DOCUMENT RESUME

ED 243 875 SP 024 341

AUTHOR Potter, Margaret L.
TITLE Decision Research and Its Application to Educational Settings: A Literature Review. IRLD Monograph No. 23.
INSTITUTION Minnesota Univ., Minneapolis. Inst. for Research on Learning Disabilities.
SPONS AGENCY Special Education Programs (ED/OSERS), Washington, DC.
PUB DATE Sep 83
CONTRACT 300-80-0622
NOTE 53p.
PUB TYPE Information Analyses (070)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Cognitive Processes; *Decision Making; Decision Making Skills; *Elementary School Teachers; Elementary Secondary Education; *Evaluative Thinking; *Information Utilization; *Problem Solving; Research and Development; *Secondary School Teachers; Student Evaluation; Teacher Attitudes

ABSTRACT

This paper is a review of the research literature related to theories of reasoning and teacher thinking. Judgment theory, decision theory, and problem-solving theory are discussed. Reviews are provided for studies from three major research projects on teacher thinking: The Institute for Research on Teaching, Special Study C of the Beginning Teacher Evaluation Study, and Shavelson's Research. Comments are made on the relevance of reasoning theories to what occurs in naturalistic settings, and the need for further research on teacher thinking, especially teacher decision making in special education settings. (Author)

****

University of Minnesota

Monograph No. 23

DECISION RESEARCH AND ITS APPLICATION TO EDUCATIONAL SETTINGS: A LITERATURE REVIEW

Margaret L. Potter

IRLD

Institute for Research on Learning Disabilities

Director: James E. Ysseldyke

The Institute for Research on Learning Disabilities is supported by a contract (300-80-0622) with Special Education Programs, Department of Education. Institute investigators are conducting research on the assessment/decision-making/intervention process as it relates to learning disabled students.

During 1980-1983, Institute research focuses on four major areas:

- Referral
- Identification/Classification
- Intervention Planning and Progress Evaluation
- Outcome Evaluation

Additional information on the Institute's research objectives and activities may be obtained by writing to the Editor at the Institute (see Publications list for address).

Monograph No. 23

DECISION RESEARCH AND ITS APPLICATION TO EDUCATIONAL SETTINGS: A LITERATURE REVIEW

Margaret E. Potter

Institute for Research on Learning Disabilities

University of Minnesota

September, 1983

Abstract

This paper is a review of the research literature related to theories of reasoning and teacher thinking. Judgment theory, decision theory, and problem-solving theory are outlined and discussed. Reviews are provided for studies from three major research projects on teacher thinking: The Institute for Research on Teaching, Special Study C of the Beginning Teacher Evaluation Study, and Shavelson's Research. Comments are made on the relevance of reasoning theories to what occurs in naturalistic settings, and the need for further research on teacher thinking, especially teacher decision making in special education settings.

Decision Research and its Application to Educational Settings: A Literature Review

Solving problems, making judgments and deciding among courses of action are integral and ever-present parts of human activity. These activities may be minor and barely conscious, or they may be major and consume a large portion of the person's attention and energy over an extended period of time. The problem to be solved, judgment to be made, or decision to be reached may be strictly intrapersonal, affecting directly only the problem solver/decision-maker, or it may be interpersonal and have its chief impact on another person. Researchers in this area believe that increased understanding of reasoning and decision behaviors perhaps can lead to more efficient and effective decisions, and thus, ultimately, to better outcomes. Effectiveness is a particular concern when the decision or judgment primarily affects someone other than the decision maker, such as in educational settings.

During the past 30 years, increasing numbers of investigators have become interested in trying to describe, understand, and predict human reasoning behavior. Three major theoretical approaches to choice-making behavior are judgment theory, decision theory and problem solving theory. For the most part, the specific content domain of the reasoning behavior is of only secondary interest to these theoreticians; the primary concern is identifying the universal processes used in reasoning. Other investigators, however, are interested in reasoning behavior within a specific content area. In this paper, the three major theoretical approaches are reviewed. This is followed by a review of research on decisions made in educational settings.

THEORIES OF REASONING

Judgment, decision making, and problem solving are not mutually exclusive areas of psychological scientific inquiry. This is an artificial breakdown of reasoning activities that more adequately represents the orientation of the investigators than it represents distinctive mental processes. Generally, however, judgment and decision models, which tend to be mathematical in nature, are considered to be synthesizing models of the decision-making process, relying on input and output data to provide a summary of the decision process. Information processing approaches, on the other hand, focus on how the problem solver gathers and uses information (Elstein & Bordage, 1979; Elstein, Schulman, & Sprafka, 1978; Payne, Braunstein, & Carroll, 1978). These three theories are outlined and some major similarities and differences are discussed.

Judgment Theory

Judgment theory is concerned chiefly with how available information is used in making a judgment about some criterion event, such as a medical diagnosis (Elstein & Bordage, 1979). A paradigm commonly used to examine judgment is the Brunswikian Lens Model, in which description and prediction of judgment behavior is based on calculation of regression equations.

The Brunswikian Lens Model uses the analogy of a convex lens to illustrate the relationship between the perceiver and unobservable objects of perception as mediated by observable cues. Brunswik (1955, 1956) believed that in any judgment situation, consideration of the environment is essential, yet the environment is erratic and the

individual rarely has direct access to the distal state (environmental object of perception) that is to be judged. The individual must, therefore, rely on the use of intermediate (proximal) cues of imperfect reliability and validity as the basis for inferences made about the distal state (Hammond, Rohrbaugh, Mumpower, & Adelman, 1977). Thus, Brunswik believed that any theory of functional psychology, such as judgment theory, (a) was inherently probabilistic, (b) demanded a "representative" research design, and (c) led to a special type of high complexity theory (Brunswik, 1955). Brunswik's probabilistic model uses correlations to express and assess the relationship between the cues and the distal state and between the cues and the judgment made.

Figure 1 is a diagram of the Brunswikian Lens Model. In this model, a conclusion is drawn or judgment made (Y_s) about an unperceivable environmental variable (Y_e) on the basis of observable cues (X_1, X_2, X_3, X_K). The correlations r_{e1}, r_{e2}, etc. represent the degree to which the observable cues describe the true environmental state, while the correlations r_{s1}, r_{s2}, etc. represent the degree to which the judgment made is related to the cues. The correlation r_a (achievement) between Y_e and Y_s reflects the overall accuracy of the judgment (Y_s) made about the objects of perception (Y_e). The correlation R_e (task uncertainty) represents the degree to which the best possible weighted linear combination of the available cues can predict the criterion variable. The correlation R_s (cognitive control) functions similarly in that it reflects how well a judgment can be made on the basis of an optimally weighted linear combination

of cues; it reflects the extent to which the subject controls use of his/her knowledge (Hammond & Summers, 1972). A fourth major correlation is G (knowledge), which represents knowledge of the environment (properties of the task) as reflected by the relationship between the regression predictions of the true nature of the criterion and the judgments about the criterion variable.

Insert Figure 1 about here

The four major correlations combine to form the lens model equation, $r_a=GR_eR_s$, which states that judgmental accuracy (r_a) is a product of knowledge of the environment (G), predictability of the true environmental state (R_e) and the subjects' cognitive control (R_s). Since knowledge and cognitive control are considered to be statistically independent, one may improve judgments either by increasing knowledge of the task or by improving the use of existing knowledge (Hammond & Summers, 1972).

The use of regression models such as Brunswik's Lens Model have led to the development of equations purported to model a person's judgmental process. There has been considerable discussion as to whether the data combined in regression equations should be combined in a configural manner to account for interaction between cues and the presence of valid nonlinear variance (Einhorn, 1970; Goldberg, 1971; Hoffman, 1960). It appears that linear models generally are just as effective as configural models and that simple unit weights do as well as (or sometimes better than) differential weights in predicting

criterion values (Dawes & Corrigan, 1974; Goldberg, 1968; Hoffman, 1960). Thus, it seems, "the whole trick is to decide what variables to look at and then know how to add" (Dawes & Corrigan, 1974, p. 103).

Decision Theory

Decision theory is concerned with making choices under conditions of uncertainty. It is essentially a mathematical approach that balances costs and benefits (utilities) of alternatives and relies on consideration of probabilities of occurrence. The equation

$$p(A|B) = \frac{p(B|A)p(A)}{p(B|A)p(A)+p(B|\bar{A})p(\bar{A})} \qquad \text{(Hayes, 1981)}$$

is a mathematical formula often used by decision theorists for calculating conditional probabilities. Through the use of this formula, probabilities can be revised in light of new information; thus, the impact of additional information and the resulting degree of change in probabilities can be assessed. Two factors that must be known or estimated in calculating posterior (adjusted) probabilities are: (a) the prior probability (base rate) of the hypothesis or original event, and (b) the diagnosticity of the new data, that is, the degree of impact new data should have based on their relevance and reliability. Once probabilities are calculated and adjusted, they are combined with estimates of value and an overall estimate of expected utility is calculated. The best decision is assumed to be the one reflecting the alternative with the highest expected utility.

Difficulties in the application of decision theory may arise at each of the three key input points: (a) estimation of prior probabilities, (b) estimation of the impact of new information, and

(c) estimation of the values of alternatives (Elstein & Bordage, 1979). The need for these estimations, which often are subjective in nature, has made the use of Bayes' theorem in decision settings controversial.

Estimation of Prior Probabilities

In few instances, particularly in the social sciences, are base rates known or accessible to the decision maker. Thus, subjective probabilities must be relied upon. Actually, Bayesians believe that the essential nature of all probability estimates is subjective; "objective" probabilities are no more than formalized subjective estimates (Edwards, Lindman, & Savage, 1963). After reviewing a number of studies investigating the accuracy of subjective probabilities in medicine, Elstein and Bordage (1979) concluded that while the evidence is conflicting, clinical experience and experience in making decisions seem to facilitate accuracy.

