Expertise in problem identification:

A descriptive analysis of the cue selection

and hypothesis generation of reading diagnosticians

by

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(ABSTRACT)

Epitomizing the cognitive process of problem identification is diagnosis. Contrary to many areas of professional expertise (e.g., medicine, architecture), studies of expertise in reading diagnosis suggest that diagnosticians identify problems idiosyncratically, with little intra- or interdiagnostician consistency in cue selection and hypothesis generation. Further, their prescriptions appear to be unrelated to their diagnoses. A close examination of this research indicates use of a treatment which restricted the cues which naturally occur in the typical diagnostic process. In addition, the data analysis focused only on the product (i.e., the diagnosis and prescription), neglecting study of the actual process.

The purpose of this study was to trace the diagnostic process, examining the cue utilization and hypothesis generation strategies, diagnoses, and prescriptions within and across five expert reading diagnosticians. Each diagnostician completed five different experimental sessions with five different clients. Each session consisted of a preparation, interaction, written diagnosis, and summary stage. The sessions were varied by mode of interaction with the client (live, videotaped, and boxed file with audiotape), time allocated to each stage, and method of verbal report (on-line think alouds or stimulated recalls). The major data sources were the verbal reports, the diagnosticians' notes, and the written diagnoses. A quantitative and qualitative analysis of the single, multiple, and missing cues, inferences, and hypotheses was conducted. Diagnoses and prescriptions were compared to the aforementioned cues and hypotheses to determine intra- and interdiagnostician consistency.

The three general sources of cues and hypotheses emanated from the client, the task environment, and background experiences. Cue selection strategies, selected cues, and related hypotheses were largely consistent within diagnosticians, with variations attributable to differences in treatment and/or individual client. Interdiagnostician consistency was lower and related to training experiences, present instructional assignments, and conceptions of assessment. Across all diagnosticians and sessions, the availability of critical cues became the criteria for reaching a diagnosis and prescription. Generally, the diagnosticians were consistent across client, with variations again influenced by the availability of cues during the process. In effect, then, the activities and information selected during the diagnostic process varied across diagnostician, but the final products (the diagnosis and prescription) were largely similar.

Acknowledgements

As learning is an interactive enterprise, many individuals with whom I've worked and commiserated with over the past five years deserve recognition and my appreciation. John K. Burton has been my advisor, my mentor, and my friend. I deeply appreciate and thank him for the wonderful way he has played all three roles. He has helped me learn about myself, my field, and my future. My committee members, Joe Harding, Jerry Niles, Larry Weber, and Terry Wildman have my sincere gratitude and respect. Each has made valuable, obvious contributions to my dissertation; but even more, each has enhanced my education and development by his unique, yet complimentary, professional demeanor.

Thanks go to the diagnosticians and children who participated in this study, as well as the Appalachian Educational Laboratory and Virginia Tech's Division of Curriculum and Instruction, who funded the study. Without these parties, this study -- the major learning task in my program -- would not have been possible.

Thanks also go to my fellow graduate students:

Over the past five years, each of these individuals has offered me support, advice, comic relief, and an anchor in reality. Behind the scenes have been

whose support, especially during the final dissertation process and production, is deeply appreciated.

As I have done all through my life, I thank my parents for confidence. Their support and love have given me the strength to take risks and meet new challenges. Of course, I must thank , for being my dog with his keen ability to listen and give me a "wet nose" when I needed it.

Finally, to , my husband, besides for just "being there," I want to thank him sincerely for keeping his eye on the goal and future of my career and our lives "after the dissertation." While I may not have shown it, I did appreciate his subtle reminders. His direction was needed especially during the last two years when I had the tendency to get immersed in the dissertation process and involved in other projects.

Table of Contents

INTRODUCTION

Undertaking advanced studies toward a doctorate typically denotes that the individual desires a career and life change. The passage of the candidate, from a career in which knowledge is basically applied to a career of inquiry and investigations, takes one through a rigorous and fairly structured program of studies. This program may entail one or more years of coursework, independent studies, and small research projects.

The dissertation is the culmination of this intensive learning experience, and if successful, the candidate is awarded a doctorate. The individual now has the "ticket" to advance into a university or college career and actively pursue his or her own area of interest.

But what is the dissertation? While doctoral candidates who are in the midst of the process call it many unmentionable names, it is, in reality, the last time an individual can assume the formal role as a student and conduct a study under the systematic guidance of a committee of experienced researchers. This luxury of having an official team of mentors to steer you in the right direction, without telling you exactly where to go or what to do, stops once the cover sheet for the dissertation is signed. If the candidate remains in a research-oriented position, future mentor relationships are likely, but not guaranteed, to happen. The new assistant professor is on his or her own to plan, conduct, analyze and publish research.

In order to give me the support to begin my own career in academia, this dissertation was viewed as the beginning, not the culmination, of a career. The exercise was more like crossing a bridge, rather than jumping off a ledge. To that end, the document was designed to be, and subsequently appears in this volume as, two publishable -- rough, but publishable -- manuscripts.

The first manuscript is a review of the literature related to reading diagnosis as a problem solving cognitive process. The review begins with a rationale of why the process of reading diagnosis deserves study. The main body is devoted to the elemental cognitive processes that comprise the complex task of identifying reading problems. The last portion

of the manuscript discusses what we do know about diagnosis from the medical, as well as the reading, literature. Recommendations for future research are offered in the closing arguments.

The second manuscript reports the actual dissertation study of the cue selection and hypothesis generation strategies used by expert reading diagnosticians. This manuscript is structured according to the format recommended by the American Psychological Association, in the third edition of the publication manual. Extensive tables and figures are offered in the text and in the appendices for further elaboration of the methodology, results and discussion. While such detail may not be appropriate for the future article, it is reported to enable my committee to peruse and hopefully continue in their role of valued mentors.

One reference section is included and contains the sources for the citations for both manuscripts. As mentioned, the appendices are extensive. Their inclusion was deemed necessary to inform the committee about the complex data collection procedures, and extensive data base that was used to formulate the interpretations stated in the discussion and conclusion sections of the article.

I am intensely satisfied with what this document is, as well as what it represents. This dissertation format, and intent, has enabled me to go beyond the acceptance of this endeavor as a mere "exercise" or "one more hoop to jump through." This dissertation truly represents a solid bridge to a new career that has been nurtured, and gradually set free, for what I feel is a promising future.

READING DIAGNOSIS REVISITED:

A REVIEW OF LITERATURE RELATED TO PROBLEM IDENTIFICATION IN READING

Reading diagnosis has often been characterized as assessment, tempered by the models of testing which undergird the diagnostician's conception of successful versus problematic reading (see Johnston, 1984, for a review). This perspective focuses on the diagnostic instrumentation and how the beliefs held by the diagnostician influence the assessments as well as the subsequent diagnostic and prescriptive decisions. In essence, the tests, and the test scores, have traditionally dominated the study of diagnostic processes and products (Taylor, Harris & Pearson, 1988).

