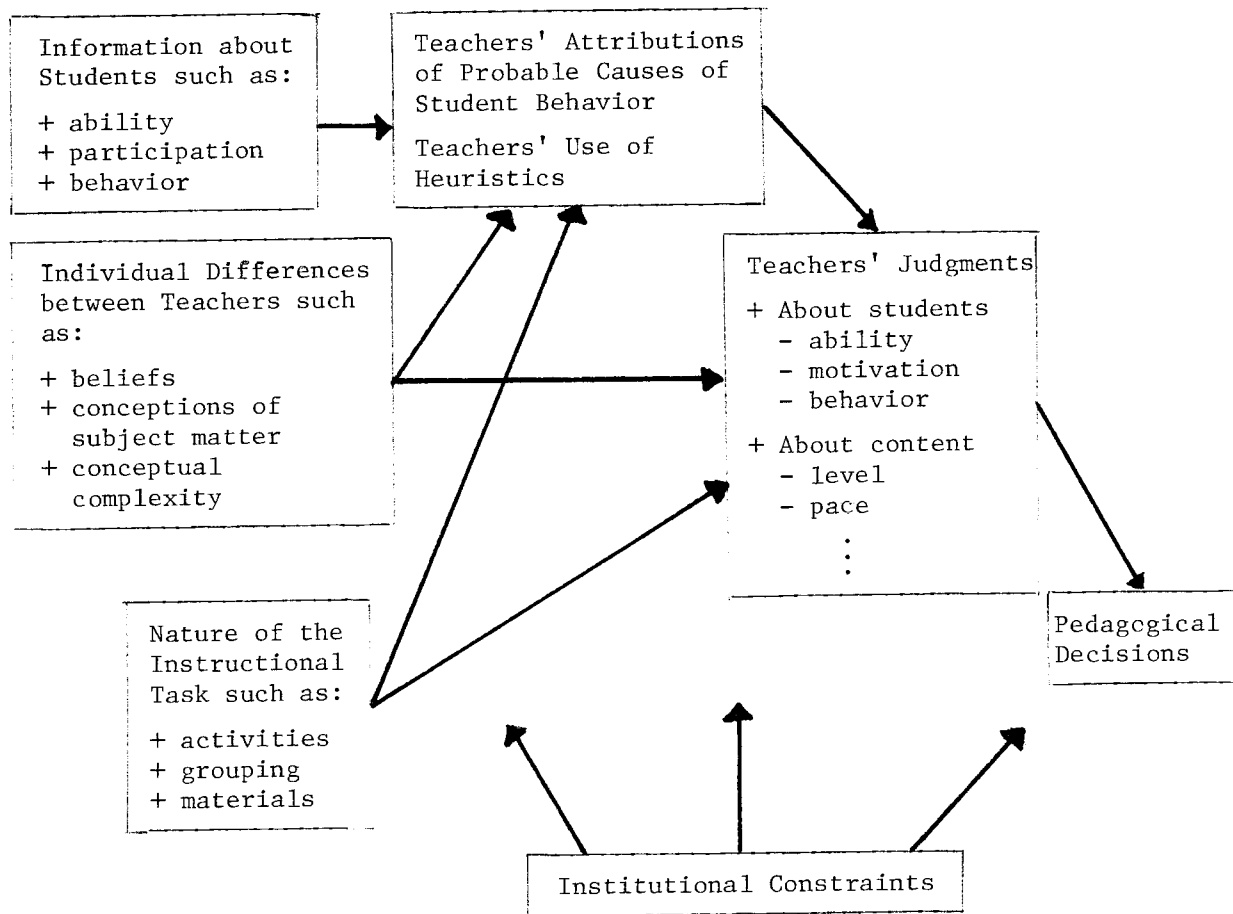
Fig. 2. Some factors contributing to teachers' pedagogical judgments and decisions (after Shavelson, 1979; Shavelson, Atwood, & Borko, 1977).

The model assumes that teaching is a process by which teachers make reasonable judgments and decisions with the intent of optimizing student outcomes (Shavelson, 1976, 1979; Shavelson & Atwood, 1977; Shavelson, Atwood & Borko, 1977; Shulman & Elstein, 1975).[2] While teachers' decisionmaking does not always match this description, it seems to apply to many goal-oriented teaching situations. For example, using the method of stimulated recall in studying teachers' thoughts and decisions while teaching students, McNair (1978-79, p. 32) reported that:

> Teachers were most affected by their concern for the pupil and based many of their decisions on what they surmized was happening with the individual student....Content accounted for the bulk of the remaining concerns voiced. Teachers apparently focused much of their attention on what was occurring during the lesson, i.e., what the students were hearing, saying, doing, and feeling.

Teachers are seen as active agents with many instructional techniques at their disposal to help students reach some goal. In order to choose from this repertoire, they must integrate a large amount of information about students from a variety of sources. And this information must somehow be combined with their own beliefs and goals, the nature of the instructional task, the constraints of the situation, and so on.

More specifically, the decision model (Fig. 2) identified some important factors which may affect teachers' pedagogical decisions. Teachers have available a large amount of information about their students (cf. Table 1) from many sources such as their own, informal observations, anecdotal reports of other teachers, standardized test scores and school records (Belli, 1979; Borko, Cone, Russo & Shavelson, 1979; Rudman et al., 1980; Shavelson, 1979; Shavelson, Atwood & Borko, 1977). In order to handle the information overload, teachers integrate this information into judgments about the student's cognitive, affective and behavioral states (cf. Borko et al., 1979; Everhart, 1979; Morine-Dershimer, 1978-79a; Shavelson, 1979; Shavelson, Cadwell, & Izu, 1977). These judgments, in turn, are used in making pedagogical decisions (e.g., Shavelson, 1976, 1978).

Attributions and Heuristics

The decision model (Fig. 2) as well as the conceptualization in
Fig. 1 posits that information is selected and integrated by teachers
to reach a judgment or make a decision, in part, on the basis of a few
heuristics and their attributions for the causes of events. Teachers'
attributions for the causes of achievement may serve as the basis for
teachers' judgments about students, such as student ability, effort,
and classroom behavior (cf. Borko & Shavelson, 1978). Thus, the liter-
ature on attribution theory in general and achievement attribution in
particular is pertinent; it has been reviewed by Kelley and Michela
(1980) and Weiner (1977; see also Borko & Shavelson, 1978; Nisbett &
Ross, 1980) and so will not be reviewed here.

Due to information processing limitations, people use heuristics
for selecting information (salience and vividness heuristic),[3] judging
the frequency or probability of an event (availability), classifying
persons and objects (representativeness), and revising their initial
judgments (adjustment and anchoring). While these heuristics lead to
accurate judgments in many situations, they may also lead to predic-
table errors (Tversky & Kahneman, 1974; Nisbett & Ross, 1980).

Shavelson, Cadwell, and Izu (1977) reviewed research bearing on
teachers' (and graduate students') judgments of their own students'
abilities and found evidence that their judgments were fairly accurate
(e.g., Shavelson, 1976). More recently, Morine-Dershimer (1978-79c)
correlated teachers' predictions of students' success made in September
and November with students' scores on reading from the Metropolitan
Achievement Test given the following April. The median correlation,
September prediction to April test, was .62 (range .42 to .80, n = 8
teachers); the median correlation, November to April, was .67 (range
.55 to .77, n = 8 teachers).