Tversky and Kahneman (1974) address the issue of subjective probabilities in a paper that describes three heuristics (rules of thumb) commonly used in the assessment of probabilities and the prediction of values. These heuristics (representativeness, availability, and anchoring and adjustment), while generally useful in reducing the complexity of the decision process, can also lead to errors. For example, under the representativeness heuristic, the degree to which event B, whose probability is unknown, resembles event A, whose probability is known, may unduly influence the estimation of the probability of B without regard for the factors that should affect the estimation of probabilities (e.g., sample size, role of chance).

Under the second heuristic, availability, a class whose instances are more familiar and salient and thus more easily retrievable from memory will be perceived as more numerous (and therefore of greater probability of occurrence) than a class whose instances are less readily brought to mind.

The anchoring and adjustment heuristic comes into play in cases where the decision maker estimates probabilities by starting from an initial value (suggested either by the formulation of the problem or by partial computation), which is then adjusted to derive a final answer. Typically, the adjustments are insufficient and the estimated final probability will vary as a function of the particular initial value used. Because of the operation of the anchoring heuristic, people will tend to overestimate the probability of conjunctive events (i.e., cases where a series of events must occur) and underestimate the probability of disjunctive events (i.e., cases where failure of any one component will lead to failure of the entire system).

Estimation of the Impact of New Information

Most studies of the ability of subjects to revise probability estimations appropriately on the basis of new data have found the revisions made to be conservative; subjects tended not to revise probability estimations enough to reflect the true impact of the new information. This conservativeness has been attributed to a variety of sources such as misperception (poor understanding of the data generator), misaggregation (difficulty in putting together various pieces of information into a single response), or artifact hypotheses response bias (difficulty in dealing appropriately with cases with extreme odds) (Slovic & Lichtenstein, 1971).

Estimation of the Values of Alternatives

Unlike subjective probabilities, values do not have an external referent to which they can be compared; there is no right or wrong, accurate or inaccurate, judgment that can be made (Elstein & Bordage, 1979). Rather, the errors that need to be considered are methodological. A basic consideration is the decision maker's ability to evaluate his/her own feelings and assign values that adequately represent those feelings. Even if those values can be adequately assigned, one's preferences may change due to changing conditions and situations. Another source of possible error is ignorance of the true nature of an alternative. Errors in assigning values also may occur when the decision maker is influenced by the opinions and desires of the person eliciting the decision, such as when a patient is unduly influenced by the personal biases of his/her physician to the point where the patient's own set of values is neglected (Elstein & Bordage, 1979).

Problem Solving

Problem solving research involves examining how data are gathered and how the individual problem solver uses the data in making the series of integrated judgments and decisions involved in solving a problem. Although a large portion of the research on how people approach and solve problems has been descriptive and atheoretical in nature (Elstein, Schulman, & Sprafka, 1978), problem solving has been almost exclusively in the realm of information processing theory. The theory of problem solving as described by Newell, Shaw, and Simon (1958), Newell and Simon (1972), and Simon (1979) is outlined here.

Information processing theory was developed as a psychological theory to describe how people process task-oriented symbolic information. This theory, modeled after the functioning of the digital computer, proposes a set of processes or mechanisms, used by the thinking person, which are explanatory as well as descriptive (Newell & Simon, 1972). Newell, Shaw, and Simon (1958) drew a comparison between information processing and the classical system of applied mathematics. The specific programs of information processing were likened to the differential equations of applied mathematics in that in both systems: (a) one attempts to deduce the general properties of the system from the program/equations, (b) one compares behavior predicted from the program/equations with actual observed behavior, and (c) one modifies the program/equations when necessary to fit the facts.

Newell and Simon (1972) further characterized information processing theory as being idiographic in that it concentrates on describing individual behavior rather than averaging findings across subjects. Furthermore, it is a dynamically oriented theory because it describes the changes in a system across time and characterizes each new act as a function of the immediately preceding state of the organism and environment. Because of its idiographic and dynamic nature, information processing, while very data oriented, is essentially non-experimental and non-statistical. Information processing also views man as using strategies that are sufficient and satisfactory, because to identify an optimal strategy may be too complex a task to achieve efficiently and without aids.

A basic diagram of the information processing system (IPS) is shown in Figure 2; the system consists of receptors and effectors, a central processor, and a long term memory. Receptors and effectors are the system's perceptual and motoric links to the environment. The central processor has three main components: short term memory (STM), elementary information processes (eip's), and an interpreter. The interpreter coordinates the operation of the eip's and the STM. The eip's are a small, discrete set of fundamental processes upon which the entire behavior of the IPS is based. These processes are general, not task specific--it is the content (information and relations) handled by the eip's that is task specific. Within the central processor, this content coming in from the environment and from long term memory (LTM) is handled by the STM which can only deal with about seven bits of information at a time. The LTM serves as the reservoir of data and operational knowledge that supplies the central processor with previously stored knowledge structures potentially useful in the current task. The LTM also stores new information fed to it by the STM.

Insert Figure 2 about here

A person is confronted with a problem when she/he has accepted a task, but does not know how to carry it out (Simon, 1979). Problems may be well-structured or ill-structured (Greeno, 1976; Newell, 1969; Newell & Simon, 1972; Reitman, 1965; Simon, 1973, 1979), they may have definite goals or indefinite goals (Greeno, 1976), or they may be

considered problems of inducing structure, of transformation, and/or of arrangement (Greeno, 1979).

Not only do problems vary in type, content, and context, but problem solvers vary in terms of the knowledge and problem solving skills they bring to a task as well as varying in the particular approach they may use in attempting to solve any given problem. Thus, there is only a broad organizational structure that is common to all problems and all problem solvers. This structure consists of an information processing system (the problem solver), a task environment (the attributes of the task), a problem space (the space where the problem solving takes place and which contains not only the actual solution, but all possible solutions), and a set of programs (strategies) within the problem space that can be used in solving the problem.

This theory of problem solving has been developed and verified through a number of different tasks investigating individual problem solving tactics. These tasks for the most part have been well defined, very specific tasks done in a laboratory-type setting. They have included such tasks as cryptarithmetic (Newell & Simon, 1972), the Tower of Hanoi problem (Simon, 1975), chess (Newell & Simon, 1972), and proving the congruence of triangles (Greeno, 1976), although some less structured tasks such as apartment hunting (Payne, 1976) and the writing of a fugue (Reitman, 1965) also have been examined and found to fit the model.

STUDIES OF TEACHER THINKING

Only a few research projects have been organized specifically to examine the mental processes of teachers. The studies reviewed here

have examined both preactive decisions (preparatory decisions) and interactive decisions (decisions made during instruction). Teacher reports through such devices as surveys, simulations, videotape-prompted recall, and thinking aloud have been the basis for most studies; however, some research has focused on the development of computer programs simulating teacher decisions.

The Institute for Research on Teaching

Investigators at the The Institute for Research on Teaching (IRT) have focused specifically on teachers' thoughts and decisions. Research conducted at IRT has been organized into several separate research groups; five of them are summarized here.

Content Determinants Research Program

This research program addresses teacher's decisions about the content of instruction. Floden, Porter, Schmidt, Freeman, and Schwille (1980) conducted a study to ascertain the relative power of six factors on the content of fourth grade mathematics programs: (a) district tests, (b) mandated text books, (c) district instructional objectives, (d) other teachers' opinions, (e) the principal's opinions, and (f) parent's opinions. These factors were examined within the context of a simulation study asking 66 teachers whether they would be willing to add and/or delete components from the curriculum they currently were using. In this study, teachers generally were willing to make changes in the content of their mathematics program no matter what the source of the pressure for change. Teachers were more willing to add than to delete components of their programs; district tests (i.e., tests to "teach to") and

district instructional objectives had a significantly greater effect than other factors on the teachers' willingness to change programs. Knowledge of these types of influences are important since it has been demonstrated that variation in content is related to variation in student achievement (Porter, Schwille, Floden, Freeman, Knappen, Kuhs, & Schmidt, 1979).

Conceptions of Reading Project

This project focuses on teachers' conceptions about the nature of reading and their influence on reading instruction (Bawden, Buike, & Duffy, 1979). Teacher surveys and naturalistic field studies revealed that conceptions of reading do influence instruction; however, this relationship varies across situations and appears to be heavily influenced by non-reading conceptions. Buike (1980) also found that teachers' major decisions were about materials; there was little evidence for decisions concerning instruction.

Teacher Planning Study

The research on teacher planning primarily has been conducted from the perspective of Yinger's (1978) cognitive information processing model. Another component of the research has been the examination of cues used by teachers in making judgments about students and activities and the usefulness of certain equations in identifying these cues.

Yinger's model and its application to planning. Yinger (1978) conducted a case study of one teacher's planning decisions over five months. From this study, Yinger developed a three-stage model of teacher planning: I - Problem Finding; II - Problem Formulation/

Solution (Design); III - Implementation, Evaluation, Routinization. Yinger's model is one of "purposeful problem solving," in contrast to the rational choice model.

The Problem Finding stage involves the development of an initial abstract conception deemed worthy of further exploration and development. In the Problem Formulation/Solution stage, the abstract conception is alternately elaborated, adapted, and investigated until an acceptable solution is reached. For teachers, who are generally the implementers of the solution, the solution will only be finally acceptable once it is successfully implemented, evaluated, and possibly ultimately routinized. Schematic representations of each of these three stages are presented in Figures 3, 4, and 5.

Insert Figures 3-5 about here

The applicability of this model was verified in a field study by Clark and Yinger (1979) in which the entire process from initial contact with a problem through development, implementation, and evaluation was traced for teachers. During a two-week period in which these teachers taught a new unit on writing, they were asked to keep a journal of their planning decisions and they were extensively observed and interviewed. Verification was found for the distinction between the Problem Finding and Problem Formulation/Solution stages. Also, the study supported Yinger's conception of the planning process as being a case of progressive elaboration of a major idea rather than the development of several alternative ideas and the selection of the optimal alternative.