But what about the diagnostic process? What are the cognitive activities which integrate assessment results and diagnostic beliefs that enable the diagnostician to identify the client's problem? What role does the context (including the client and setting) have on these cognitive activities? And finally, to what extent is the diagnostic process generalizable across and within diagnosticians over varying clients and settings? Past research has characterized this complex process as individualistic, idiosyncratic, and inconsistent (e.g., Vinsonhaler, Weinshank, Wagner & Polin, 1983). But, is this truly the case, or is this view an artifact of the traditional view of the diagnostic process? The purpose of this section is to review the literature related to diagnosis from a much broader perspective, that of a cognitive orientation to problem identification. To set a context for this discussion, let us first look back briefly on the major research on diagnosis from the medical and reading perspectives, their respective paradigms, and subsequent findings that have shaped and, in the case of reading, restricted the view of diagnosis as a cognitive process.

Over a decade ago, Vinsonhaler and his associates at the Institute for Research on Teaching began a large-scale study of the clinical problem-solving behavior in reading diagnosis (Elstein, Shulman, Vinsonhaler, Wagner & Bader, 1978b). These researchers made the case that clinical reading diagnosis was very much like medical diagnosis in that both fields share a common set of goals and processes; both are problem-initiated and problem-directed. This framework had flourished and gained widespread acceptance during the preceding decade as investigations focused on the clinical reasoning of expert and novice medical diagnosticians. Given the conceptual similarities of the two fields, it made sense to transport inquiry paradigm to reading diagnosis.

In addition to the conceptual framework, initial studies of reading diagnostic processes borrowed the methodology from the medical diagnosis literature (see Elstein, Shulman & Sprafka, 1978a, for a complete description). In these studies, "high-fidelity" simulations were used. That is, expert medical diagnosticians were asked to diagnose the maladies of live, simulated patients in contexts closely resembling physicians' examination offices. These "patients" were actors trained to play their roles in order to present the physicians with as realistic a representation of the clinical environment as possible.

In these high-fidelity diagnostic situations, the physicians could decide how much data to collect, whether to enlist the help of consultants, or whether to order laboratory tests. They were encouraged to take as much time as deemed necessary. The participants knew that the patients were actors and that the diagnostic sessions were staged, but reported that, on the whole, these factors had little influence on their usual methods of gathering data. To trace the diagnostic process, expert physicians were asked to "think aloud" and provide an ongoing account of their reasoning as they conducted the examinations and formulated their diagnoses and prescriptions. They reported that they felt at ease with this procedure as they all worked in teaching positions and had to verbalize workups during daily rounds with the residents. The resulting verbal protocols were transcribed and analyzed descriptively for the nature and interpretation of cues, strategies for hypotheses formulation, associative retrieval processes, and modes of mental problem representation.

The findings indicated that the physicians appeared to leap directly to a small array of provisional hypotheses very early in their meetings with the "patients." These provisional hypotheses seemed to be generated from the physicians' background knowledge of medicine (including their range of specific experiences), and associated with the problematic cues recognized in the early stages of interaction with the patients. The most common error was that of overinterpretation; that is, regarding noncontributory information as confirmation of an existing hypothesis. In addition, diagnostic competence was related to the nature of the problem at hand, the available information, and the amount of experience the particular physician had with that specific problem.

As this paradigm was adapted for the study of expert reading diagnosticians, modifications of the methodology, focus, and subsequently the findings, occurred. Rather than the actor/patients in the medical studies, the simulated cases of problem readers were collections of information, organized in a box per case, which included test scores, completed test booklets, audiotapes, and written, non-judgmental comments by other experts (Lee & Weinshank, 1978). Instead of having open access to the "boxed" client, the diagnosticians were given the information on a cue inventory list and instructed to ask the experimenter for as many specific cues from the inventory as were necessary to write a diagnosis and initial remedial plan. The diagnosticians were asked to give an on-going account of what they were examining during the data collection procedure, then asked to write a written diagnosis and prescription based on their findings. Upon completion of the written task, the diagnosticians were asked to reconstruct their thinking as they proceeded through their data collection and written phases. The purpose of this debriefing was to record their explanations for selecting specific cues and which cues generated, confirmed or disconfirmed specific hypotheses. Finally, the diagnosticians were allowed to revise their written diagnoses based on their thinking during the debriefing session.

In the pilot study (Lee & Weinshank, 1978), the research focus was on the diagnostic process. As such, the verbatim transcripts of the sessions and the written products were analyzed for cue values, tentative hypotheses, and general diagnostic strategies in order to ex-

amine the entire procedure. The effort yielded results similar to those found in the medical diagnosis research regarding cue selection and hypothesis generation strategies. That is, relatively few hypotheses were considered at any one time. In addition, despite variability in the number of cues requested and the amount of total elapsed time, the diagnosticians ultimately correctly identified the client's major problems.

Subsequent studies changed the focus of this preliminary effort with an eye toward the development of a computer simulated diagnostic system (e.g., Gil, Wagner & Vinsonhaler, 1979). To that end, the research questions focused more on the product than the process. The variables of interest narrowed to two discrete aspects of diagnosis: the frequency of each diagnostic statement made in the written diagnosis across all sessions for each case, and the individual agreement for each case (interdiagnostician and intradiagnostician). The results indicated that there was very little commonality between diagnosticians in their statements about similar cases. In a summary of the entire research effort, Vinsonhaler and colleagues (1983) reported that, in fact, most statements in the written diagnosis and remediation for a given case were mentioned only once. In relation to reliability, across the series of six studies of reading diagnosticians, learning disabilities specialists, and classroom teachers, the inter-diagnostician agreement (*Phi* coefficient) was about 0.10 and the intra-diagnostician agreement was 0.20. Moreover the suggested remediations appeared to be uncorrelated with the diagnoses. These findings, according to the researchers, could not be accounted for by differences in training or position (i.e., clinician versus learning disabilities specialist versus classroom teacher). Vinsonhaler and colleagues concluded that "diagnosis as presently conducted should not be continued," and that future study should focus on "the causes of low diagnostic agreement and methods by which we may improve the training and decision making of reading specialists" (p. 161).

Since this research, there has been little study of (or apparent interest in) how reading diagnosticians actually engage in the diagnostic process. (As an example, no studies of the diagnostic process have appeared in the National Reading Conference Yearbook for the past six years.) The field of reading assessment, however, is in the midst of a reconsideration of

what assessment should be (see, for example, Pearson & Valencia, 1987) in light of the process-oriented models of reading supported by cognitive psychology (see Samuels & Kamil, 1984, for a review).