However, Shavelson et al. (1977) reviewed literature that found
that, in laboratory settings, teachers and others (e.g., undergraduates)
fell prey to predictable errors from several heuristics: For example,
the representativeness heuristic states that people decide whether or
not some person or object belongs to a particular category by judging
the similarity between the attributes of the person or object and the

attributes of the category (cf. Tversky & Kahneman, 1974). For example, when a description of a student matches the stereotype of a slow learner, even if the description is unreliable, incomplete, or outdated, people often predict with high certainty that the student is a slow learner. And Dusek (1975) and Smith and Lugenbuhl (1976) have shown that, in laboratory studies, teacher-student interaction is influenced by un-reliable information about the student.

The anchoring heuristic states that "people make estimates about events and other people by starting from an initial value that is ad-justed to yield a final answer. The initial value, or starting point, may be suggested by the formulation of the problem, or it may be the result of a partial computation. In either case, adjustments are typi-cally insufficient. That is, different starting points yield different estimates, which are biased toward the initial values" (Tversky & Kahneman, 1974, p. 1128). For example, subjects were asked to estimate percentages of African countries in the United Nations. They were given an initial percentage determined at random and asked to estimate the actual percentage. Groups of subjects beginning at either 10 percent or 65 percent estimated actual percentages of 25 and 45, respectively. Shavelson et al. (1977) suggested that this heuristic might be one mech-anism underlying the teacher expectancy phenomenon in that a teacher's initial expectation may serve as an anchor for his subsequent estimate of the student's ability. In a number of studies reviewed by Dusek (1975), for example, initial but not necessarily valid information about students influenced ('anchored') the way in which tutors taught students. Brophy and Good (1970) found that teachers' estimates of student ability influenced teacher-student interaction.

Shavelson et al. (1977), in a laboratory simulation, examined subjects' estimates of a student's ability based on either reliable or unreliable information, and their willingness to revise these estimates on the basis of subsequent information, which was either reliable or unreliable. They reported that:

> ...the subjects did consider the reliability of the information,
> adjusting their estimates in the direction predicted by the

Bayesian model. Furthermore, the anchoring heuristic and
research on teacher expectancy suggest that initial esti-
mates are difficult to overcome, even in the face of con-
flicting information. Nevertheless, the data show that
the subjects did revise initial probability estimates,
as expected by Bayes' Theorem. (p. 95.)

These findings are in contrast to much of the literature on the
use of heuristics (e.g., Einhorn & Hogarth, in press; Slovic et al.,
1976). There are a number of possible explanations. One is that the
research in most of the literature has used undergraduate students
making judgments in areas outside their expertise and so experts may
not fall prey to these errors (Winkler & Murphy, 1973; Beach, 1975;
but see Slovic et al., 1976). Hence, subjects in this study (teachers
and students in a graduate school of education), being professionals,
may have not fallen prey to errors based on the anchoring heuristic.
A second possible explanation is that the laboratory simulation was
so highly structured that the subjects could only act rationally.
Further research is needed to decide which of these or some other ex-
planation is most plausible.

Judgments and Decisions

Much of the research on teachers' judgments and decisionmaking
has used a policy capturing approach (see Section II). Research in
the literature on human decisionmaking has found that people's policies
can be represented by an additive model with about three pieces of in-
formation in the model. Research on teachers' policies for judging
ability, motivation and the probability that a student will be a be-
havior problem supports these findings in the more general literature.
Laboratory simulations by Borko (1978), Cone (1978), Cooper, Burger
and Seymour (1979), Giesbrecht and Routh (1979), Russo (1978) and
Shavelson et al. (1977), have found that, in judging student ability,
teachers primarily use information about student achievement but also
may use information about problematic behavior. In judging motivation
(effort), teachers rely heavily on information about achievement,
problematic behavior and work habits. And estimates of behavior prob-
lems rely on information about classroom behavior and, to a lesser ex-
tent, achievement.

Teachers' judgments about students, for example, and not the original information about students, appear to be the basis for their decisionmaking (Borko, 1978; Cone, 1978; Russo, 1978; Shavelson, 1976; Shavelson & Borko, 1979; Shavelson et al., 1977). That is, decisions about selecting content, tutoring, handling behavior problems, and grouping students tend to be made on the basis of teachers' judgments about students.

Furthermore, laboratory and classroom studies indicate that, when students are grouped (Barr, 1974, 1975; Russo, 1978; Shavelson & Borko, 1979) or treated as a whole class (Prawat, 1980) for instruction, teachers tend to think about the group and not the individual student. And they make pedagogical decisions--especially planning decisions-- on the basis of the group or whole class.

Research on human judgments and decisionmaking has found that people are generally unaware of the nature of their judgment policies. Hence, they report using more information in more complex ways than is suggested by the statistical (regression) model of their policies (e.g., Shulman & Elstein, 1975; Slovic et al., 1975). Studies of teachers' policies parallel these findings. For example, Clark et al. (1979) and Marx (1978) reported that teachers were unaware of their judgment policies.

Judgments and Diagnoses Regarding Reading

Byers and Evans (1980) used a lens model analysis (Brunswick, 1955; see Section II) to study the accuracy of teachers' judgments of students' reading interests. Students' reading choices served as the criterion measure. Twenty-nine cues were used to describe the books from which children could choose (e.g., presence or absence of animals, humor, mystery; see Evans & Byers, 1979). And the teachers judged their students' reading preferences.

Twenty-nine teachers (27 of them female) participated in the study. From teachers' class limits, 227 K to 6th grade, male and female students were selected randomly. Students identified their reading preferences from a brochure that contained brief descriptions of Scholastic Press

books. Teachers also were asked to identify, from the same brochure, the books they thought each of their students might like.

The results indicated: (a) students' reading interests fluctuated widely over grade level and sex (see Byers & Evans for details), (b) teachers inaccurately predicted students' reading preferences (over-all range of accuracy was -.23 to .69 with a mean of .23) because they lacked knowledge about students' interests, (c) teachers differed in the cues they used to reach their judgments, and (d) the 29 cues used in the present analysis were better predictors of girls' interests than boys' interests, particularly in grades 1, 5 and 6.

Teachers' and expert clinicians' diagnoses of children with reading problems have been studied extensively by Vinsonhaler and his colleagues (e.g., Vinsonhaler, 1979; see also Gill, 1980; Van Roekel & Patriarca, 1979; Weinshank, 1980). An "Inquiry Theory" of clinical problem solving underlies the research (Gil, Hoffmeyer, Van Roekel, & Weinshank, 1979; see also Elstein, Shulman & Sparfka, 1978; Vinsonhaler, 1979). According to the first principle of the theory, the behavioral domain is defined by a clinician--e.g., a teacher or reading specialist; a case--e.g., a simulated case of a student with reading difficulties or the student himself; and an interaction between the clinician and the case which has, as its goal, a diagnosis of the problem and a proposal for remediation. The elements of the case are: (a) a set of problems (e.g., inadequate word recognition), (b) a set of cue names (items of information, such as a Dolch word list), (c) a set of cue values which specify a student's performance level on each cue (e.g., e.g., 70 percent accuracy on Dolch words), and (d) a set of responses constituting potential treatments.