Policy-capturing research. This research has as its focus the cues used by teachers in making judgments about students and activities, and the ways in which those cues are used. Clark and Yinger (1978) allowed cues to emerge during a judgment task related to language arts activities. Thirteen elementary school teachers were given descriptions of 26 language arts activities and asked to rate the potential usefulness for their classroom of each activity as high, medium, or low. As they rated the activities, the judges were asked to indicate what information about the activity (cues) most influenced each rating. The most frequently rated cues were related to "student behavior" (motivation and attention); the next most frequently rated category was "subject matter and materials" (difficulty). Only a few cues rated as influential fell into the "teacher" and "environmental" categories. The investigators in this study concluded that this method of cue identification is relatively simple and yet realistic. The major limitation to this type of procedure is the possibility that judges are not able to identify accurately the influences on their judgments (Nisbett & Wilson, 1977; Smith & Miller, 1978).

In another study, Yinger, Clark, and Mondol (1981) asked teachers to rate the likelihood that they would use each of 32 language arts activities. These activities were designed by the researchers to reflect varying degrees of (a) difficulty, (b) student involvement, (c) integration with other skills or materials, (d) demand on the teacher, and (d) fit between purpose and the instructional process. Yinger et al. found that although these factors generally did have a significant effect on decisions made, they did not fully account for

the complexity of teacher judgments. Because of what they perceived as insurmountable barriers in the policy-capturing model (e.g., limitations in the linear model, loss of information due to averaging), Yinger et al. proposed that a process-tracing methodology might be more useful for in examining teacher judgments.

Clinical Studies Research Program

The theoretical basis for this research is the "inquiry theory" developed by Elstein and Shulman in their research on medical decision-making practices (Elstein, Shulman, & Sprafka, 1978). This theory has been elaborated and adapted to educational problem solving, specifically in examining the diagnostic and remediation practices of reading clinicians, classroom teachers, and other specialists who diagnose reading problems and prescribe instructional interventions.

Inquiry theory is an information processing theory of problem solving. Its behavioral domain is known as a "clinical encounter" and consists of the events that occur when a clinician (e.g., reading teacher, regular teacher, specialist) attempts to solve a problem in a case (a student) by making a diagnosis (identifying the problem) and prescribing an intervention for that problem. The characteristics of the clinical encounter are determined by the nature of the case and by the clinician's memory and strategies. Thus, this theory takes into account not only the individual characteristics of each situation but also the experience and abilities of the teacher/clinician.

Since a goal of inquiry theory is to predict characteristics of the clinical interaction that will reoccur, three performance corollaries have been postulated (Gil, Hoffmeyer, VanRoekel, & Weinshank, 1979):

(1) Agreement Corollary: This corollary consists of two complementary components--(a) group and inter-clinician agreement (if clinician memory and strategies are influential in determining diagnoses, then similar memories and strategies should result in similar diagnoses), and (b) intra-clinician agreement (one person's memories and strategies should result in diagnoses which are more consistent over time than those of two people).

(2) Training Corollary: Assuming training is different, similarity of diagnoses within a professional field should be more consistent than diagnoses across fields.

(3) Instructional Corollary: Improvement in a clinician's memory and strategies as a result of instruction should improve diagnostic performance.

(4) Remedial Corollary: Problems and treatments are assumed to be associated in memory such that the probability of choosing an effective treatment given a problem that characterizes the case is greater than the probability of choosing a general treatment.

The Agreement Corollary was tested in a study in which reading clinicians were given case studies of students with reading difficulties and asked to diagnose the students and prepare treatment plans (Gil et al., 1979). The results showed some support for the Agreement Corollary in that the mean commonality score, or degree of agreement, of a clinician with the entire group was .55. However, the average individual correlations between the diagnosis of any two clinicians (interclinician agreement) was -.07 and the average agreement of each clinician with him/herself on replicate case studies was .17. Also, the mean correlation between the cues selected by different clinicians for the same case was .18.

In another study (Gil et al., 1979), the Training Corollary was tested by comparing the diagnostic procedures of 10 reading clinicians and 10 learning disabilities teachers in a simulated case study

format. The purpose of this study was to determine whether these two groups of specialists conceptualized, diagnosed, and treated a given child's reading behavior in different manners. Preliminary results indicated a great deal of variation both within and between groups with respect to the number and types of cues collected on a given case, the interpretation of the cues, the length and specificity of a written diagnostic report, and the degree of agreement of these clinicians with a small group of expert clinicians.

In a third study reported by Gil et al. (1979), graduate students in a summer school reading diagnosis course were pre- and posttested. The results of this study supported the Instructional Corollary; clinicians' memories and diagnostic performances were related and training improved both.

The Remedial Corollary was tested by examining the relationship between clinicians' diagnostic statements and their remedial statements (Gil et al., 1979; Weinshank, 1978, 1980). Experienced reading specialists collected cues about case studies of students with reading difficulties, then diagnosed the student and developed a remediation plan. The clinicians were extremely inconsistent; actual performance on cue collection, diagnosis, and remedial write-ups was never consistent with the stated plan of the teacher. Common cues collected among cases generally resulted in noncommon diagnoses and remediations; moreover, thoroughness of data collection had little effect on diagnostic reliability. At the group level, but not at the individual level, diagnosis and remediation did show a modest level of association. However, cues did not predict either diagnosis or

remediation at either the group or individual level. The data indicated that the clinicians had no commonly agreed upon heuristic to guide their gathering of information and interpretation of data. The actual behavior of teachers was consistent only with the Instructional Corollary. This at least provides hope that the inconsistent behavior found in tests of the other corollaries can be modified through instruction.

The South Bay Study

The South Bay Study (Joyce & McNair, 1979; McNair & Joyce, 1979; Morine-Dershimer, 1979a, 1979b) involved an extensive and intensive study of the decision-making behaviors of 10 elementary school teachers from one school over an entire school year. Three aspects of teacher behavior and thinking were studied: (a) interactive teaching styles, (b) thought processes while teaching, and (c) teacher conceptions of pupils.

Interactive teaching styles. Each teacher was observed 12 times over the course of the year. Observers used a complex categorization system sensitive to variations in teaching style and strategy. It was found that the teachers consistently used a fact-oriented, materials-based recitation style of teaching and did not change their basic teaching style during the course of the 12 observations. When style was examined across academic subjects, it was found that there was less information-processing and greater attention to structuring when subjects other than reading were being taught. Although there was not a consistent pattern across teachers, a comparison of high and low ability student groups indicated that there was some variation in

teacher style depending on the group with which she/he was working (Joyce & McNair, 1979).

Thought processes while teaching. In this portion of the South Bay Study, the 10 teachers were videotaped during a reading lesson at six intervals throughout the year. The tapes were played back and the teachers were asked to identify at two specified and two randomly selected points what they were thinking. They also were asked to identify any other points at which they remembered making a decision. Teachers were found to concentrate mostly on the pupil and task at hand, with little concern voiced about objectives. The most frequently reported areas of concern were content of the lesson, procedures, time, and materials. The pattern of decisions revealed that most were "fine-tuning" adjustments in instruction. None of the teachers made any major changes in teaching strategy during the entire series of 60 lessons (McNair & Joyce, 1979).

Teacher conceptions of pupils. The South Bay Study researchers examined teachers' conceptions of pupils during the year by having teachers complete a pupil sort task. The characteristics most frequently used by the teachers to categorize the students were: (a) ability/achievement, (b) involvement in instruction, (c) personality, (d) peer relationships, (e) activity orientation, and (f) growth/progress. The content of the teacher conceptions varied according to time of year. For example, in September they concentrated on pupil personality and in June they concentrated on growth/progress and peer relations. In regard to the valence of the labels teachers used, negative labeling peaked in November, neutral

labeling increased steadily during the year, and positive labeling remained fairly stable. In general, teacher conceptions and predictions were sensitive to aspects of instructional context such as time of year, setting, the curriculum management system, and pupil achievement patterns (Morine-Dershimer, 1979a)

A fourth report of the South Bay Study (Morine-Dershimer, 1979b) integrates and expands the data reported in the other three South Bay Study reports. In this report, Morine-Dershimer examines the relationship between individual teachers' expectations for a lesson (plan) and the actual events that occur during the lesson (reality). She concludes that:

> the amount of perceived discrepancy between teacher plan and classroom reality may be a crucial factor in determining whether interactive decision points are handled by established routines, inflight decisions, or postponement of decisions to a later time when the opportunity for more reflective thinking will be available. (p. 27)

Beginning Teacher Evaluation Study, Special Study C

The rationale for Special Study C of Far West Laboratory's Beginning Teacher Evaluation Study is stated in the introduction to the study's technical report (Morine, 1976) as follows:

> The virtue of planning as an enterprise has been so accepted, that hardly anyone has stopped to ask what difference it makes whether a teacher plans or not. In fact it is only recently that we have bothered to ask how teachers plan, how they state their goals, how they project and shape classroom events, or how willing they are to abandon their "best laid plans" when they begin to [go awry]. (p. 1)

Forty second and fifth grade teachers participated in this study; 20 of the teachers previously had been rated as "more effective," the other 20 (10 in each grade) had been rated as "less effective" on the

basis of pupil gains in reading and math. Each teacher took part in four tasks. In one task, the teacher taught a reading lesson using an assigned topic after which the teacher sorted students into self-determined categories, engaged in a stimulated recall task using a videotape of the lesson, and completed a task in which the lesson just completed was reflected on and follow up lessons considered. In another task, the teacher taught a math lesson on a predetermined topic which also was followed by a pupil sort task, as well as a task in which the teacher viewed videotapes of others teaching the same lesson, followed by an exercise in which the teacher devised possible variations for instruction of the math lesson. The last two tasks were diagnostic simulation tasks. In the long-term diagnosis task, teachers were assigned case studies of 14 students, given access to information about each of the students and told to assign the students to reading groups. In the short-term diagnosis task, teachers viewed videotapes of students reading orally and then were asked a set of questions about diagnosis and remediation.