Johnston's (1984) review of the development and current status of the assessment of reading outlines exciting trends in alternative means for understanding how a person reads. These ideas go beyond the narrow capabilities of standardized instruments. For example, Clay's research (1979) employs "running records" to examine the naturally occurring teacher-student interaction as the child "reads himself into a corner with consecutive errors," (Johnston, p. 174), and the teacher responds by having him try again. This cycle continues until the child is successful and the teacher gains an understanding of the child's reading behavior. This interaction indicates that a more complex, dynamic means of reading assessment is taking place in real diagnostic settings. Consequently, the past emphasis on the diagnostician's use of standardized tests as the key to the diagnostic process appear to no longer be valid. Investigations must examine the naturally occurring diagnostic process as it occurs in real diagnostic settings. It will be from these studies that a picture of the actual nature of reading diagnosis can be revealed, along with a more accurate portrayal of the problem identification processes in which the diagnostician truly engages.

To inform these speculations, however, it is necessary to "revisit" the basic research that undergirds the identification of problems (i.e., diagnosis) in order to lay out the elemental processes that compose a cognitive activity. These may be a good deal more complex and interesting than originally depicted. This review is divided into three main sections. First, a discussion and integration of the research on those cognitive sub-processes and factors involved in accurate problem identification are set forth. The second section focuses on diagnosis, outlining relevant findings from the medical and reading research. This section begins with discussion of how problem identification processes are operationalized in medical diagnosis, based primarily on the studies by Elstein, Shulman & Sprafka (1978a). The next part elaborates on the work by Vinsonhaler and his colleagues (1983) concerning reading diagnosis. Recommendations for future research are offered in the third section.

The Information Processing Model of Human Problem Solving

In the realm of cognitive psychology, humans are frequently portrayed as active processors of information (Klatsky, 1980). This information processing approach, brought to the forefront by the publication of Neisser's *Cognitive Psychology* in 1967, focuses on how the human memory system acquires, transforms, reduces, elaborates, stores, retrieves, and uses information. Referring to the computer as a metaphor for the memory system, cognitive psychologists have constructed models to depict the flow of information through a number of separate stages, and to explain what happens to that information at each stage.

While many variations of the information processing approach appear in the literature (see, for example, Klatsky, 1980), they all seem to have the following elements in common (see Figure 1). Perceived information first enters the sensory store, where it is held in its original sensory form (e.g., visual - "icon", auditory - "echo"). The sensory store holds stimuli for a brief period of time -- less than 250 milliseconds for visual or iconic images (Sperling, 1960) and less than 4 seconds for auditory or echoic sounds (Darwin, Turvey & Crowder, 1972) -- allowing salient stimuli or patterns to be recognized. This pattern recognition process involves matching previously-learned knowledge stored in long-term memory with the new stimuli in the sensory store. Information that is not recognized is lost. Recognized patterns are filtered to (Broadbent, 1958), or selected for (Treisman, 1964), attention in our short-term memory (STM). STM is limited in both the length of time it can hold information (about 20 seconds without rehearsal) (Peterson & Peterson, 1959), and the amount of information it can retain (7 +/- 2 units) (Miller, 1956). STM is characterized as a "work space" (Klatsky, 1980) in which information may be rehearsed, elaborated, used for decision making, stored in long-term memory, or lost. Long-term memory (LTM) is divided into two storage components

-- semantic (memory of general world knowledge) and episodic memory (memory for specific events) (Tulving, 1972). Information in LTM is organized according to the way it was encoded (Tulving & Thomson, 1973). Information flows into LTM from STM, and from LTM into STM or to the stage of pattern recognition (Norman, 1982).

FIGURE 1 WILL APPEAR ABOUT HERE.

The information processing model of human memory characterizes problem solving as a complex mental activity that involves the interaction between a task environment and the individual problem solver (Newell & Simon, 1972). The task environment is the description of the problem as presented to the individual. This description includes the information, assumptions, and constraints, as well as the context in which the problem is presented. The individual then forms a problem space or mental representation of the problem. It is in this "space" that the problem solver evaluates the possible choices, hypotheses, and strategies that may be used to solve the problem.

Critical features that affect the success of the problem solving effort begin with a clear understanding of the problem which leads to the construction of an effective representation of the problem. Without this, the problem space will direct the individual on the wrong course toward a solution (Reed, 1983). In addition, performance on the task is also influenced by the capacity and storage time in STM, and the time it takes to retrieve relevant information from LTM (Newell & Simon, 1972). In STM, as much capacity as possible needs to be devoted to important aspects of the problem so that space is not "clouded" with non-essential data that would impede the consideration of relevant alternatives. This relevant information must be actively rehearsed or considered in order for it to remain in STM; inattention may result in forgetting. Further, the size and organization of the "search space" in LTM determines the amount of information that can be used in the problem space (Mayer, 1983). That is, the more sophisticated, efficiently and meaningfully "chunked" together the knowledge base is, the more likely it is that necessary information can be recalled and considered.

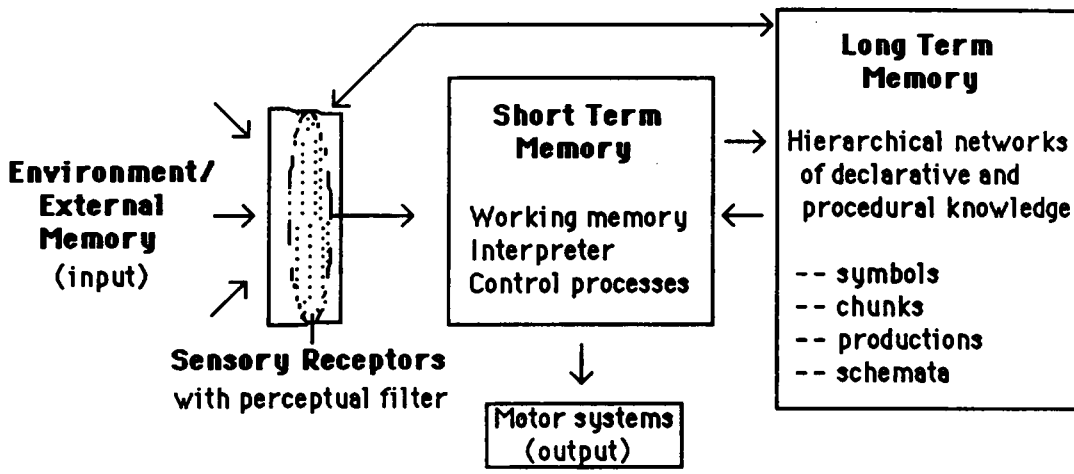

Figure 1. A conceptual representation of the human memory system.