Inquiry Theory predicted that the following sequence of events will occur repeatedly during a clinical interaction: (1) principal complaint (statement of a problem by a case); (2) cue requests (gathering of data by the clinician); (3) cue values (clinician's perception of the significance of the data related to the problem); (4) diagnostic decision (determination of the problem by the clinician); (5) treatment decision (clinician's selection of most appropriate treatment); (6) follow-up decisions (determination of treatment's success).

The interaction between the clinician and the case is determined by the clinician's memory and strategy. The clinician's memory consists of a set of problems, cases, treatments and the relationships among them. The clinical strategy is the sequence of tasks which translates memory into action. These information gathering and information processing tasks are: (1) cue acquisition (gathering date); (2) hypothesis generation (different hypotheses about the case's problems given limited data); (3) cue interpretation (interpreting data); (4) hypothesis evaluation (probable validity of each hypothesis); (5) treatment evaluation (estimate of expected gain for each possible treatment); (6) prescription selection (selection of exact methods of remediation).

Three types of studies of the Inquiry Theory have been conducted: (1) laboratory and classroom studies of reading specialists, special education personnel and classroom teachers diagnosing children's reading problems; (2) computer simulation studies; and (3) training studies. Since training is discussed in Section III, the training studies are not reviewed here.

Four laboratory and classroom studies have examined the degree to which reading clinicians and classroom teachers agree on the diagnosis of reading problems (Gil, 1980; Van Roekel, 1980; Vinsonhaler, 1979; Weinshank, 1980). The Agreement Corollary of Inquiry Theory states that "for a given case and a given set of clinicians, the greater the similarity of clinical memory, the greater the agreement of diagnosis" (Vinsonhaler, 1979, p. 3). In particular, this corollary states that (a) individuals' diagnoses are more closely related to a diagnosis aggregated at the level of the group of clinicians ("group agreement") than are diagnoses of individuals, and (b) agreement between diagnoses made by one individual on equivalent cases (intra-clinician agreement) should be greater than agreement between clinicians (inter-clinician agreement).

The results of the studies indicated that there was a reasonable level of group agreement (e.g., agreement measure of .55 in Vinsonhaler, 1979; and .45 in Gil, 1980) on diagnosis. Further, the intra-clinician agreement coefficients (e.g., .17 in Vinsonhaler, 1979; and .14 in

Weinshank, 1980) and the inter-clinician agreement coefficients (e.g.,
-.07 in Vinsonhaler, 1979; -.04 in Gil, 1980; and .11 in Weinshank,
1980) were low. Reading clinicians, special educators, and classroom
teachers did not agree with themselves and each other on diagnosis.
Neither did they agree on remediation (inter-clinician agreement = .10,
intra-clinician agreement = -.20; Weinshank, 1980). In addition, a
correlation of zero was found between diagnosis and remediation at the
individual level (Weinshank, 1980).

Clinicians agreed more on cue collection than on either diagnoses
or strategies for remediation: (a) intra-clinician agreement was .33
(Vinsonhaler, 1979), and (b) inter-clinician agreement was .18 (Vinson-
haler, 1979). Further, consistent with the prediction of the Agreement
Corollary, the mean intra-clinician agreement was greater than the mean
inter-clinician agreement. Reading clinicians and classroom personnel
tended not to make reliable diagnoses. The lack of agreement among
reading specialists and teachers may be due to varied training back-
grounds and/or the possession of different conceptions of reading.

Gil (1980) observed and interviewed teachers about their diagnoses.
He found that the 10 teachers: (a) lacked systematic strategies for
collecting and using information to reach diagnostic decisions, (b)
differed on a number of process variables such as the length of their
interaction with a case and the number of cues collected, and (c) used
general and incomplete diagnostic strategies both in the laboratory and
in the natural classroom setting. Teachers appeared to lack information
processing strategies to make complete, specific diagnoses. In addi-
tion, Weinshank (1980) found that individual clinicians interacting
with a case tended not to follow their stated plans of action regarding
data collection procedures, diagnosis and remediation.

Computer simulation studies examined diagnostic accuracy as a
function of (a) having a specific routine for collecting information
on a case; and (b) generating a few or many hypotheses, depending on
the certainty of the hypotheses (Gil, Vinsonhaler, & Wagner, 1979).
These studies found that simulations that used routine cue collection
procedures performed significantly better than those that did not. How-
ever, the simulations did not perform as well as the human clinicians

who diagnosed the same cases. And, regardless of the certainty of the
hypotheses, successful simulations generated hypotheses early rather than
late in the interaction (see Gil, Vinsonhaler, & Wagner, 1979).

V. TEACHERS' INSTRUCTIONAL PLANNING

COMPONENTS OF TEACHERS' INSTRUCTIONAL PLANNING

Most teachers plan instruction by: (a) specifying (behavioral) objectives, (b) specifying students' entry behavior (knowledge and skills), (c) selecting and sequencing learning activities so as to move students from entry behavior to objectives, and (d) evaluating the outcomes of instruction in order to improve planning. While this prescriptive model of planning may be one of the most consistently taught features of the curriculum of teacher education programs, the model is consistently not used in teachers' planning in schools. Obviously there is a mismatch between the demands of classroom instruction and the prescriptive planning model. This mismatch arises because teachers must maintain the flow of activity during a lesson or face behavioral management problems. Hence, they are faced first and foremost with deciding what activities will engage students during the lesson or, put another way, the teacher must decide how to entertain his audience while attending to the curriculum. Activities, then, and not the prescriptive model, are the focus of teacher planning.

Research on teacher planning has found that the instructional activity is the basic instructional unit of planning (Clark & Yinger, 1979; Peterson et al., 1978; Smith & Sendelbach, 1979; Yinger, 1977; Zahorik, 1975), and action in the classroom (see Section VI). In order to avoid a confusion of the meanings of the term "activity" as it is used in teacher planning research, we term the basic, structural unit of planning the task (cf. Doyle, 1980). A task is comprised of several elements. One element is content, the subject matter to be taught (e.g., Clark & Yinger, 1979). Once a curriculum has been selected, teachers accept the textbook as the major, usually the only, source of content (e.g., Clark, 1978-79; see Shavelson, 1976, for references). A second element of a task is materials, those things that children can observe and/or manipulate (e.g., Morine-Dershimer, 1978-79b; Peterson et al., 1977; Zahorik, 1975). A third element of the task is activity (e.g., Clark & Yinger, 1979; Smith & Sendelbach, 1979), the things the

teacher and student will be doing during the lesson. The concept of
activity includes sequencing, pacing, and timing the instructional con-
tent and materials (cf. Carnahan, 1979; Mintz, 1979; Taylor, 1970).
A fourth element is goals, the teacher's general aim for the task, usu-
ally learning and/or affect. Goals are not the same as behavioral
objectives; they are much more general and vague, but functional (cf.
Clark & Yinger, 1979). A fifth element is the student, especially his
abilities, needs and interests (Borko et al., 1979; Carnahan, 1979;
Mintz, 1979; Morine-Dershimer, 1978-79b; Shavelson, Atwood & Borko,
1977). The last element is the social cultural context of instruction
(cf. Florio, 1979; Janesick, 1978; Shavelson & Borko, 1979). This
refers to the class as a whole and its sense of "groupness" (Janesick,
1978) or a specially created community (Florio, 1979) as well as
teachers' groupings of students for instructional purposes (e.g.,
tutor-tutee, reading groups; cf. Barr, 1974, 1975; Borko, 1978;
Shavelson & Borko, 1979).