The results of this study indicated that overall there were few significant differences between the planning and problem-solving practices of low and high effectiveness teachers or between second and fifth grade teachers. Often differences noted were interaction effects such as the tendency for fifth grade low effective teachers to concentrate on pupil performance records in making reading group placements while fifth grade high effective teachers paid more attention to student potential, or the finding that second grade teachers with high effectiveness ratings sought general information as

input less often and provided specific information as output more often in the long-term task than did low effectiveness teachers (no differences were found among fifth grade teachers). Although the study results indicated few practicable differences between teachers rated low or high effective, the author did postulate four variables that appeared to be related to differences in the planning of more or less effective teachers. These variables were: (a) the use of general or specific information in planning, (b) the teacher's perceptions of the student's potential to learn the material, (c) the teacher's consideration of cognitive aspects of instruction, and (d) the tendency of the teacher to produce his/her own instructional materials.

Shavelson's Research

Richard Shavelson and his colleagues have developed a model of teacher decision making that is based on and continually modified by their research on teacher decision making. The basis for the model is the assumption that in teaching teachers are making rational decisions with the aim of optimizing student outcomes. The teacher is seen as a person who must integrate information from a variety of sources and who must select from a large repetoire of skills and techniques when making instructional decisions (Shavelson, 1978). This model relies heavily on information processing theory in its basic view of teacher thinking, but it also utilizes Tversky and Kahneman's (1974) decision heuristics and the notion of revision of probabilities in explaining how teachers use available information. The model basically proposes that instructional decisions are based on cues about students,

individual differences among teachers, the nature of the instructional task, institutional constraints, and external pressures.

The research on teacher thinking conducted by Shavelson and his colleagues has, for the most part, been conducted in controlled laboratory-type settings. Borko, Cone, Russo, and Shavelson (1979) outline four studies that examined the effects of features of the model on decision behavior. In Study I, the accuracy of teachers' estimates of student aptitudes and the influence of these estimations on instructional decisions were examined. Teachers were presented with a case study for a student and asked to make preactive and interactive-type instructional decisions based on the case study information. The information in the case studies was systematically varied in regard to its reliability (high or low) and its valance (representing good or poor student effort). The results indicated that the teachers used different information in making different decisions and they did revise decisions when new information became available. For the interactive decisions, it was apparent that the teachers were using information not available in the cases provided.

In Study II, the effects of teacher beliefs, student cues, and types of lessons were examined. Again teachers were asked to make decisions about students represented in simulated case studies. It was found that estimates of a student's ability to master curriculum goals were based on the most relevant piece of information (e.g., reading achievement for reading goals). Instructional grouping decisions also were made on the basis of achievement. Decisions about strategies were based on educational beliefs, the nature of the group being taught, and the type of instructional objective.

Preinstructional decisions about classroom organization and management strategies were the focus of Study III. Following a case study exercise, it appeared that teacher estimates of students' abilities to master curriculum skills, to be motivated, and to be a behavior problem were related to the single most relevant cue (i.e., achievement information, behavior information, etc.).

Finally, Study IV looked at interactive class management decisions during a reading lesson. Using scenarios of an incident that allegedly occurred in a class during a reading lesson, teachers were asked to estimate the probability that the deviant behavior would upset the instructional routine. Preliminary data analyses suggested that estimates of the disruptiveness of the behavior primarily were based on information available about the previous history of the deviant child.

These studies indicate that teachers do not use all of the information available when making instructional decisions. Rather, decisions are based on only a few pieces of information, possibly only one, which is viewed as most relevant. Furthermore, in an ethnographic study of reading instruction in a fifth/sixth grade classroom, Stern and Shavelson (1981) found that once grouping decisions were made, later instructional decisions were generally based on group rather than individual information. This further supports the hypothesis that teachers reduce available information to a manageable level.

COMMENTS

The development, refinement, and validation of formal theories of human reasoning generally are approached through the examination of

simple, carefully selected, and easily controllable tasks. These tasks are usually well defined with definite beginning and end points. However, in naturalistic settings, seldom are tasks well defined and often just determining the nature of the task is a major concern. Therefore, researchers frequently find that no one formal theory of judgment, decision making, or problem solving is adequate on its own. Instead, as is evident in the research of the Institute for Research on Teaching and in the research of Shavelson, different aspects of educational decision making are examined with different theories, or relevant portions of various theories are combined into models appropriate to educational decisions.

The research discussed here is by no means an exhaustive coverage of all educational research on teacher thinking. It is an overview of the kind of research being done, both theoretically based and atheoretical, and is fairly comprehensive in that there has been, until recently, very little research, particularly theoretically-based research, on teacher thinking. Except for a few studies in which the diagnostic practices of reading clinicians were examined and one small study in which the diagnostic practices of learning disabilities teachers and reading clinicians were compared, research on teacher thinking has concentrated on regular classroom teachers, thus ignoring a large component of educational decision making, special education.

In special education a significant additional consideration in how decisions are made is the requirements of PL 94-142. This law specifies procedures to be followed in making diagnostic placement and planning decisions and imposes a structure that is generally absent in

regular education. Since the passage of PL 94-142 in 1975, a few studies of the special education decision process have been conducted (Applied Management Sciences, 1979; Poland, Ysseldyke, Thurlow, & Mirkin, 1979; Rucker & Vautour, 1981; Thurlow & Ysseldyke, 1979; Yoshida, Fenton, Maxwell, & Kaufman, 1978; Ysseldyke, Algozzine, Regan, Potter, Richey, & Thurlow, 1980; Ysseldyke, Algozzine, & Thurlow, 1980; Ysseldyke & Thurlow, 1980). These studies, however, have concentrated on formal diagnostic decision making and team decision processes. Thus, not only does research need to continue in efforts to understand how regular education teachers plan, problem solve, and make decisions, and to understand, predict, and improve formal diagnostic decision making in special education settings, but the decision processes of teachers operating under different constraints (i.e., special education teachers) need to be examined also.

References

Applied Management Sciences. Study for determining the least restrictive environment (LRE) placement for handicapped children. Final Report to BEH, 1979.

Bawden, R., Buike, S., & Duffy, G. Teacher conceptions of reading and their influence on instruction (Research Series No. 47). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1979. (EDRS No. ED 174-952)

Borko, H., Cone, R., Russo, N. A., & Shavelson, R. Teachers' decision making. In P. L. Peterson & H. J. Walberg (Eds.), Research on teaching. Berkeley, CA: McCutchan, 1979.

Brunswik, E. Representative design and probabilistic theory in functional psychology. Psychology Review, 1955, 62, 193-217.

Brunswik, E. Perception and the representative design of psychological experiments (2nd ed.). Berkeley, CA: University of California Press, 1956.

Buike, S. Teacher decision making in reading instruction (Research Series No. 79). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1980. (EDRS No. ED 191-000)

Clark, C. M., & Yinger, R. J. Methods for discovering cues used by judges: Two working papers. (Research Series No. 11). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1978. (EDRS No. ED 166-134)

Clark, C. M., & Yinger, R. J. Three studies of teacher planning (Research Series No. 55). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1979. (EDRS No. 175-855)

Dawes, R. M., & Corrigan, B. Linear models in decision making. American Psychologist, 1974, 81, 95-106.

Edwards, W., Lindman, H., & Savage, L. Bayesian statistical inference for psychological research. Psychological Review, 1963, 70, 193-242.

Einhorn, H. J. The use of nonlinear, noncompensatory models in decision making. Psychological Bulletin, 1970, 73, 221-230.

Elstein, A., & Bordage, G. Psychology of clinical reasoning. In G. Stone, F. Cohen & N. Adler (Eds.), Health psychology. San Francisco: Jossey-Bass, 1979.

Elstein, A. S., Shulman, L. S., & Sprafka, S. A. Medical problem solving: An analysis of clinical reasoning. Cambridge, MA: Harvard University Press, 1978.

Floden, R. E., Porter, A. C., Schmidt, W. H., Freeman, D. J., & Schwille, J. R. Responses to curriculum pressures: A policy capturing study of teacher decisions about content (Research Series No. 74). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1980. (EDRS No. ED 190-526)

Gil, D., Hoffmeyer, E., VanRoekel, J., & Weinshank, A. Clinical problem solving in reading: Theory and research (Research Series No. 45). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1979. (EDRS No. 179-914)

Goldberg, L. R. Simple models or simple processes? Some research on clinical judgments. American Psychologist, 1968, 23, 483-496.

Goldberg, L. R. Five models of clinical judgment: An empirical comparison between linear and nonlinear representations of the human inference process. Organizational Behavior and Human Performance, 1971, 6, 458-479.

Greeno, J. Indefinite goals in well-structured problems. Psychological Review, 1976, 83, 479-491.

Greeno, J. G. Natures of problem-solving abilities. In W. K. Estes (Ed.), Handbook of learning and cognitive processes (vol. 5). Hillsdale, NJ: Erlbaum, 1979.

Hammond, K. R., Rohrbaugh, J., Mumpower, J., & Adelman, L. Social judgment theory: Applications in policy formation. In M. Kaplan & S. Schwartz (Eds.), Human judgment and decision processes in applied settings. New York: Academic Press, 1977.

Hammond, K. R., & Summers, D. A. Cognitive control. Psychological Review, 1972, 79, 58-67.

Hayes, W. L. Statistics. New York: Holt, Rinehart & Winston, 1981.

Hoffman, P. J. The paramorphic representation of clinical judgment. Psychological Bulletin, 1960, 57, 116-131.

Joyce, B., & McNair, K. Teaching styles at South Bay School: The South Bay study, Part I (Research Series No. 57). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1979. (EDRS No. ED 187-666)

McNair, K., & Joyce, B. Teacher's thoughts while teaching: The South Bay study, Part II (Research Series No. 58). East Lansing, MI: Institute for Research on Teaching, Michigan State University, 1979. (EDRS No. ED 191-797)

Morine, G. A study of teacher planning, Special Study C. (Beginning Teacher Evaluation study. Technical Report Series). San Francisco: Far West Laboratory for Educational Research and Development, 1976. (EDRS No. ED 146-160)

Morine-Dershimer, G. Teacher plan and classroom reality: The South Bay study, Part IV (Research Series No. 60). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1979. (EDRS No. ED 191-769) (a)

Morine-Dershimer, G. Teachers' conceptions of pupils: The South Bay study, Part III (Research Series No. 59). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1979. (EDRS No. ED 180-988) (b)

Newell, A. Heuristic programming: Ill-structured problems. In J. Aronofsky (Ed.), Progress in operations research (vol. 3). New York: Wiley, 1969.