Problem representation, capacity of STM, and the size and organization of the search space in LTM are all mitigated by the level of expertise. Expertise can be defined in terms of familiarity and experience with the context, knowledge of the relevant content, and the capability to employ the necessary strategies (Ericsson, 1985). In essence, expertise in the context and content area allows the individual to extract the critical information from the task environment in order to arrive at a solution quickly and reduce the chance of error. Consequently, in order to understand how problem solving is accomplished, one must focus on the processes employed by experts as they select cues across changing task environments (Ericsson, 1985).

Selective attention and pattern recognition

From the broad perspective, attention and pattern recognition play prominent and interrelated roles in the identification of environmental information needed to solve problems (Newell & Simon, 1972; Norman, 1969). In their active search to select critical information from the environment, problem solvers keep all sensory channels open for initial processing of cues and analysis of patterns that are associated with some representation in long-term memory. From a few key cues, relevant knowledge from long-term memory is activated, causing tentative hypotheses about potential recognition of relevant cues and probable patterns based on previous experiences to be generated. It is at this point in the process that individuals attend selectively to specific cues in the context (Norman, 1969). These specific cues can be compared to features associated with internal patterns held in existing memory (Klatsky, 1980). The most highly activated or best-matching pattern is processed, and all other patterns on competing channels are eliminated. In essence, then, according to Norman (1969), recognizing a pattern corresponds to attending to it.

Selective attention is an indispensible, adaptive mechanism that enables humans to simplify the complexity of their environment (Simon, 1977). In the effort to circumvent environmental complexity and a limited short-term memory system (Miller, 1956), individuals select particular cues that will help them identify relevant concepts (Neisser, 1967). A number of mechanisms assist in the selection process. Rich, organized structures of factual (declarative) and strategic (procedural) schemata embody the content knowledge (Greeno, 1980). Past experience and an internalized rule system delineates cue dominance (e.g., Trabasso, 1963) and strategies for selective attention (e.g., Bruner, Goodnow & Austin, 1956). These strategies are especially important in multiple cue judgments (N.H. Anderson, 1974). And finally, to enable the efficient operation of these subordinate mechanisms is an important superordinate control process -- the automatic application of all relevant knowledge structures when these critical cues are noticed (Bloom, 1986; Shiffrin & Dumais, 1981).

Building knowledge structures. Human memory contains large quantities of information that are organized into networks of related knowledge (Norman, 1982). The development of these knowledge structures begins with accretion (Norman, 1978) or the learning of isolated basic details (Bloom, 1986). Effort and attention must be devoted to each movement, concept, and decision in order for the learner to categorize the new information according to specific features, related content, and function (Norman, 1982). Initially, this new knowledge is added to, or subsumed, into existing memory schemas or packets of information that hold existing bodies of knowledge (Anderson, Greeno, Kline & Neves, 1981). It is at this point that inferences are made based on past experiences to reduce the range of possible schemas that may be applied to the new knowledge (Anderson & Pearson, 1984). For example, when reading diagnosticians first encounter a new client, they must compare and integrate the reading performance of this client with their past experiences with readers who emit similar cues that are associated with problem categories or schemata.

Through practice and effort, this information is restructured into sequences of movements or chunks of related information (Newell & Rosenbloom, 1981) resulting in new conceptualizations (Norman, 1982). As the existing schemas are no longer sufficient to

adequately define the new conceptualizations, new schemas are formed. Continuing with our diagnostician example, through continued interaction with this client and/or reading problem, our diagnostician begins to notice specific differences between this particular client's reading problems and others which appear to be similar. He/she groups those differences into specific categories, and begins to form new schemata or frameworks for this problem as opposed to the one that was instantiated (retrieved and applied) originally. With continued practice, series of chunks and processes are restructured from previous smaller units.

Rich schemas are developed, practiced, and finely tuned, resulting in rapid, accurate recognition and application when critical cues are selectively noticed (Norman, 1978). Because this process occurs on an effortless, automatic level, the need for conscious processing is bypassed and excess space in short-term memory is available for other, more effortful, processes, such as the consideration of alternative disease possibilities or treatments (Shiffrin & Dumais, 1981).

Cue dominance. Implicit in the concept of selective attention is the idea that features are typically not chosen at random; that is, certain elements of the environment attract attention more readily than others (Mayer, 1983). The research on pattern recognition indicates that certain dominant or salient dimensions of environmental cues account for this selection process. Using a concept attainment task, Heidbreder (1946, 1947) found participants were able to learn the appropriate, target features of picture-name pairs (e.g., relk for face, mulp for tree), and they were able to abstract these features when asked to respond. But more interesting was the finding that certain picture-word pairs were easier to learn than others. Pictures with concrete characteristics (e.g., trees, faces) were easier to learn than pictures of abstract concepts (e.g., shapes, numbers). Heidbreder concluded that the preferences indicated the presence of a "hierarchy of dominance," focusing on concrete objects first, and then looking at abstract shape or number concepts.

This notion was modified by Underwood and Richardson (1956) with their finding that a certain stimulus will elicit a response based on a particular characteristic such as shape, color, size, feel, smell, and so on. This concept of dominance level was developed from the

frequency of a given association elicited by verbal stimuli. That is, the greater the frequency of a given response, the higher the dominance level. The dominance level notion indicates that concepts are linked by their relative associative strength. For example, round has a high dominance level for words like barrel, doughnut, and knob, but a low dominance level for words like snail, cherry, and skull. According to the dominance level concept, a feature is attended to unless it fails to predict the concept, in which case the second most dominant feature of the concept is attended to, and so forth.

Another explanation for cue selection is Trabasso's (1963) notion of cue salience. In a concept identification task, participants were presented with instructions regarding the relevance of particular attributes of flower design, such as color, leaf shape and angle to the stem, flower type, etc. The results indicated that in the subsequent test situation, the participants based their hypotheses on the learned rules for relevant cues for flower design identification. That is, from prior experience or training as to the relative importance of cues, some cues can be more salient than others. As such, predictions can be made regarding which cues will be selected.

Undergirding all of these possible explanations for selective attention and cue effectiveness is the principle of encoding specificity (Tulving & Thomson, 1973). "Specific encoding operations performed on what is perceived determine what is stored, and what is stored determines what retrieval cues are effective in providing access to what is stored" (p. 369). As cue effectiveness depends upon the stimulus conditions present at the time of attempted retrieval, cues appearing in different contexts may access different bodies of information. Thus, cues that prove to be effective in activating stored knowledge are associated with the content and the structure of that knowledge base.