The conception of teacher planning, then, is one in which instruc-
tional tasks are created by the teacher. Figure 3 summarizes the ele-
ments teachers consider in planning a task. Unfortunately, the sequence
of elements considered and the compromises that have to be made are
as yet unknown. They probably depend on the particular task at hand
as well as the proclivities of the particular teacher. As Taylor (1970)
pointed out, most planning is unsystematic and general in nature;
teachers appear uncertain as to what the planning process requires.
Until further research is conducted, the development of a model of
teacher planning is premature.

Before leaving the topic of instructional planning, a time dimen-
sion is essential. One aspect of the time dimension is the hierarchical
organization of planning with five levels (Yinger, 1977, p. 172):

1. Long range yearly--basic ideas for social studies, science
   --some for math and reading--basic structure of what will be
   done but not specific time.
2. Term--planning on a term basis for social studies, science,
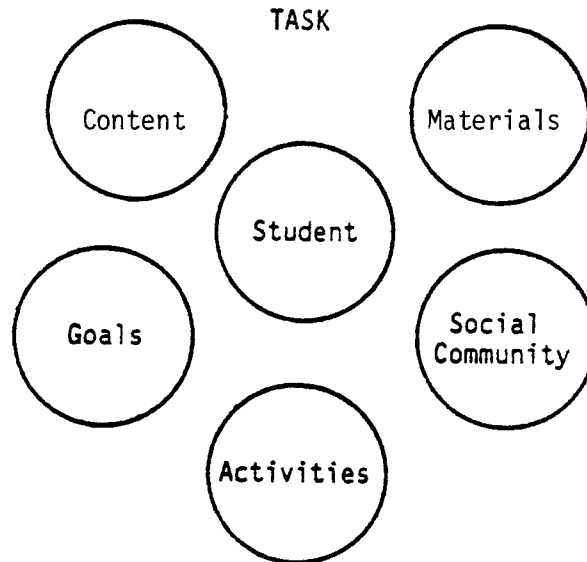   and for movies.

Figure 3. Elements of teachers' planning of instructional tasks.

3. Monthly--deciding on basic units for social studies, science, and math. I decide on what I need librarian to get or what movies I need.

4. Weekly--use teacher's plan book--specific units and time element added--more detailed.

5. Daily--put schedule on board, getting actual materials out.

A second aspect of the time dimension is that planning decisions made early in the academic year exert a profound influence on teachers' planning for the remainder of the year (e.g., Clark, 1978-79; Joyce, 1978-79; Mintz, 1979). According to Joyce (1978-79, p. 75):

> Most of the important preactive decisions by teachers are
> long-term in their influence as opposed to the influence
> of lesson by lesson planning. Relatively early in the year,
> most teachers set up a series of conditions which were to
> be powerfully influential on the possibilities of decision
> making thereafter. Lesson planning, to the extent that it
> goes on consciously, involves the selection and handling
> of materials and activities within the framework that has
> been set up by the long-term decisions.

Studies of Teacher Planning[4]

Researchers on teacher planning have used a variety of methods including questionnaires/interviews (e.g., Morine-Dershimer, 1978-79a-c; Zahorik, 1975), ethnography (e.g., Yinger, 1977), simulations (e.g., Borko, 1978; Morine, 1976; Russo, 1978; Shavelson et al., 1977; Yinger, 1977) and "think aloud" protocols (e.g., Peterson et al., 1978). And different methods reveal different aspects of the planning process. Nevertheless, for the most part, the findings, as summarized above, have been consistent or complementary. Namely, teachers focus on _tasks_ and embedded in these tasks are teachers' concerns about content, activities, students, goals, and the like.

The results of research on teacher planning are summarized in Table 2. Most of the research has found that teachers are concerned with subject matter in planning instruction. Their concern, however, is less with the structure of the subject matter (cf. Schwab, 1962; Shavelson, 1972, 1974, in press) and more with the selection of content for the purpose of building tasks (cf. Clark, 1978-79; Shavelson, 1980).

Research also has found that teachers consider information about students, especially student ability, when planning instruction (e.g., Cooper et al., 1979; Borko, 1978; Morine-Dershimer, 1978-79b; Russo, 1978; Shavelson et al., 1977). Both Morine-Dershimer (1978-79b) and Mintz (1979) pointed out that teachers' concerns about students in their planning were greatest early in the year when teachers were "getting to know" their students. Once teachers had reached a judgment about their students, less attention (i.e., conscious concern) was given to students in verbal reports. In contrast, Peterson et al. (1978) reported that verbal protocols showed little mention of students during planning. However, such findings may be an artifact of the

Table 2

Studies of Teacher Planning*

Study	Method of Investigation	Content Focus: Subject Matter & Materials	Student Focus	Activities Focus	Specifying Goals or Objectives During Planning Unimportant or Secondary	Teachers Have Long-Term Preactive Plans
Borko (1978)	Laboratory	X	X		Contradictory Findings	X
Carnahan (1979)	Literature Review	X	X			
Clark & Elmore (1979)	Classroom					X
Clark, Wildfong & Yinger (1978)	Laboratory	X	X			
Clark & Yinger (1979)	Laboratory		X	X		X
Cooper et al. (1979)	Literature Review	X	X	X		
Joyce (1978-79)	Theoretical			X		X
Mintz (1979)	Laboratory	X	X	X	X	X
Morine (1976)	Classroom/ Laboratory	X	X	X	X	X
Morine-Dershimer (1978-79b)	Classroom/ Laboratory	X	X	X		

Table 2 continued

Study	Method of Investigation	Content Focus: Subject Matter & Materials	Student Focus	Activities Focus	Specifying Goals or Objectives During Planning Unimportant or Secondary	Teachers Have Long-Term Preactive Plans
Peterson et al. (1978) also see	Laboratory	X	X	X	X	
Peterson & Clark (1978)	Laboratory					
Russo (1978)	Laboratory	X	X		Contradictory findings	
Shavelson et al. (1977)	Laboratory	X	X			
Smith & Sendelbach (1979)	Classroom				X	X
Stern & Shavelson (1980)	Classroom	X	X	X	Contradictory findings	X
Taylor (1970)	Classroom	X	X		X	
Yinger (1977)	Ethnography	X		X	X	X
Zahorik (1975)	Laboratory	X	X	X	X	

*A blank space indicates the topic of the column was not a focus of the study.

methods used. First, in the Peterson et al. (1978) study, students
were randomly assigned to teachers--hence, teachers did not have in-
formation about their students. Second, Morine (1978-79b) has pointed
out that "while the...teachers rarely mentioned pupil ability, specific
objective [sic], teaching strategy, or seating arrangement in response
to the general question [to state their lesson plans], their ready
responses to the probes indicated that the mental plans or images of
the lesson...did include such aspects of instruction" (p. 85, our
italics).