Newell, A., Shaw, J. C., & Simon, H. A. Elements of a theory of human problem solving. Psychological Review, 1958, 65, 151-166.

Newell, A., & Simon, H. Human problem solving. Englewood Cliffs, NJ: Prentice-Hall, 1972.

Nisbett, R. E., & Wilson, T. D. Telling more than we can know: Verbal reports on mental processes. Psychological Review, 1977, 84, 231-259.

Payne, J. W. Task complexity and contingent processing in decision making: An information search and protocol analysis. Organizational Behavior and Human Performance, 1976, 16, 366-387.

Payne, J. W., Braunstein, M. L., & Carroll, J. S. Exploring predecisional behavior: An alternative approach to decision research. Organizational Behavioral and Human Performance, 1978, 22, 17-44.

Poland, S. F., Ysseldyke, J. E., Thurlow, M. L., & Mirkin, P. K. Current assessment and decision making practices in school settings as reported by directors of special education (Research Report No. 14). Minneapolis: University of Minnesota, Institute for Research on Learning Disabilities, 1979. (EDRS No. ED 185-758)

Porter, A. C., Schwille, J. R., Floden, R. E., Freeman, D. J., Knappen, L. B., Kuhs, T. M., & Schmidt, W. H. Teacher autonomy and the control of content taught (Research Series No. 24). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1979. (EDRS No. ED 181-006)

Reitman, W. Cognition and thought. New York: John Wiley, 1965.

Rucker, C. N., & Vautour, J. A. C. The child study team training program: Research and development. Teacher Education and Special Education, 1981, 4, 5-43.

Shavelson, R. J. A model of teacher decision making. Paper presented at the annual meeting of the American Educational Research Association, Toronto, 1978.

Simon, H. A. The structure of ill-structured problems. Artificial Intelligence, 1973, 4, 181-201.

Simon, H. A. The functional equivalence of problem solving skills: Cognitive Psychology, 1975, 7, 268-288.

Simon, H. A. Information-processing theory of human problem solving. In W. K. Estes (Ed.) Handbook of learning and cognitive processes (vol. 5). Hillsdale, NJ: Erlbaum, 1979.

Slovic, P., & Lichtenstein, S. Comparison of Bayesian and regression approaches to the study of information processing in judgment. Organizational Behavior and Human Performance, 1971, 6, 649-744.

Smith, E. R., & Miller, F. D. Limits on perception of cognitive processes: A reply to Nisbett and Wilson. Psychological Review, 1978, 85, 355-362.

Stern, P. R., & Shavelson, R. J. The relationship between teachers' grouping decisions and instructional behaviors: An ethnographic study of reading instruction. Paper presented at the annual meeting of the American Educational Research Association, 1981. (EDRS No. ED 201-971)

Thurlow, M. L., & Ysseldyke, J. E. Current assessment and decision-making practices in model programs for the learning disabled (Research Report No. 11). Minneapolis: University of Minnesota, Institute for Research on Learning Disabilities, 1979. (EDRS No. ED 185-755)

Tversky, A., & Kahneman, D. Judgment under uncertainty: Heuristics and biases. Science, 1974, 185, 1124-1131.

Weinshank, A. The relationship between diagnosis and remediation in reading: A pilot study (Research Series No. 37). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1978. (EDRS No. ED 169-475)

Weinshank, A. B. An observational study of the relationship between diagnosis and remediation in reading (Research Series No. 72) East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1980. (EDRS No. ED 189-574)

Yinger, R. J. A study of teacher planning: Description and a model of preactive decision making. Paper presented at the annual meeting of the American Educational Research Association, Toronto, 1978. (EDRS No. ED 152-747)

Yinger, R. J., Clark, C., & Mondol, M. Selecting instructional activities: A policy capturing analysis (Research Series No. 103). East Lansing, MI: The Institute for Research on Teaching, Michigan State University, 1981. (EDRS No. 206-007)

Yoshida, R. K., Fenton, K. S., Maxwell, J. P., & Kaufman, M. J. Group decision making in the team process: Myth or reality? Journal of School Psychology, 1978, 16, 237-244.

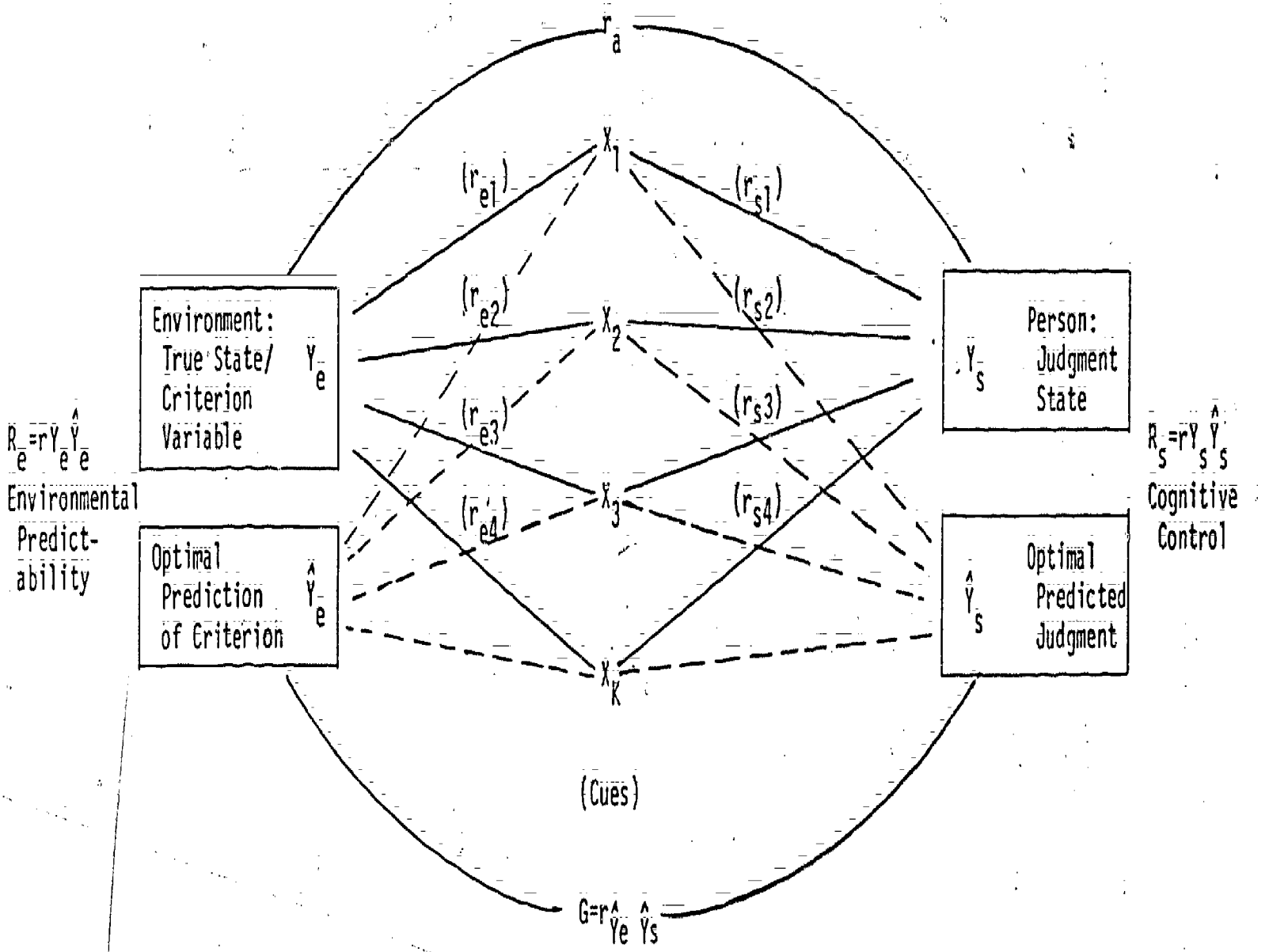
Ysseldyke, J. E., Algozzine, B., Regan, R. R., Potter, M., Richey, L., & Thurlow, M. Psychoeducational assessment and decision making: A computer-simulated investigation (Research Report No. 32). Minneapolis: University of Minnesota, Institute for Research on Learning Disabilities, 1980. (EDRS No. ED 203-607)

Ysseldyke, J. E., Algozzine, B., & Thurlow, M. L. (Eds.) A naturalistic investigation of special education team meetings (Research Report No. 40). Minneapolis: University of Minnesota, Institute for Research on Learning Disabilities, 1980. (EDRS No. ED 132-899)

Ysseldyke, J. E., & Thurlow, M. L. (Eds.). The special education assessment and decision-making process: Seven case studies (Research Report No. 44). Minneapolis: University of Minnesota, Institute for Research on Learning Disabilities, 1980. (EDRS No. ED 203 589)

Footnote

The author currently is a school psychologist with the Northern Trails Area Education Agency, Clear Lake, Iowa.