Strategies for cue selection. As the environment becomes more complex and the number of competing cues increases, the strategy for cue selection must be considered. According to Bruner and his colleagues (1956), there are three major benefits for using a selection strategy. The first benefit is to obtain information relevant to the goals of the inquiry. This includes choosing the feature that can give the most information about what the concept

might be without having to examine redundant features. The second benefit is to reduce the amount of cognitive effort that is involved in integrating all that is happening in the context without having to reconsider discarded hypotheses. The third benefit is that by engaging in an ordered strategy, the task becomes less risky. The correct solution can then be attained with a minimal chance of error.

In their effort to identify concepts, people generally create and test hypotheses based on relevant past experience. Depending upon the number of relevant cues and subsequent rules for classification (e.g., single-value concepts, conjunctive concepts, disjunctive concepts), Bruner and his colleagues (1956) noted four discernable selection strategies were used by the participants in their studies: simultaneous scanning, successive scanning, conservative focusing, and focused gambling.

In the simultaneous scanning strategy, participants began with all possible hypotheses and eliminated the untenables ones after considering each instance. This strategy puts a heavy load on memory as the individual must consider, after each choice, which hypothetical concepts have been eliminated, and hold the results of these deductions in memory.

In the successive scanning strategy, a single hypothesis is tested at a time. If this instance predicts class membership, the scanner then limits successive choices to those instances that can directly test the hypothesis. A weakness of this strategy is that there is no guarantee that the instances with the maximum amount of information will be encountered.

In conservative focusing, the individual picks one positive instance and verifies it against choices that alter one attribute value at a time. This strategy guarantees that each instance is informative, and thus avoids redundancy and reduces the risk.

Focused gambling is the fourth strategy. In this strategy, the individual focuses on a positive instance, but then changes more than one attribute at a time. This strategy often produces faster results, however, it is subject to higher risk and redundancy due to the speed with which it is implemented.

An important aspect of cue selection strategy is the valence or marker of the available cue (Bruner *et al.*, 1956). That is, does the cue represent a positive or negative instance of the

concept? In a study of stimulus selection, Bourne (1974) examined the effects of the number and category of cue marker (positive or negative) on the memory strategies used for different types of problems. An overall finding was that the more markers available and used, the fewer trials were needed for solving the problems. Further, marker category did not matter in disjunctive problems, however the participants showed a definite preference for negative markers in conditional problems. Moreover, this preference for negative markers was learned over successive trials. With regards to specific strategies, the more successful participants used a shifting focus strategy, comparing their successive selections to those just previously examined.

Multiple cue judgments. Research on multiple cue judgments indicates that individuals integrate information into subjective scale values before inferences are made about criterion variables (N.H. Anderson, 1974). That is, when the situation becomes complex (as would be found in the naturally occurring diagnostic context), people impose decision rules on the context to integrate the information and decrease the cognitive load. These decision rules or judgments often reflect the individual's desired rules and policies somewhat imperfectly, due to systematic biases (e.g., conceptions of reading and how the reader learns to read) and random error (e.g., Hammond & Summers, 1972; Slovic & MacPhillamy, 1974). These systematic biases, or perceptions about cue salience, have been generated through the individual's prior experience or training in the context (Trabasso, 1963). Consequently, consistent implementation of individual policy appears to be related to the degree of cognitive skill for the context and the task.

In their investigation of people's ability to integrate information from several cues, Brehmer and Solvic (1980) examined the amount of distortion of subjective values of component cues during the integration process. Using a series of tasks that paralleled real-life situations (i.e., evaluation of job attractiveness, medical diagnosis), participants were asked to make decisions given a number of dimensionally different cues. For example, in the job attractiveness task, individuals had to make choices based on salary and commuting time.

The findings indicated that scale values did not differ when multiple cues were added into the decision making task.

In terms of perceptual chunks of multiple cues, Seibel (1963) was able to gradually entrain participants to make "on-off" decisions about an increasing span of perceived lights. Beginning with a "chunk" composed of a span of one "on" light, participants were taught to recognize the light position, the states of off and on, and the response ("on" meaning to press the button). In essence, similar to the studies of singular cue dominance (e.g., Trabasso, 1963), these participants learned that specific states (i.e., cues) carried different degrees of salience (Trabasso, 1963), valences (Bruner *et al.*, 1956), or values (N.H. Anderson, 1974). Gradually, eight lights, in different on-off states were added to the decision task. By the conclusion of the experiment, participants were able to chunk information about the stimuli and report their decisions rapidly.

Automaticity and skilled memory. Supporting all of these mechanisms and central to the concept of skilled memory is the concept of automatic processing (Chase & Ericsson, 1981). Skilled memory is "the rapid and efficient utilization of memory in some knowledge domain to perform a task at an expert level" (p. 141). Automaticity refers to the apparent lack of short-term memory capacity requirements for a particular task (Ellis & Hunt, 1983). Automatic processes are those that have been restructured and tuned or refined until they are performed without effort, minimizing the "space" required in the limited capacity of STM (Norman, 1982). The critical ingredient for the development of this expert level of skill is practice (Bloom, 1986; Newell & Rosenbloom, 1981; Shiffrin & Dumais, 1981; and Simon, 1977). Estimates varying from 5,000 hours (Norman, 1978) to 10,000 hours (Simon, 1980) have been offered as requisite for the development of expert automatization.

Due to the fact that experts have many of the processes related to their area of expertise developed to an automatic level, they are free to devote cognitive capacity to more complex or novel aspects of the situation that require conscious effort. During problem solving, experts have the capacity to entertain a number of hypotheses simultaneously while environmental cues are constantly being selected to support or disconfirm tentative solutions. However,

situations may arise when conscious effort must be paid to the task (e.g., scrambling of typical patterns or chunks, Egan & Schwartz, 1979), slowing the entire selective attention and pattern recognition process and increasing the chance of error (Larkin, McDermott, Simon & Simon, 1980).

In terms of problem solving, this skilled memory is especially critical at the initial or "understanding the problem" stage of the process (Polya, 1957). It is at this stage that the individual is ascertaining what is unknown, what are the data, and what are the given conditions. Due to the complexity of the environment, the individual must scan the context for critical cues and his or her LTM for stored, associated patterns of knowledge or strategies in order to construct a tentative solution (Newell & Simon, 1972). Decisions must be made as to what will receive attention and what will be ignored. Consequently, the problem solver attends selectively to specific information, factoring out less important or irrelevant stimuli (Simon, 1977). Equipped with extensive, highly organized knowledge structures (Norman, 1978) and prior experience with identifying relevant cues (Bower & Trabasso, 1964), experts are able to focus quickly on relevant cues and construct an accurate representation of the problem.

From research on skilled memory, a number of interesting parallels have been found across content areas. Chase and Simon (1973), for example, suggest that the chess masters have a large "vocabulary" of recognizable configurations of chess pieces. Pea and Kurland (1983) assert that expert programmers have a "plan library" of basic programming "schemas," or recurrent functional chunks of programming code that are often used. Yinger (1980) describes teachers as having a number of "routines" for planning and instructional activities. From these findings, we can conclude that one distinct advantage experts have over novices is their highly organized cognitive structures related to their content area and the availability of this knowledge for complex cognitive tasks.