A central focus of teachers is the activity developed in the les-
son plan (see Table 2). Activity refers to the allocation of time,
the sequencing and the timing (or pacing or flow) of content and mate-
rials during the lesson. While most research has found activity to be
of central importance in plans, little is known about how activities
are constructed or what scripts or routines teachers bring to the plan-
ning process which are filled out monthly, weekly and daily (cf. Yinger,
1977) to provide the routine for interactive teaching. Yinger's (1977)
study provides some insight into activity planning. He found that one
teacher approached the activity as a three-stage problemsolving task
including: (1) problem finding where content, goals, knowledge, and
experience combined to yield an initial conception of the activity
worthy of future consideration; (2) problem formulation and solution
involving progressive elaboration of the activity; and (3) activity
implementation emphasizing "evaluation and routinization to the teacher's
repertoire of knowledge and experience, which in turn play a major role
in future planning deliberations" (Clark & Yinger, 1979, p. 238).
Research, having established the task as a central focus in planning,
needs to move on to describing the variety of scripts teachers have
for planning activities and under what conditions they are used.

Most naturalistic research reports that objectives do not play
a major role in the planning process while laboratory simulation
studies report that teachers do take objectives/goals into consider-
ation. This conflicting finding might be resolved on methodological
grounds. Apparently teachers' verbal reports and lesson plans do not
emphasize objectives. However, in laboratory simulations asking

teachers to make decisions about goals or objectives, teachers do so
and report that doing so is consistent with their classroom planning
(e.g., Borko, 1978; Russo, 1978). As Morine-Dershimer (1978-79b) pointed
out, while objectives are not part of their verbal reports about lesson
plans, they are part of the teacher's mental image or plan. Probing,
done either directly or indirectly as in simulations, is apparently
needed to find this out.

Finally, several studies have shown that teachers, at the begin-
ning of the academic year, set forth plans and make decisions that guide
subsequent planning over the remainder of the year. This means that,
unless researchers examine planning at the beginning of the year, they
are liable to miss some aspects of planning. They are also liable to
conclude that teachers do not, for example, consider student character-
istics or objectives when, during most of the year, such information is
part of the teacher's planning script or routine. Moreover, these long-
term plans have a profound influence on classroom teaching. "In effect,
the selection of materials and the subsequent activity flow establishes
the 'problem frame'--the boundaries within which decisionmaking will be
carried on" (Joyce, 1978-79, p. 75; italics in original).

There are a few findings, not reported in Table 2, that deserve
attention. Several studies have found that management of students is
a primary concern in planning (Smith & Sendelbach, 1979), especially in
grouping students (Mintz, 1979; Stern & Shavelson, 1980). And Zahorik
(1970) observed that teachers who planned were less sensitive to their
students (i.e., encouraged student ideas and discussion less). Peterson
et al. (1978) found that teachers who were prolific planners had stu-
dents with lower attitude scores than students whose teachers did not
plan extensively. These last two studies suggest planning may be
counter-productive if teachers become single-minded and do not adapt
their lesson to student needs.

VI. TEACHERS' THOUGHTS, JUDGMENTS, AND DECISIONS
DURING INTERACTIVE TEACHING

A MODEL OF INTERACTIVE JUDGMENT AND DECISIONMAKING

Research on teachers' planning showed that instructional tasks--
content, materials, and activities in which to engage students--con-
stituted much of the planning activities. These instructional tasks--
perhaps in the form of mental "scripts" (cf. Abelson, 1976, Schank &
Abelson, 1977) or "images" (cf. Morine-Dershimer, 1978-79b)--serve as
a mental plan for carrying out interactive teaching (cf. Joyce, 1978-79;
Morine-Dershimer, 1978-79b). These images or plans are routinized so
that once begun, they typically are played out (Joyce, 1978-79; Morine-
Dershimer, 1978-79b), much as a computer subroutine is (cf. Shavelson,
1976). Routines minimize conscious decisionmaking during interactive
teaching (Clark & Yinger, 1979; Joyce, 1978-79; MacKay, 1977; MacKay &
Marland, 1978; Morine-Dershimer, 1978-79b) and so "activity flow"
(Joyce, 1978-79) is maintained. Moreover, from an information-process-
ing perspective, the routinization of behavior makes sense. Routines
reduce the information-processing load on the teacher by making the
timing and sequencing of activities and students' behavior predictable
within an activity flow. Hence, conscious monitoring of instruction
can then focus on particular students (Connors, 1978; MacKay, 1977;
McKay & Marland, 1978; Marland, 1977; Morine-Dershimer, 1978-79b) and
on deviations of the lesson from the original plan (e.g., Clark &
Yinger, 1979; Joyce, 1978-79; Peterson & Clark, 1978).

Decisionmaking during interactive teaching, then, usually arises
when the teaching routine is not going as planned (cf. Clark & Yinger,
1979; Joyce, 1978-79; MacKay, 1977; MacKay & Marland, 1978). Usually
on the basis of lack of student involvement or behavior problems,
teachers judge that the lesson is problematic (e.g., Peterson & Clark,
1978) and may choose to: (a) continue the lesson or (b) change the
lesson (Joyce, 1978-79; Peterson & Clark, 1978; Snow, 1972). Typically,
teachers choose not to change the lesson (Clark and Yinger, 1979;
Joyce, 1978-79; Peterson & Clark, 1978). In some cases, this choice is
based on a decision to deal with the problem in future plans (cf. Joyce,

1978-79; Peterson & Clark, 1978). This tactic seems reasonable since, if the expectation is set up that the teacher will continually change a lesson, management of students and instructional tasks may become problematic.

Morine-Dershimer (1978-79b, 86) captured the picture being drawn here:

> For the lessons examined in detail here, when there was little or no discrepancy between teacher plan and classroom reality, teacher information processing was "image-oriented," with teacher recall of previous knowledge about pupils playing an important part. Decision points were handled by established routines. When there was a minor discrepancy between teacher plan and classroom reality, teacher information processing was "reality-oriented," with a fairly narrow range of pupil behavior being observed. When a more pervasive discrepancy between teacher plan and classroom reality was perceived, then teacher information processing was "problem-oriented," with teachers tapping a broader spectrum of information about pupils. When a large discrepancy existed, decisions were postponed to a later time.