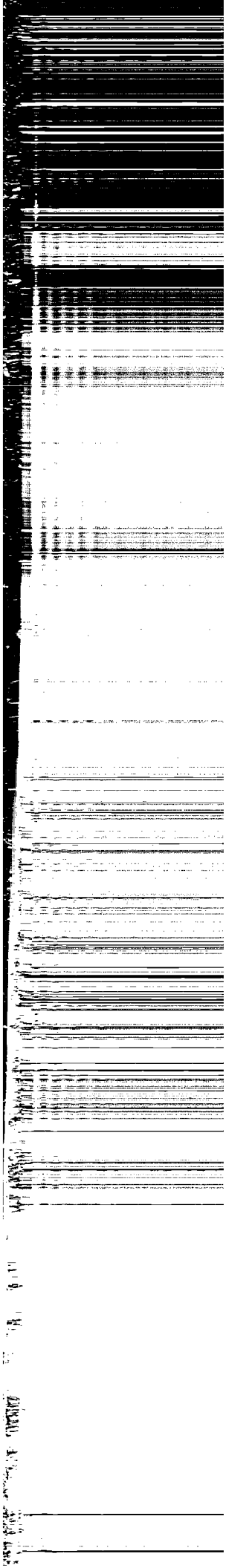


40

$$r_a = G R_e R_s$$

39

Figure 1. Brunswikian Lens Model of Judgment Theory



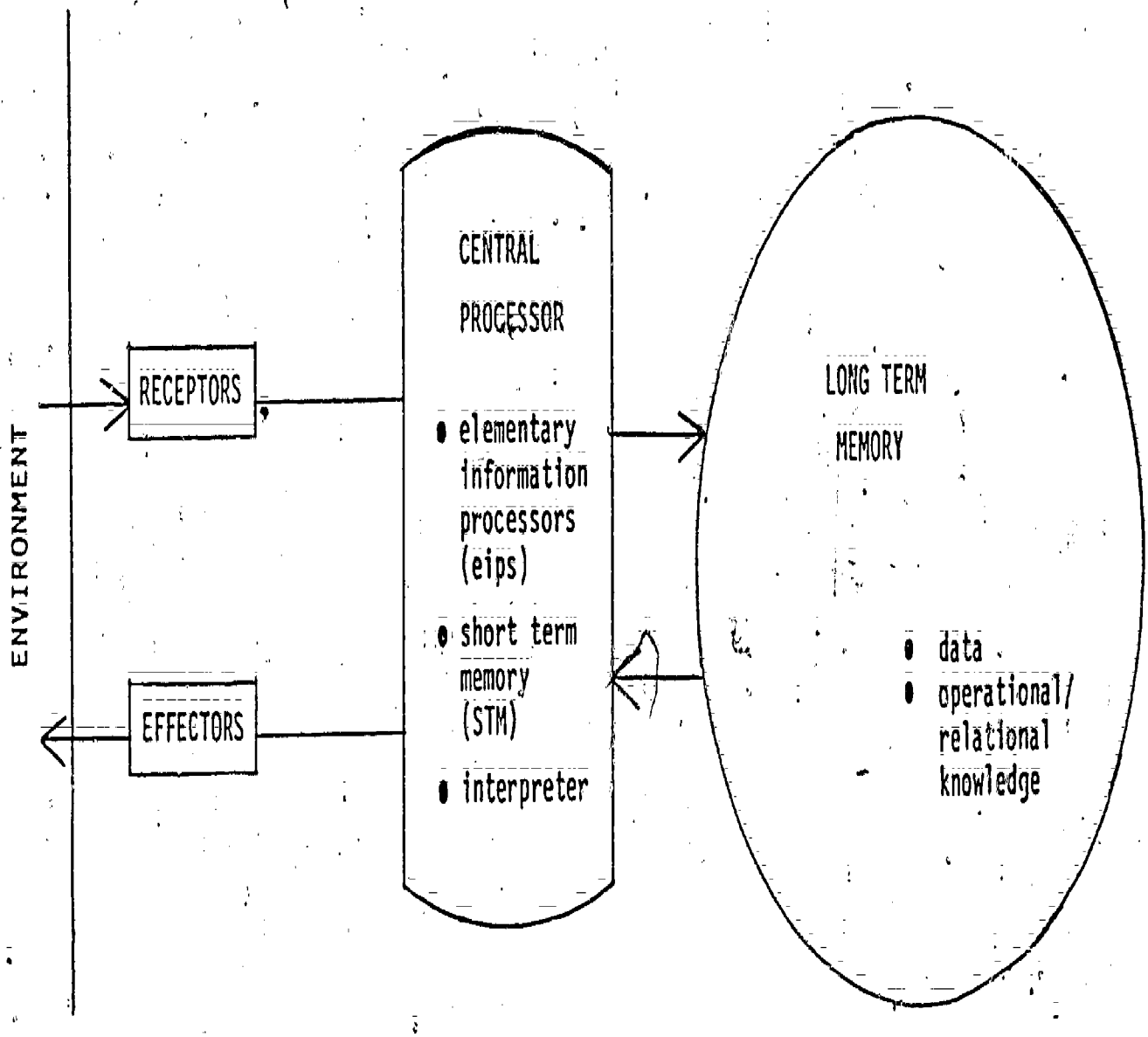


Figure 2. The information processing system (adapted from Newell and Simon, 1972).

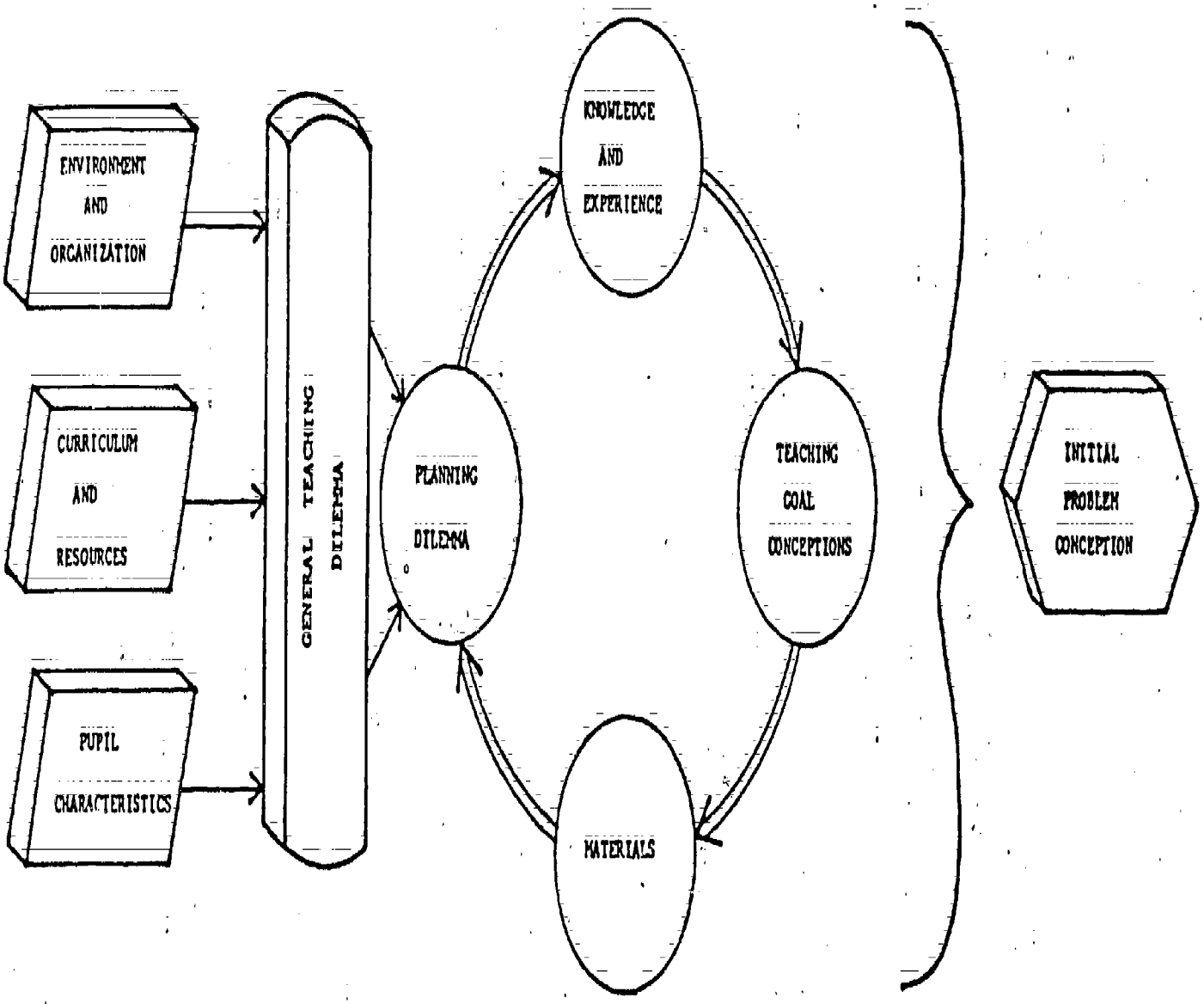


Figure 3. The Problem Finding stage of teacher planning. (From Yinger, 1978)