Factors affecting selective attention and pattern recognition

Two main factors affect accurate pattern recognition -- the context and the complexity of the concept rule. Contexts vary from minute to minute and from person to person depending upon past experience, priorities, and expectations (Erickson & Schultz, 1981). However, in contexts that retain many of the same stimuli, patterns that are most probable or pertinent in this context receive activation independently from sensory analysis, which increases the probability that they will be selected for full recognition (Norman, 1969). In the case of those cues that must be recognized through a conscious or deliberate analysis of the context, depending upon the context in which the judgment must be made, different cues carry different amounts of information, and thus have different "weights" or levels of importance (N.H. Anderson, 1974). Consequently, the pattern or specific knowledge activated in and recalled from long-term memory will vary depending upon the selected cue or cues.

Moreover, on a larger scale, the fact that a familiar context is present affects what knowledge is activated and how the context is understood. Bransford and Johnson (1973) reported significant differences in text comprehension when the context was presented before or after reading a passage. The participants recalled significantly more ideas when given a picture before they read a passage, as opposed to after the passage was read. Further, research indicates that a coherent, meaningful context, as opposed to one that is disorganized, facilitates recognition (Biederman, Glass & Stacy, 1973). And, according to Biederman (1977), probable objects (i.e., those consistent with the context) are recognized better than improbable ones in a coherent scene.

The complexity of the concept rule also affects what patterns will be recalled (N.H. Anderson, 1974). To identify a pattern correctly, the individual must know the rules relating the cues to the various possibilities and be able to apply those rules (Brehmer & Slovic, 1980). The complexity of the rules is determined not only by the number of specific rule decisions that must be made (Berch & Israel, 1971), but also by the nature and availability of the feedback (Levison & Restle, 1973) and the familiarity with the rule (Neisser, 1967). Further, through

prolonged practice with recognizing specific concepts, individuals develop pre-attentive recognition systems which do not require conscious effort (Neisser, 1967) and are applied automatically (Norman, 1969). While these pre-attentive systems may make errors, their major function is to narrow the field, eliminating all globally irrelevant cues for more selective processes. Thus, individuals who are highly familiar with the concepts and the rules that define those concepts, will be able to quickly identify relevant cues even when contexts change.

Diagnosis

Diagnosis epitomizes the problem identification stage of the complex task of problem solving (Elstein *et al.*, 1978b). It is at the beginning of the problem-solving process that diagnosticians must incorporate what they know and believe about their field with the critical cues or features observed and selected during their interaction with the task environment. In diagnosis, the task environment is comprised of the client, the client's history, and all the diagnostic "tools" (materials, etc.) that may be available in the setting. According to Elstein, Shulman and Sprafka (1978a), diagnosis is composed of the following sub-processes:

1. Cue acquisition: gathering and collecting data.
2. Hypothesis generation: generating alternative formulations of the problem.
3. Cue interpretation: interpreting the collected evidence in light of the hypotheses.
4. Hypothesis evaluation: eliminating unlikely hypotheses based on the probability that others are likely to be correct.
5. Diagnosis judgment: identifying the problem.

Medical diagnosis

While the study of medical diagnosis flourished at a number of institutions during the 1970's, one particular research effort emerged as a major contributor to the understanding of clinical reasoning. Supported by the Office of Medical Education Research and Development at Michigan State University, Elstein, Shulman, Sprafka and many other colleagues conducted a major research program with the aim of understanding the problem solving and reasoning skills of physicians. To briefly reiterate what was mentioned in the beginning of this review, this research was grounded in the information processing model of human problem solving, which depicts clinical diagnosis as problem-initiated and problem-directed. The methodology involved the use of live, simulated patients and verbal reporting techniques to gain access to the internal cognitive processes occurring while the physician is formulating a diagnosis. The general results described the cue selection and utilization strategies, hypothesis formulation strategies, and those factors that influence accurate diagnoses. While other researchers have offered equally important contributions to the field (e.g., Kleinmuntz, 1968), the findings from this body of research are used in this review to present a coherent picture of medical diagnosis.

According to Elstein, Shulman and Sprafka (1978a), diagnostic problems are solved through a process of hypothesis generation and verification. Hypotheses are generated very early in the clinical encounter, usually within the first five minutes. No more than four to five hypotheses are considered at any one time (maximum number observed was seven), with the number narrowing to about two at the point of problem identification. Cues were found to be positive, noncontributory, or negative with respect to a particular hypothesis. Inconsistent cues were ignored. Diagnostic accuracy was related to both thoroughness of cue acquisition and accuracy of cue interpretation, although these two variables were statistically independent. The majority of hypothesis judgments were based on either of two rules: "(1) select the hypothesis with the maximum number of positive cues, or (2) select the hypothesis with the maximum difference of positive cues minus negative cues" (p. 115).

Cues were detected, interpreted and used in a variety of ways across diagnostic sessions. Physicians tended to focus on verbal cues, yet non-verbal cues (e.g., personality, background) helped to form a general impression that aided in judging the accuracy and objectivity of the cues reported verbally by the patient. Physicians reported that they did not often give weight to the patient's presenting complaint, as this typically masks a "hidden agenda" which must be uncovered through careful questioning. Depending on the cue and the context, physicians either selectively focused on the cue, attempted to progressively interrelate the cue with others, or store the cue to interrelate at a later time.

In their research, Elstein, Shulman and Sprafka (1978a) reported clear evidence of a selective attentional process at work as the diagnosticians searched the task environment for cues. The most frequently occurring method used by the physicians to identify a problem was a rapid associative cue-to-problem category retrieval. Moreover, the problem identification was based more consistently on single salient cues than on combinations of cues. They concluded that physicians' long-term memory storage consists of potential problem-formulation categories that are "indexed in terms of a very small number of pathognomonic cues for each category, rather than in terms of a complex system of multiple-entry, cross-referenced cues" (p. 195) (cf. Chase & Simon, 1973; Pea & Kurland, 1983; Yinger, 1980).

Kleinmuntz (1968) proposed that the medical diagnostic process is characterized by a hierarchical search, with hypothesis-testing or problem formulation proceeding from the general to the specific. That is, initially diagnosticians begin with general categories of problems and move to increasingly specific diagnostic formulations. This proposal is similar to Bruner and colleagues (1956) successive scanning strategy, except that it is somewhat confined to a general category of diseases. Elstein, Shulman and Sprafka (1978a) reported that a problem hierarchy was indeed generated, but that the elaboration of this hierarchy may proceed three ways: (1) from general to specific, (2) from specific to general, or (3) generation of general and specific formulations simultaneously. This choice of problem-formulation strategy was based on task variables, rather than individual physician's preferences. That is, the strategy

chosen appeared to depend largely on the content of the problem and the physician's understanding of it.