A model of teachers' interactive decisionmaking is presented in Fig. 4; it is a synthesis of research by Joyce (1978-79), Peterson & Clark (1978), Shavelson (1976), and Snow (1972). It posits that teachers' interactive teaching may be characterized as carrying out well established routines. In carrying out the routine, the teacher monitors the classroom, seeking cues, such as student participation, for determining whether the routine is proceeding as planned. This monitoring is probably automatic as long as the cues are within an acceptable tolerance. However, if the teacher judges the cue to be outside tolerance (e.g., student out-of-seat behavior during discussion), the teacher has to decide if immediate action is called for. If so, the teacher has to decide if a routine is available for handling the problem. The teacher may take action based on a routine developed from previous experiences. If no routine is available, the teacher reacts spontaneously and then continues the teaching routine. If an immediate action is not called for, the teacher considers whether delayed action, say after the lesson or in the future planning,
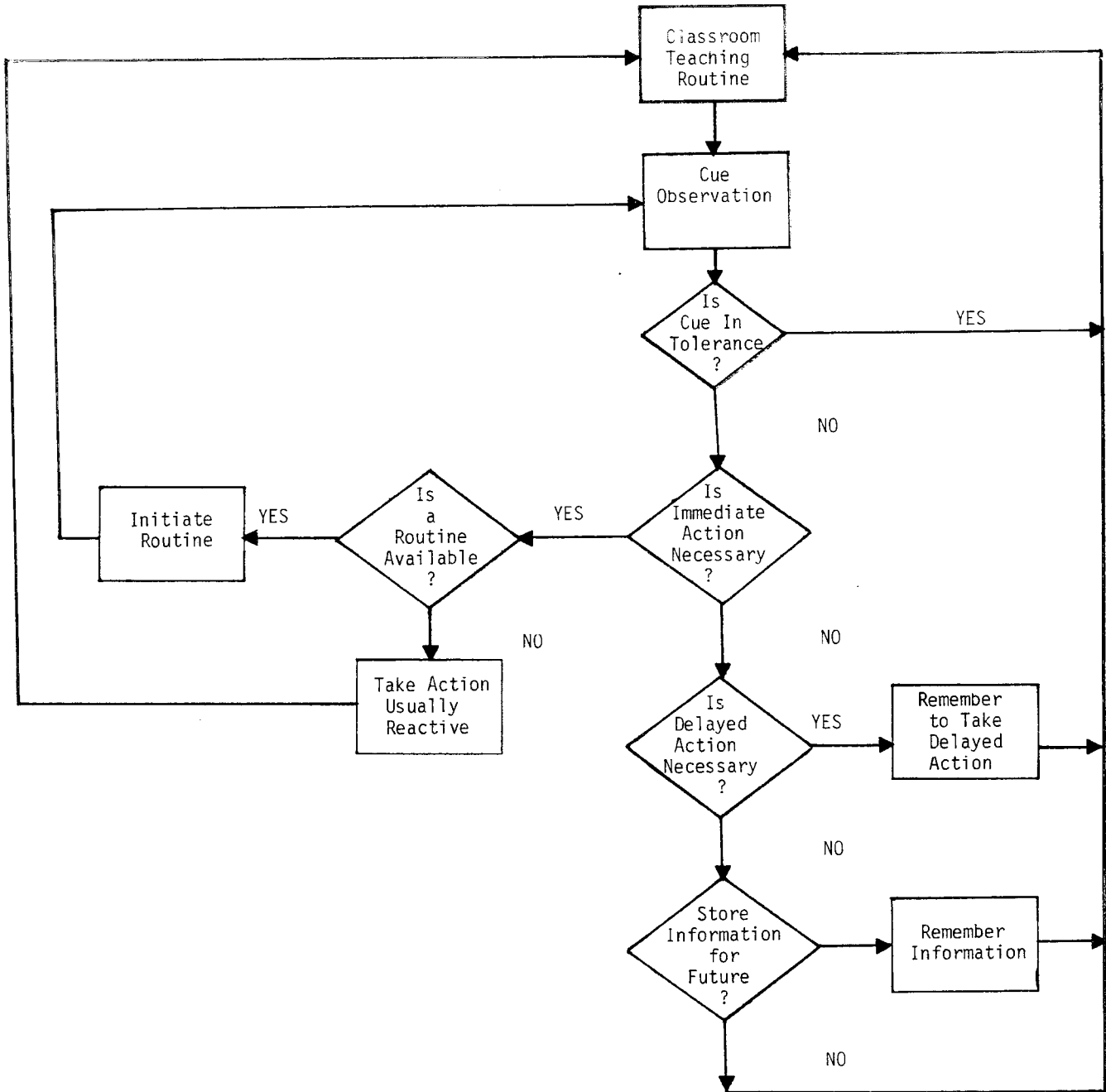
Fig. 4. Model of teachers' decisionmaking during interactive teaching

is necessary. The teacher stores the action in memory and carries on his teaching routine. If no action is necessary, the teacher decides whether or not to retain the information and continues with his teaching routine.

Research on Interactive Teaching

Most of the research on teachers' thoughts, decisions and behavior during interactive teaching has employed the method of stimulated recall (see Section II). This research consistently has found that teachers' plans serve as a mental script (cf. Abelson, 1976) or image (Morine-Dershimer, 1978-79b) which guides their interactive teaching. These images or scripts are routinized. Once begun, they typically are carried out. Hence, interactive teaching has been described in many studies as primarily carrying out a routine (see Table 3).

Moreover, this research has found that teachers are reluctant to change their routines, even if they are not proceeding as well as expected. When changes do occur, they typically are minor adjustments in the routine and not major revisions (i.e., "fine tuning," e.g., Joyce, 1978-79). However, this research does not reveal why teachers are reluctant to change their plans (but see Peterson and Clark, 1978). One possible reason is that the routine chosen during planning was judged, on the basis of past experience and the nature of the task, to be better than any alternative routine available to the teacher. A second possible reason is that the current routine was the only one available and any hastily-developed routine might not be expected to fare as well. A third possible reason is that changing routines during a lesson introduces uncertainty, both for teachers and students. For teachers, this constitutes an information-processing burden and a decrease in their ability to monitor participation and behavior in the class. For students, shifting routines might lead to their having difficulty following the flow of instruction in learning and classroom management problems (cf. Doyle, 1980).

In sum, teachers' main concern during interactive teaching is to maintain the flow of the activity. To interrupt this flow to reflect on an alternative and consider the possibility of changing a routine

Table 3

Studies of Interactive Teaching*

Study	Method of Investigation	Routines	Little Generation of Alternatives Change or Plans	Fine Tuning Focus	Activity Flow Focus	Selective Awareness of Behavior	Teachers' Interactive Thoughts	Problems (Unpredictable Events) Break Activity Flow
Connors (1978)	Stimulated recall						X (focused on pupils' responses and participation in activities)	
Joyce (1978-79)	Theoretical	X		X	X			
Lynch (1977)	Stimulated recall						X (focused on pupil and nature of task)	
MacKay (1977)	Stimulated recall	X	X		X		X (teachers thought about what they'd do next)	X (lack of student participation)
Marland (1977)	Stimulated recall				X		X (focused on students' responses)	
McNair (1978-79)	Stimulated recall			X	X	X	X (focused primarily on whether students understood the material)	
McNair & Joyce (1979)	Stimulated recall			X	X	X		
Morine-Dershimer (1978-79)	Stimulated recall	X	X	X	X	X		X (e.g., material too difficult)

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Table 3 continued

Study	Method of Investigation	Routines	Little Generation of Alternatives Change or Plans	Fine Tuning Focus	Activity Flow Focus	Selective Awareness of Behavior	Teachers' Interactive Thoughts	Problems (Unpredictable Events) Break Activity Flow
Morine & Vallance (1973)	Stimulated recall	X					X (focused on instructional processes--justification based on pupil characteristics)	
Peterson & Clark (1978)	Stimulated recall	X	X	X	X			X (lack of student participation & involvement)
Semmel (1977)	Stimulated recall						X (focused on pupil & nature of task)	
Shroyer (in progress)	Stimulated recall	X	X		X	X		X (incidents such as an incomplete response to student that make teacher aware lesson is running poorly)
Stern & Shavelson (1980)	Observation	X			X			

51

*A blank space indicates the topic of the column was not a focus of the study.

drastically increases the information processing demands on the teacher
and increases the probability of classroom management problems.