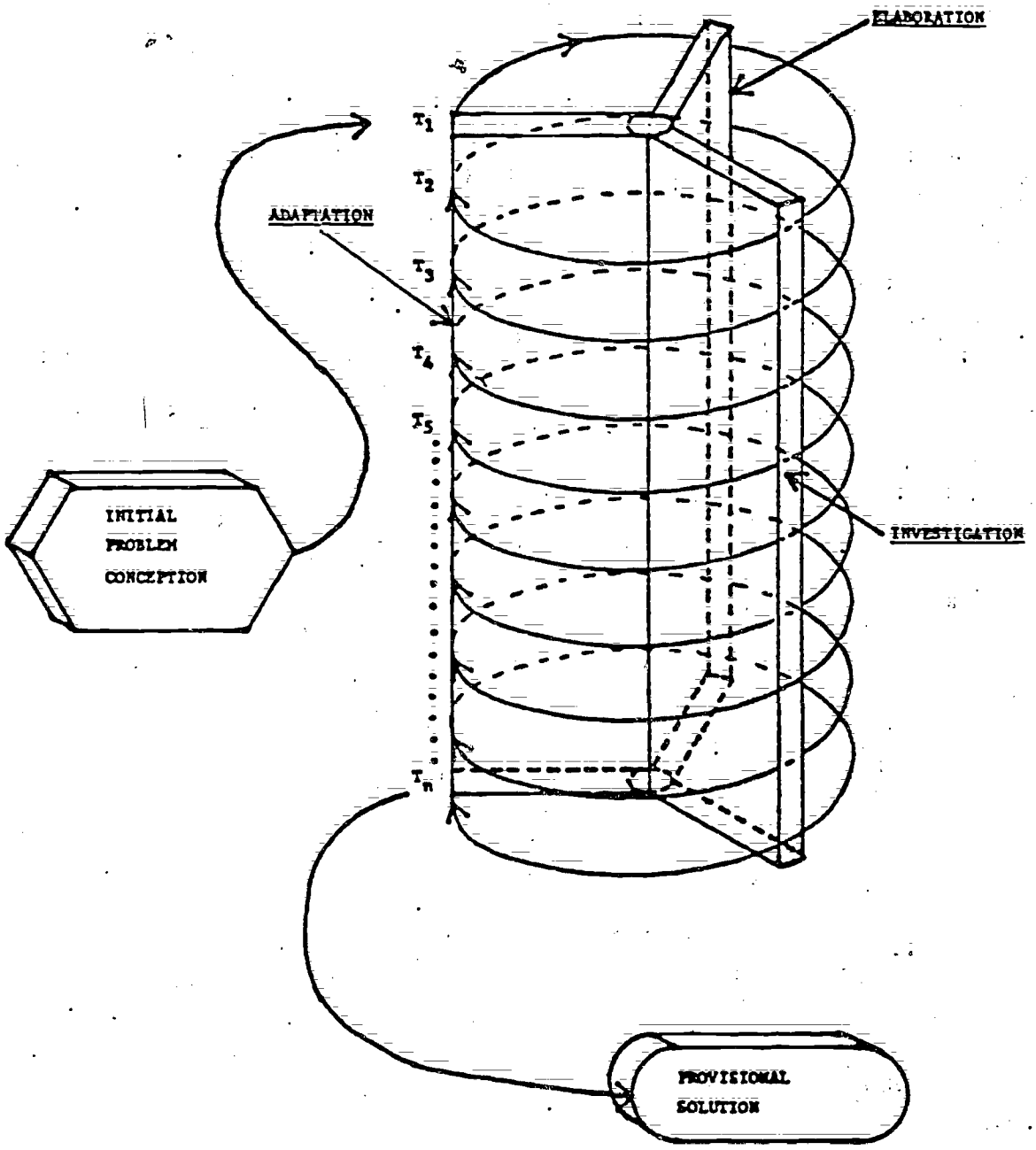


Figure 4. The Problem Formulation/Solution stage of teacher planning. (From Yinger, 1978)

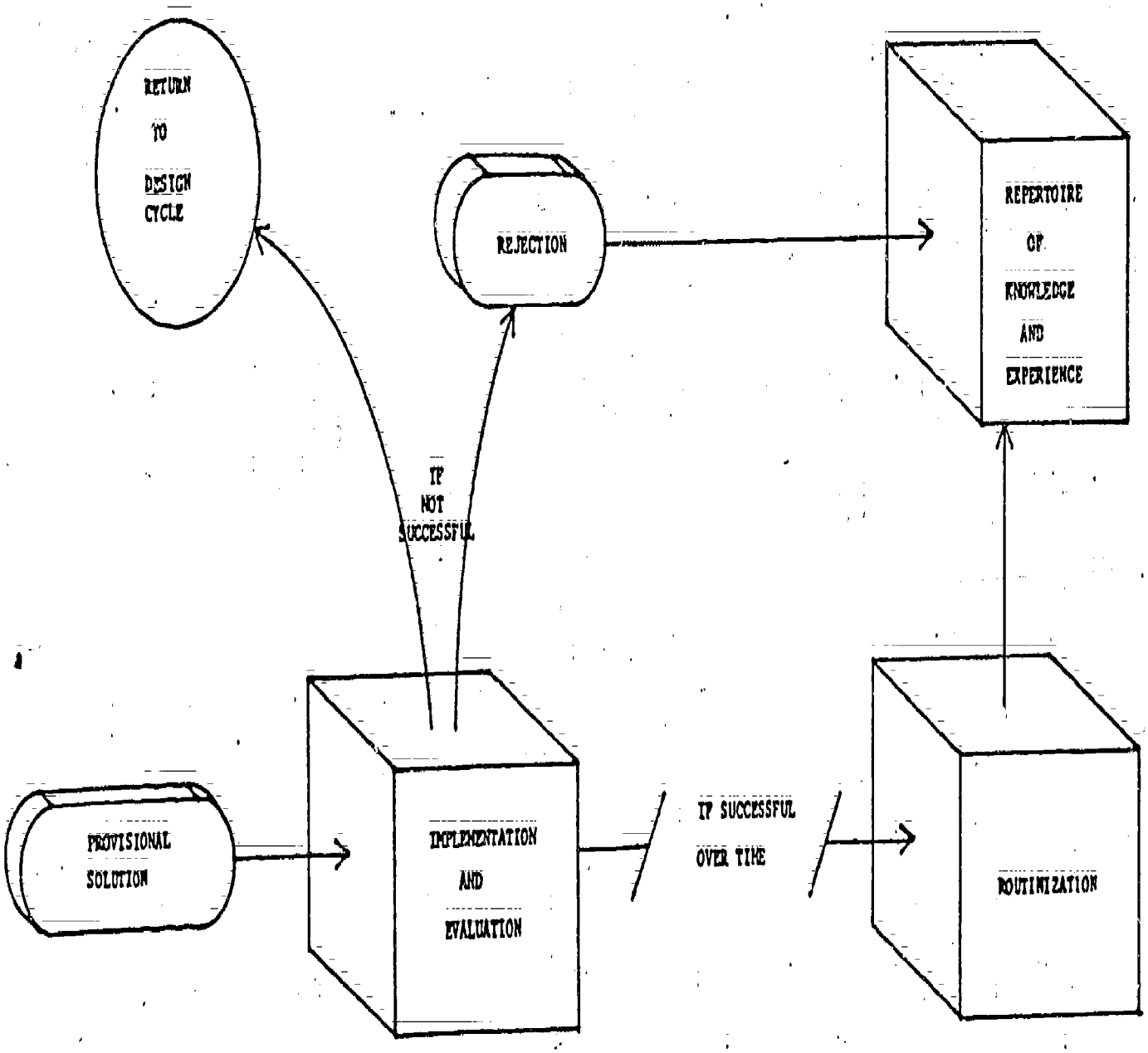


Figure 5. The Implementation, Evaluation, Routinization stage of teacher planning. (From Yinger, 1978)

PUBLICATIONS

Institute for Research on Learning Disabilities
University of Minnesota

The Institute is not funded for the distribution of its publications. Publications may be obtained for $4.00 each, a fee designed to cover printing and postage costs. Only checks and money orders payable to the University of Minnesota can be accepted. All orders must be prepaid. Requests should be directed to: Editor, IRLD, 350 Elliott Hall; 75 East River Road, University of Minnesota, Minneapolis, MN 55455.

The publications listed here are only those that have been prepared since 1982. For a complete, annotated list of all IRLD publications, write to the Editor.

Wesson, C., Mirkin, P., & Deno, S. Teachers' use of self instructional materials for learning procedures for developing and monitoring progress on IEP goals (Research Report No. 63). January, 1982.

Fuchs, L., Wesson, C., Tindal, G., Mirkin, P., & Deno, S. Instructional changes, student performance, and teacher preferences: The effects of specific measurement and evaluation procedures (Research Report No. 64). January, 1982.

Potter, M., & Mirkin, P. Instructional planning and implementation practices of elementary and secondary resource room teachers: Is there a difference? (Research Report No. 65). January, 1982.

Thurlow, M. L., & Ysseldyke, J. E. Teachers' beliefs about LD students (Research Report No. 66). January, 1982.

Graden, J., Thurlow, M. L., & Ysseldyke, J. E. Academic engaged time and its relationship to learning: A review of the literature (Monograph No. 17). January, 1982.

King, R., Wesson, C., & Deno, S. Direct and frequent measurement of student performance: Does it take too much time? (Research Report No. 67). February, 1982.

Greener, J. W., & Thurlow, M. L. Teacher opinions about professional education training programs (Research Report No. 68). March, 1982.

Algozzine, B., & Ysseldyke, J. Learning disabilities as a subset of school failure: The oversophistication of a concept (Research Report No. 69). March, 1982.

Fuchs, D., Zern, D. S., & Fuchs, L. S. A microanalysis of participant behavior in familiar and unfamiliar test conditions (Research Report No. 70). March, 1982.

Shinn, M. R., Ysseldyke, J., Deno, S., & Tindal, G. A comparison of psychometric and functional differences between students labeled learning disabled and low achieving (Research Report No. 71). March, 1982.

Thurlow, M. L. Graden, J., Greener, J. W., & Ysseldyke, J. E. Academic responding time for LD and non-LD students (Research Report No. 72). April, 1982.

Graden, J., Thurlow, M., & Ysseldyke, J. Instructional ecology and academic responding time for students at three levels of teacher-perceived behavioral competence (Research Report No. 73). April, 1982.

Algozzine, B., Ysseldyke, J., & Christenson, S. The influence of teachers' tolerances for specific kinds of behaviors on their ratings of a third grade student (Research Report No. 74). April, 1982.

Wesson, C., Deno, S., & Mirkin, P. Research on developing and monitoring progress on IEP goals: Current findings and implications for practice (Monograph No. 18). April, 1982.

Mirkin, P., Marston, D., & Deno, S. L. Direct and repeated measurement of academic skills: An alternative to traditional screening, referral, and identification of learning disabled students (Research Report No. 75). May, 1982.

Algozzine, B., Ysseldyke, J., Christenson, S., & Thurlow, M. Teachers' intervention choices for children exhibiting different behaviors in school (Research Report No. 76). June, 1982.

Tucker, J., Stevens, L. J., & Ysseldyke, J. E. Learning disabilities: The experts speak out (Research Report No. 77). June, 1982.

Thurlow, M. L., Ysseldyke, J. E., Graden, J., Greener, J. W., & Mecklenberg, C. Academic responding time for LD students receiving different levels of special education services (Research Report No. 78). June, 1982.

Graden, J. L., Thurlow, M. L., Ysseldyke, J. E., & Algozzine, B. Instructional ecology and academic responding time for students in different reading groups (Research Report No. 79). July, 1982.