Four major principles helped physicians to rank-order tentative hypotheses: probability, seriousness, treatability, and novelty. Probability estimates were the statistical likelihood that a particular disease is the cause of the problem. Life-threatening or incapacitating conditions were considered before less serious diseases. Treatable diseases were ranked higher so as not to overlook a treatment that might be helpful. Finally, in order to insure that unlikely avenues are explored and to keep the physician interested, novel or improbable hypotheses were sometimes considered. The novelty or remoteness of the proposed hypothesis prevented the physician from accepting a more generally probable hypothesis which may be in error. Elstein, Kagan, Shulman, Jason & Loupe (1972) found these major principles to be differentially weighted by each physician according to the nature of his practice and his own personal characteristics. Thus, similar to the literature on multiple-cue judgments (N.H. Anderson, 1974), physicians impose decision rules on the context to integrate and evaluate the information, thus reducing the cognitive load.

After the physician has generated and rank-ordered a small array of hypotheses, each is systematically tested to support or reject a set of formulated hypotheses. Elstein and colleagues (1972) emphasized that during the clinical work-up the physician is not gathering data in order to limit the possibilities prior to risking a problem identification. Rather, the physician was using his work-up activities to test specific hypotheses formed very early in his encounter with the patient. "Quick rule-outs" were used to eliminate highly improbable hypotheses during the initial interview. Later diagnostic hypotheses were generally elaborations or refinements of earlier ones. While this finding is not parallel with results of concept identification tasks (e.g., Bruner *et al.*, 1956), the research that has examined how experts in such content areas as chess (e.g., DeGroot, 1966) and physics (e.g., Larkin, *et al.*, 1980) have found patterns similar to those used by the experienced physicians. Such differences may be attributed to the levels of expertise in the content areas and the experimental tasks. That is, in the concept identification tasks, randomly selected participants made decisions about simple

shapes, colors, and sizes. In the content area studies (i.e., chess, physics, physicians), the participants were composed of a purposive sample of experts engaged in complex cognitive tasks in their particular domains.

Elstein and colleagues (1978a) attributed these findings to the limited capacity of short-term memory. That is, each hypothesis along with its relevant cues served as a chunk of data. Elstein and colleagues found the number of hypotheses entertained at any one time to be four plus or minus one, similar to Simon's estimate (1980), yet at variance with Miller's seven plus or minus two (Miller, 1956). This discrepancy was accounted for by the number of unstructured inputs the physicians received prior to and during the work-up.

Other explanations may be equally plausible. For instance, according to Chase and Ericsson (1981), experts rapidly store and reaccess intermediate chunks of knowledge, sometimes in access time that is less than a second. Consequently, this speed of knowledge use may result in error in experimental calculation of the number of chunks in memory at any one time. Still another explanation relates to the difference between a simple recall task versus a sophisticated problem solving task. In Miller's (1956) experiment, memory span was calculated via a digit recall task. In the medical diagnosis study (Elstein *et al.*, 1972, 1978a), physicians' memory spans were measured while they were diagnosing a patient's disease. The physicians were attending to cues, considering hypotheses, and temporarily storing schemas related to the task at hand -- all amounting to a great deal more cognitive activity than required in simple recall.

The most frequently occurring mode of mental representation of the problem was verbal. Verbal lists of problem formulations were generated 84 percent of the time, appearing as a stable characteristic of nearly every physician's behavior on every task. Mental images appeared less frequently. The three types of mental images in frequency order from most to least were general, anatomical, and a previous patient.

In summary, Elstein and colleagues (1978a) state that the physician's problem identification activity was primarily an associative retrieval of problem formulation labels on the basis of cues. The ability to accurately diagnose a malady was case related. That is, certain

individuals were more effective than others with particular types of problems, in particular situations. The two foundational components to expertise in diagnosis were the possession of relevant bodies of knowledge and sufficiently broad experiences with problems related to the knowledge base.

Reading diagnosis

Elstein and colleagues (1978b) along with a number of other colleagues at the Institute for Research on Teaching (see, for example, Gil, Hoffmeyer, VanRoekel, Vinsonhaler & Weinshank, 1979; Lee & Weinshank, 1978; Vinsonhaler *et al.*, 1983; Weinshank, 1978a, 1980) attempted to apply this medical model of problem solving to reading diagnosis. Given that both medical and reading diagnosis are problem-initiated and problem-directed activities, the case was made that the cognitive processes of expert physicians would also be observed in reading diagnosticians. The product of this agenda was a series of studies directed toward the understanding of the diagnostic problem-solving behavior of reading specialists (Weinshank, 1978a, 1980b; Vinsonhaler, 1979), learning disabilities specialists (VanRoekel, 1979), and classroom teachers (Gil, 1979). (This series of studies is summarized in Vinsonhaler *et al.*, 1983.) The focus was on reading diagnosis, specifically: (1) what information these specialists collected, (2) the diagnostic categories they used, (3) the recommended remedial programs, (4) the relationship between their diagnoses and remediations, and (5) the reliability of the diagnoses.

As mentioned earlier, the agenda for this research was somewhat different than the one set forth by Elstein and colleagues (1978a), with the reading studies focusing on the development of a computer diagnostic simulation program. As such, the findings do not describe the reading diagnosticians' cognitive processes in detail. Instead the results from these studies emphasized a methodology characterized by a more controlled setting, the discrete products

of diagnosis, relationships between products, and the consistency within and across diagnosticians. Consequently, this review will not parallel the structure of the previous section. In effect, it will point out how much we still need to learn about diagnosis in reading.

As with the experimental treatment used in the medical diagnosis studies, the reading diagnosticians were asked to diagnose and suggest remediation for simulated cases of reading difficulty. However, while the simulated cases in the medical studies were well-trained actors, the reading simulated cases were collections of information, organized in a box per case, which included test scores, completed test booklets, audio tapes, and written, non-judgmental comments by other experts (Lee & Weinshank, 1978). Each participant diagnosed three cases, two of which were identical in order to test for reliability.

Data were collected in two phases. First, the diagnosticians were given the referral information and instructed to ask the experimenter for specific cues from the inventory in an effort to collect as much information as desired in order to write a diagnosis and initial remedial plan. The diagnostician was asked to verbalize his/her thinking, as long as it did not interfere with performance. An observer recorded the information that was requested and any comments made by the participant. After the information was collected, a stimulated recall of the diagnostic activity was conducted using the information recorded by the observer. Questions focused on: Why were particular cues requested? How were specific cues interpreted? What hypotheses were generated by specific cues? Which cues supported or disconfirmed existing hypotheses? For the final task, the diagnosticians wrote their diagnosis and tentative prescription for each case.