Studies of teachers' reports of their thoughts while teaching re-
veal that teachers attend to their mental script or image while teach-
ing, and this focus of attention is broken only when their monitoring
of the classroom indicates a potential problem or unexpected event
(see Selective Awareness in Table 3). When a problem or unexpected
event arises, teachers report becoming "aware of reality" (e.g., McNair,
1978-79; McNair & Joyce, 1978-79). Their attention then focuses on
student behavior.

A very common script used by teachers during interactive teaching
is one of structuring, soliciting, responding and reacting (Bellack,
Kliebard, Hyman, & Smith, 1966), where teachers ask questions and stu-
dents respond. Teachers using this script attend to subject matter in
the script and to students (see Teachers' Interactive Thoughts in Table
3). A decision is required when a student gives a somewhat unexpected
response. In carrying out this script, teachers apply certain princi-
ples or "routines" regarding their interaction with students (Connors,
1978; MacKay, 1977; MacKay & Marland, 1978; Marland, 1977). One prin-
ciple is termed compensation. The teacher attempts to compensate the
alleged "have-nots" in their classes by favoring the shy, or low-
achieving student in, for example, selecting respondents to their
questions. A second principle is strategic leniency, which entails
being lenient with a student in need of special attention. A third
principle is power sharing, where the teacher uses the informal power
structure for dispensing his influence. A fourth principle is progres-
sive checking, where the teacher checks on especially low-ability stu-
dents' progress during interactions or on assigned tasks. And the
fifth principle is suppressing emotions. Teachers systematically
suppress their emotions in front of students because: (a) their emo-
tions might be a catalyst for unmanageable student behavior; (b) their
emotions, especially negative reactions toward students' responses,
might harm the students' self-concepts; or (c) their emotions might
lead to unjust treatment of different students.

Teachers regularly monitor the classroom as a way to evaluate a routine (e.g., Joyce, 1978-79). A problem with a routine often is signaled by a lack of student participation or by unsanctioned behavior, such as out-of-seat noise (see Table 3). If the problem is serious enough, it may interrupt the routine (see Fig. 4). This is the occasion for most decisionmaking during interactive teaching.

Most studies report that teachers' decisionmaking is not pervasive during interactive teaching (e.g., MacKay, 1977; Marland, 1977). However, MacKay reported that teachers made about 10 interactive decisions per hour and Morine-Dershimer and Vallance (1975) reported between 9.6 and 13.9 decisions per lesson (!). Clearly, teachers make decisions during interactive teaching. In making decisions, teachers tended to consider only a few alternative courses of action. MacKay (1977) reported that teachers seldom considered more than two alternatives and Morine-Dershimer and Vallance reported means of between 2.2 and 3.2 alternatives per lesson for four different groups of teachers. Moreover, teachers tended not to critically evaluate the alternatives; rather, they sought confirmation for their choice (MacKay, 1977; MacKay & Marland, 1978; see Einhorn & Hogarth, 1978, for a review of research on confirmation in judgment and decisionmaking).

Effects of Teacher Behavior on Student Achievement

Few studies of teachers' judgments, decisions and behavior have traced the teaching process from initial information through teacher characteristics and cognitive processes to planning and interactive teaching and the effects of these components of teaching on students' achievements and attitudes. One notable exception is a study by Peterson and Clark (1978). Twelve teachers taught a social studies unit (not previously taught by the teachers) to three different groups of eight junior high students who they did not know and on whom they had no other information. They found that teachers used information about student participation and involvement in the lesson to judge how well their lesson was going. They considered alternatives only when teaching was going poorly and changed strategies in about half the problematic situations. However, these changes usually were not major

ones; rather they were more like fine tuning out of the original plan (cf. Joyce, 1978-79).

Peterson and Clark (1978) also found that teachers high in verbal ability (measured by a vocabulary test) were more likely to generate alternative courses of action and to use a more complex decision strategy than were teachers low in verbal ability. Moreover, teachers high on reasoning ability and conceptual level were very likely to use a more complex decision strategy than teachers who scored low on these measures.

Correlations between measures of planning and interactive decisions and measures of student achievement and attitude were negative (!). Teachers who considered alternative teaching strategies and even changed strategy during teaching were associated with students lower in achievement and attitude. Note, however, that these teachers also experienced problems with their normal teaching routine and so had to consider alternatives. In contrast, teachers reporting that their teaching went as planned were associated with high student achievement. Those routines which maintained the flow of activity, then, were associated with higher student achievement.

In a review of four studies, Shavelson and Borko (1979; the studies were: Barr, 1974, 1975; Russo, 1978; Stern & Shavelson, 1980) examined teachers' policies about grouping students for reading and traced the grouping decision through interactive teaching and student achievement. They reported that most teachers grouped students for reading on the basis of ability. However, a few teachers did not group students primarily due to a lack of materials and other resources. Once grouped, the group and not the individual student became the unit for planning instruction. Teachers' plans for low groups differed considerably from their plans for high groups. Procedures, decoding skills (reading aloud) and highly structured assignments were prescribed for low groups, while flexibility in procedures and assignments and an emphasis on comprehension skills were stressed for high groups. During interactive teaching, the high groups were paced as much as 15 times faster than the low groups. And student achievement in the high groups was correspondingly higher than in the low groups.

VII. RECOMMENDATIONS

One possible outcome of this review would be to place the litera-
ture into a taxonomy of decisions. This taxonomy would identify criti-
cal decisions made by teachers, the major alternatives considered in
the decision, the information used in making the decision, and the con-
sequences of the decision on teachers' instructional planning, on in-
teraction with students, and on student achievement and attitudes.
Table 1, for example, is a step in this direction; it links gross des-
criptions of decisions (e.g., planning) with the information sought by
teachers to make these decisions (e.g., student ability, classroom
participation). However, Table 1 clearly falls far short of a taxonomy.

A taxonomy could not be constructed from this review for/at least
three reasons. First, most of the research described certain components
of the decisionmaking process, such as the information used by teachers
to reach a wide variety of decisions or the types of goals teachers
balanced in planning instruction. In short, only one or at best a few
components of the model shown in Fig. 1 were examined simultaneously
in the literature. This is probably as it should be since the formu-
lation of teaching in Fig. 1 was in its infancy. Second, the studies
did not have a taxonomy of decisions guiding them. Hence, certain
details of a study, such as the decision alternatives considered by
teachers and the subject matter taught were not reported or were only
cryptically reported. And third, a taxonomy of decisions cannot be
developed solely on the basis of the existing literature. Considerable
conceptual research in collaboration with teachers, subject-matter
experts and so on is needed to identify key decisions.
Recommendation 1: Conceptual and empirical research should be directed
toward constructing a taxonomy of critical teaching decisions.

In the spirit of this recommendation, an example of such a taxonomy
is briefly outlined here. The example is taken from research on deci-
sions about teaching reading. Two critical decisions are whether to
group students and if students are grouped, then what the composition

of the group should be. In general, elementary teachers decide to
group students for reading; virtually all teachers choose to group stu-
dents on the basis of reading ability. This decision, clearly, reflects
individual differences in students' reading performance. Alternatives
such as heterogeneous grouping or homogeneous grouping for oral reading
(e.g., decoding) and heterogeneous grouping for comprehension and carry-
ing out assignments have not been reported in the literature reviewed.
The consequence of ability grouping on teachers' planning is that
teachers used different planning scripts for different groups. These
differences in scripts lead to differences in interactive teaching.
For example, students in the high-ability group may be paced as much
as 15 times faster than students in the low-ability group. And stu-
dents' reading achievement reflects the differences in groups. To
summarize, a taxonomy incorporating findings of research on grouping
decisions might look like the following:

Alternative: Whole class or ability groups.