Mirkin, P. K., & Potter, M. L. A survey of program planning and implementation practices of LD teachers (Research Report No. 80). July, 1982.

Fuchs, L. S., Fuchs, D., & Warren, L. M. Special education practice in evaluating student progress toward goals (Research Report No. 81). July, 1982.

Kuehnle, K., Deno, S. L., & Mirkin, P. K. Behavioral measurement of social adjustment: What behaviors? What setting? (Research Report No. 82). July, 1982.

Fuchs, D., Dailey, Ann Madsen, & Fuchs, L. S. Examiner familiarity and the relation between qualitative and quantitative indices of expressive language (Research Report No. 83). July, 1982.

Videen, J., Deno, S., & Marston, D. Correct word sequences: A valid indicator of proficiency in written expression (Research Report No. 84). July, 1982.

Potter, M. L. Application of a decision theory model to eligibility and classification decisions in special education (Research Report No. 85). July, 1982.

Greener, J. E., Thurlow, M. L., Graden, J. L., & Ysseldyke, J. E. The educational environment and students' responding times as a function of students' teacher-perceived academic competence (Research Report No. 86). August, 1982.

Deno, S., Marston, D., Mirkin, P., Lowry, L., Sindelar, P., & Jenkins, J. The use of standard tasks to measure achievement in reading, spelling, and written expression: A normative and developmental study (Research Report No. 87). August, 1982.

Skiba, R., Wesson, C., & Deno, S. L. The effects of training teachers in the use of formative evaluation in reading: An experimental-control comparison (Research Report No. 88). September, 1982.

Marston, D., Tindal, G., & Deno, S. L. Eligibility for learning disability services: A direct and repeated measurement approach (Research Report No. 89). September, 1982.

Thurlow, M. L., Ysseldyke, J. E., & Graden, J. L. LD students' active academic responding in regular and resource classrooms (Research Report No. 90). September, 1982.

Ysseldyke, J. E., Christenson, S., Pianta, R., Thurlow, M. L., & Algozzine, B. An analysis of current practice in referring students for psychoeducational evaluation: Implications for change (Research Report No. 91). October, 1982.

Ysseldyke, J. E., Algozzine, B., & Epps, S. A logical and empirical analysis of current practices in classifying students as handicapped (Research Report No. 92). October, 1982.

Tindal, G., Marston, D., Deno, S. L., & Germann, G. Curriculum differences in direct repeated measures of reading (Research Report No. 93). October, 1982.

Fuchs, L.S., Deno, S. L., & Marston, D. Use of aggregation to improve the reliability of simple direct measures of academic performance (Research Report No. 94). October, 1982.

Ysseldyke, J. E., Thurlow, M. L., Mecklenburg, C., & Graden, J. Observed changes in instruction and student responding as a function of referral and special education placement (Research Report No. 95). October, 1982.

Fuchs, L. S., Deno, S. L., & Mirkin, P. K. Effects of frequent curriculum-based measurement and evaluation on student achievement and knowledge of performance: An experimental study (Research Report No. 96). November, 1982.

Fuchs, L. S., Deno, S. L., & Mirkin, P. K. Direct and frequent measurement and evaluation: Effects on instruction and estimates of student progress (Research Report No. 97). November, 1982.

Tindal, G., Wesson, C., Germann, G., Deno, S. L., & Mirkin, P. K. The Pine County model for special education delivery: A data-based system (Monograph No. 19). November, 1982.

Epps, S., Ysseldyke, J. E., & Algozzine, B. An analysis of the conceptual framework underlying definitions of learning disabilities (Research Report No. 98). November, 1982.

Epps, S., Ysseldyke, J. E., & Algozzine, B. Public-policy implications of different definitions of learning disabilities (Research Report No. 99). November, 1982.

Ysseldyke, J. E., Thurlow, M. L., Graden, J. L., Wesson, C., Deno, S. L., & Algozzine, B. Generalizations from five years of research on assessment and decision making (Research Report No. 100). November, 1982.

Marston, D., & Deno, S. L. Measuring academic progress of students with learning difficulties: A comparison of the semi-logarithmic chart and equal interval graph paper (Research Report No. 101). November, 1982.

Beattie, S., Grise, P., & Algozzine, B. Effects of test modifications on minimum competency test performance of third grade learning disabled students (Research Report No. 102). December, 1982

Algozzine, B., Ysseldyke, J. E., & Christenson, S. An analysis of the incidence of special class placement: The masses are burgeoning (Research Report No. 103). December, 1982.

Marston, D., Tindal, G., & Deno, S. L. Predictive efficiency of direct, repeated measurement: An analysis of cost and accuracy in classification (Research Report No. 104). December, 1982.

Wesson, C., Deno, S., Mirkin, P., Sevcik, B., Skiba, R., King, R., Tindal, G., & Maruyama, G. Teaching structure and student achievement effects of curriculum-based measurement: A causal (structural) analysis (Research Report No. 105). December, 1982.

Mirkin, P. K., Fuchs, L. S., & Deno, S. L. (Eds.). Considerations for designing a continuous evaluation system: An integrative review (Monograph No. 20). December, 1982.

Marston, D., & Deno, S. L. Implementation of direct and repeated measurement in the school setting (Research Report No. 106). December, 1982.

Deno, S. L., King, R., Skiba, R., Sevcik, B., & Wesson, C. The structure of instruction rating scale (SIRS): Development and technical characteristics (Research Report No. 107). January, 1983.

Thurlow, M. L., Ysseldyke, J. E., & Casey, A. Criteria for identifying LD students: Definitional problems exemplified (Research Report No. 108). January, 1983.

Tindal, G., Marston, D., & Deno, S. L. The reliability of direct and repeated measurement (Research Report No. 109). February, 1983.

Fuchs, D., Fuchs, L. S., Dailey, A. M., & Power, M. H. Effects of pre-test contact with experienced and inexperienced examiners on handicapped children's performance (Research Report No. 110). February, 1983

King, R. P., Deno, S., Mirkin, P., & Wesson, C. The effects of training teachers in the use of formative evaluation in reading: An experimental-control comparison (Research Report No. 111). February, 1983.

Tindal, G., Deno, S. L., & Ysseldyke, J. E. Visual analysis of time series data: Factors of influence and level of reliability (Research Report No. 112). March, 1983.

Tindal, G, Shinn, M., Fuchs, L., Fuchs, D., Deno, S., & Germann, G. The technical adequacy of a basal reading series mastery test (Research Report No. 113). April, 1983.

Sevcik, B., Skiba, R., Tindal, G., King, R., Wesson, C., Mirkin, P., & Deno, S. Communication of IEP goals and student progress among parents, regular classroom teachers, and administrators using systematic formative evaluation (Research Report No. 114). April, 1983.

Wesson, C. Two student self-management techniques applied to data-based program modification (Research Report No. 115). April, 1983.

Wesson, C., Skiba, R., Sevcik, B., King, R., Tindal, G., Mirkin, P., & Deno, S. The impact of the structure of instruction and the use of technically adequate instructional data on reading improvement (Research Report No. 116). May, 1983.

Wesson, C. Teacher vs student selection of instructional activities (Research Report No. 117). May, 1983.

Tindal, G., & Deno, S. Factors influencing the agreement between visual and statistical analyses of time series data (Research Report No. 118). June, 1983.

Skiba, R. S. Classroom behavior management: A review of the literature (Monograph No. 21), June, 1983.

Graden, J. L., Thurlow, M. L., & Ysseldyke, J. E. When are students most academically engaged? Academic responding time in different instructional ecologies (Research Report No. 119). June, 1983.

Fuchs, L. S., Deno, S. L., & Roettger, A. The effect of alternative data-utilization rules on spelling achievement: An n of 1-study (Research Report No. 120). June, 1983.

Skiba, R., Sevcik, B., Wesson, C., King, R., & Deno, S. The non-effect of process-product variables in resource classrooms (Research Report No. 121). June, 1983.

Fuchs, L. Tindal, G., Shinn, M., Fuchs, D., Deno, S., & Germann, G. Technical adequacy of basal readers' mastery tests: The Ginn 720 series (Research Report No. 122). June, 1983.

Tindal, G., Germann, G., Marston, D., & Deno, S. The effectiveness of special education: A direct measurement approach (Research Report No. 123). June, 1983.

Sevcik, B., Skiba, R., Tindal, G., King, R., Wesson, C., Mirkin, P., & Deno, S. Curriculum-based measurement: Effects on instruction, teacher estimates of student progress, and student knowledge of performance (Research Report No. 124). July, 1983.

Skiba, R., Marston, D., Wesson, C., Sevcik, B., & Deno, S. L. Characteristics of the time-series data collected through curriculum-based reading measurement (Research Report No. 125). July, 1983.

Ysseldyke, J., Christenson, S., Graden, J., & Hill, D. Practical implications of research on referral and opportunity to learn (Monograph No. 22). July, 1983.

Marston, D., Deno, S., & Tindal, G. A comparison of standardized achievement tests and direct measurement techniques in measuring pupil progress (Research Report No. 126). July, 1983.

Fuchs, D., Fuchs, L. S., Tindal, G., & Deno, S. L. Variability of performance: A "signature" characteristic of learning disabled children? (Research Report No. 127). July, 1983.

Tindal, G., Fuchs, L., Fuchs, D., Shinn, M., Deno, S., & Germann, G. The technical adequacy of a basal series mastery test: The Scott-Foresman reading program (Research Report No. 128). July, 1983.

Fuchs, L. S., Fuchs, D., & Deno, S. L. The nature of inaccuracy among readability formulas (Research Report No. 129). July, 1983.

Fuchs, L., Tindal, G., Fuchs, D., Shinn, M., Deno, S., & Germann, G. The technical adequacy of a basal reading mastery test: The Holt basic reading series (Research Report No. 130). July, 1983.

Ysseldyke, J. E., Christenson, S., Algozzine, B., & Thurlow, M. L. Classroom teachers' attributions for students exhibiting different behaviors (Research Report No. 131). July, 1983.