Alternatives not considered: Heterogeneous grouping or a mix
of homogeneous and heterogeneous groupings.

Information Sought: Reading ability, availability of resources,
etc.

Consequences for Whole Class Alternative: See results of low
ability group.

Consequences for Ability Grouping:

a. Teacher planning script

1. Low = high structure; focus on procedures, as well
as content, decoding, motivational exercises (etc.).

2. High = low structure; focus on content, comprehen-
sion; motivational exercises generally absent (etc.).

b. Interactive teaching

1. Low = slow pace (etc.).

2. High = fast pace (etc.).

c. Student Outcomes

1. Achievement = low ability groups perform below high
ability groups.

2. Attitudes = data not presented in studies reviewed.

Most of the research conducted to date is descriptive. It de-
scribes, for example, the number and kinds of variables teachers con-
sider in making (say) grouping decisions, the kinds of variables teachers
consider in planning, the kinds of extra-classroom pressures that may
impinge on teachers' selection of content, and the strategies teachers
follow during interactive teaching. However, few studies speak to the
practice of teaching, i.e., prescribe either an empirically validated
or a valued (normative) decision strategy for practice. An empirically
validated decision strategy might map out the consequences of a certain
decision policy such as forming reading groups on the basis of ability.
Or it might show, as has some of Vinsonhaler's (e.g., 1977) research,
that expert reading diagnosticians are slightly more reliable in their
diagnoses than non-specialists and that this greater consistency seems
to arise from the application of a consistent strategy (conception) for
diagnosing reading problems. A valued decision strategy would be one
that states how certain decisions such as grouping or diagnosing for
reading instruction should be made on the basis of some normative
model.
Recommendation 2: Research should shift from descriptive studies to
empirical and conceptual research bearing on decision strategies and
decision policies for the practice of teaching.

Most of the studies on teachers' decisions have been descriptive;
they have provided insight into a world heretofore unexplored by re-
search on teaching. With this work as a foundation, it is time to
develop and empirically test the effects of alternative decisions and
decision aids on teachers' behavior and students' behavior, achieve-
ment, and attitudes. Vinsonhaler (e.g., 1977), for example, has
examined the effect of providing reading diagnosticians with extended
"memories" using a computer and with a systematic approach to diagnos-
ing reading problems. And Stern and Shavelson (1980) have suggested
modifying teachers' decisions for grouping students for reading and
for teaching students, especially in lower reading groups, with the

expectation that students' reading would improve. In short, experimental, comparison group, and comparative case studies are needed to examine the effects of different decision policies and aids on teaching and student outcomes.

Research that describes or sets forth policies for the practice of teaching, however, is not guaranteed to influence practice. For research to affect practice, it must also be adopted by teachers and modified to fit within a particular teaching context. Fenstermacher (1980) has argued that, in order for teachers to adopt research findings, a chain of events should occur. First, teachers must become aware of their subjective beliefs about teaching. Second, these beliefs should be held open to empirical verification. The empirical verification might be in the form of practical research findings (see Recommendation 2) or in the form of a teacher "experiment." Third, a subjectively held belief becomes an objectively held belief if it is verified empirically. Disconfirmation of the subjective belief constitutes grounds for a change in belief, consistent with the empirical evidence. And fourth, objectively held beliefs constitute reasonable grounds for action.

Recommendation 3:   Research on teaching should not stop at generating recommendations for practice.   Rather, it should link research recommendations to the implementation of these recommendations in practice.

This review has focused on teachers' thoughts, judgments, and decisions, and has purposely avoided literature focusing primarily on students, classroom context, and extra classroom context in order to concentrate on teaching and to make the task manageable. Nevertheless, most of the studies reviewed have not examined the impact of students, and social and organizational contexts on teachers' decisions. Yet a consideration of context is essential in studying teaching, as Erickson (1979b) argued:

> If I am correct in asserting...that human learning is always
> mediated in social relationships, that pedagogy is conjoin-
> ing social action, that all face-to-face "content instruction"
> has social as well as referential meaning (and by extension

that no curriculum package or classroom can possibly be
"teacher proof" or "student proof"), then a more differ-
entiated and dynamic theory of face-to-face social re-
lations is crucial for classroom research. (Italics in
original.)

Recommendation 4: Research on teaching should focus on teachers'
thoughts, decisions and behaviors in studying how students (e.g.,
class composition, conflicting goals), classroom context (e.g.,
social relations) and organizational context (e.g., textbook adoptions,
assignment of students to teachers) influence these decisions and be-
haviors.

Very little attention has been paid to how knowledge of a subject
matter is integrated into teachers' instructional planning and the con-
duct of teaching (cf. Shavelson, in press). Nevertheless, the struc-
ture of the subject matter and the manner in which it is taught (e.g.,
with integrity or improbability, contempt or respect; see Fenstermacher,
1980) is extremely important to what students learn and their attitudes
toward learning and the subject matter. Teacher-student dyads seem
particularly well suited to studying how teachers communicate subject
matter (cf. Collins & Stevens, 1980) since teachers are freed of the
responsibility of balancing multiple goals (e.g., classroom management,
social relations). A second "research site" is continually created
each time a student makes an error. This offers the researcher an
opportunity to study how, if at all, teachers explain the subject matter
in order to correct misconceptions or procedural errors.

Recommendation 5: Research should examine how teachers communicate
subject matter structure and the manner in which they do so. This
research should not merely be descriptive, it should lead to tentative
policies for practice.

Finally, research on instructional planning suggests that teachers
balance multiple goals such as maintaining a flow of activity, reducing
management problems, teaching concepts and skills, and maintaining a
social organization. In reaching a balance, some teachers emphasize
(say) subject matter, while others emphasize (say) behavior management.

Moreover, teachers' scripts for planning instruction probably differ
as a function of goal emphasis. However, little is known about how
teachers balance potentially conflicting goals or about the scripts
teachers use.

Recommendation 6: Research should examine how teachers balance goals,
what scripts teachers use in planning instruction, and the relation
between goals and scripts. This research should not merely be descrip-
tive, it should lead to tentative policies for planning instruction.

FOOTNOTES

[1]While teachers may act reasonably, this does not necessarily mean that their decisions are optimal with respect to the teacher's goal or someone else's goal.

[2]This formulation ignores multiple, potentially conflicting goals which teachers have to balance daily.

[3]"[P]eople effectively assign inferential weight to physical and social data in proportion to the data's salience and vividness. Information is heeded, processed, stored, and retrieved in proportion to its sensory, cognitive, and affective salience" (Nisbett & Ross, 1980, p. 8).

[4]Several reviews of research on teacher planning have been published recently (e.g., Borko et al., 1979; Carnahan, 1979; Clark & Yinger, 1979) and they, along with the original studies, can be consulted as an adjunct to this section.

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RESEARCH ON TEACHERS' PEDAGOGICAL THOUGHTS, JUDGMENTS, DECISIONS, AND BEHAVIOR

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