In the pilot study (Lee & Weinshank, 1978), eight experienced diagnosticians interacted with two simulated cases representing different, but commonly encountered types of reading difficulty in children, grades three to seven. The data analysis examined how the diagnosticians gathered and interpreted the available information. Analysis of the verbal protocols revealed findings similar to those reported in the medical diagnosis research, specifically:

1. Most diagnosticians base their diagnoses on a relatively small number of key cues;

2. They entertain their first hypotheses very early in the session; and,
3. Despite the variability in the number of cues requested and the amount of total elapsed time, the diagnosticians ultimately correctly identified the client's major difficulties.

Subsequent studies in this effort changed the original questions (beginning with Weinshank, 1978a) and focused on two discrete aspects of diagnostic process: the frequency of each diagnostic statement made across all sessions for a given case, and the individual agreement for each case (interdiagnostician and intradiagnostician). The results indicated that there was very little commonality between the diagnosticians in their statements about similar cases. In a summary of the entire research effort, Vinsonhaler and his colleagues (1983) report that, in fact, most statements in the written diagnosis and remediation for a given case were mentioned only once. In relation to the reliability, across the series of six studies the interdiagnostic agreement was about 0.10 and the intradiagnostician agreement was 0.20. Further, the remediations appeared to be uncorrelated with the diagnoses.

In attempting to explain the disparate findings between the pilot study (Lee & Weinshank, 1978) and the first observational study (Weinshank, 1978a), the researchers considered a variety of possible confounding factors (Weinshank, 1980a). The first factor that was considered was that the original sample was unrepresentative. To test the hypothesis that another group of similarly trained specialists would perform more reliably, a second observational study, examining the diagnoses of learning disabilities specialists, was conducted (VanRoekel, 1979). The findings revealed that the group agreement (interspecialist reliability) results paralleled those of the reading diagnosticians.

A second explanation was that the difference was due to a lack of standardized vocabulary among the clinicians. To test this, Hoffmeyer (1980) had the reading diagnosticians transfer their own natural language statements to the standardized checklist used in the larger study. Again there was little reliability given the same cases.

A third explanation focused on the methodology -- the experimental setting and the data analysis. To test the validity of the "boxed" paper and pencil simulated case format with ac-

cess to a singular cue at any one time, Stratoudakis (1980) presented the information in a three-ring notebook and allowed the diagnosticians to work independently. The results were the same as with the previous investigation using the boxed simulated cases and presence of the experimenter.

A fourth explanation focused on the unit of analysis, all diagnostic statements. By focusing on each diagnostic statement, the researchers may have "inadvertently 'swamped' substantial agreement" (Weinshank, 1980a, p. 11). A structured checklist was constructed for the subsequent study (Weinshank, 1980b), with no apparent difference in the number of different statements reported.

An additional explanation for the lack of inter- and intradiagnostician reliability was hypothesized to be the lack of proper training of the diagnosticians (Vinsonhaler, 1979). This notion was supported by the results of a series of training studies (e.g., Gil, Polin, Vinsonhaler, & VanRoekel, 1980). That is, after specific training in development of heuristics for cue selection and interpretation, inter- and intradiagnostician reliability significantly increased.

A similar correlation between training and subsequent diagnostic performance was also reported by Mitchell (1978). Specifically, in a study in which twelve diagnosticians were allowed to work with the actual clients (children, ages 8-9), Mitchell (1978) found that the error coding and interpretation of children's errors was significantly related to the diagnosticians' prior training. However, while these studies demonstrate that specific cue selection strategies and interpretations can be learned (cf., Trabasso, 1963), they offer no explanation for the data that were collected from the 66 participants in the observational studie (Gil, 1979; VanRoekel, 1979; Weinshank, 1980a, 1980b). In these studies, the participants were purposively chosen from diverse backgrounds. Thus, while Vinsonhaler may have explained disparate diagnoses as a result of improper training, the differences may be due to different training or differences in experiences since the initial training (cf., N.H. Anderson, 1974; Elstein, Shulman & Sprafka, 1978a; Heidbreder, 1946, 1947; Trabasso, 1963).

A close examination of the Vinsonhaler reading diagnosis research reveals some key factors that may explain the disparate results (i.e., reliability of final diagnoses) emanating

from a body of research that was grounded in the same clinical problem-solving model of inquiry (i.e., Elstein *et al.*, 1972, 1978a). First, after the pilot study by Lee and Weinshank (1978) was completed, the research questions and methods changed. Subsequent studies were no longer examining patterns of diagnostic processes, these studies focused more on discrete units of behavior and written products (i.e., written diagnoses and tentative prescriptions).

A second and critical factor relates to the nature of the subject (client or patient) with which the diagnosticians interacted. In the medical studies (Elstein *et al.*, 1972, 1978a), the patients were live simulated cases -- well-trained actors who could display symptoms and talk with the physicians. Each actor was provided with a comprehensive case history and was trained to recount relevant medical history and simulate the physical symptoms of the disease. Elstein and his colleagues (1972, 1978a) report that most of the physicians said that "the simulations were convincing and provided a satisfactory approximation of a real case" (p.87). Similarly, reliability in cue selection and subsequent diagnoses were reported in the Mitchell reading study (1978), in which the diagnosticians were able to interact with live clients in their own classroom settings.

In the Vinsonhaler reading studies (e.g., Vinsonhaler *et al.*, 1983) (excluding the study by Stradoukis who used a 3-ring notebook, 1980), the clients were compilations of information, organized in a file box, which included written reports of family history, test scores, classroom behavior reports, and audiotapes of the clients' oral reading. Given that the context plays a critical role in any task (Erickson & Schultz, 1977; Norman, 1969), these client differences may be a key explanation for the diagnostic reliability differences.

A third related factor focuses on the availability of informational cues to the diagnostician. In the medical studies (Elstein *et al.*, 1972, 1978a), the physicians were free to elicit whatever data thought to be necessary and in whatever order of selection. For instance, the physicians were allowed to ask the simulated patients any questions, order any laboratory tests, and request any reports from those forms used by the university health service. In essence, the physicians were instructed to work in their customary manner and to do whatever was judged to be appropriate with the given case.

In both the Mitchell (1978) and the Vinsonhaler (e.g., Vinsonhaler *et al.*, 1983) reading studies, the cues available to the diagnosticians were restricted. In the Mitchell study, the diagnosticians had to analyze children's miscues from specific oral reading passages. No other cue sources were available. In the Vinsonhaler studies, the diagnosticians could request one piece of information at a time chosen from the list of available information. The informational cues were presented to the diagnosticians upon request. That is, the diagnosticians were not able to elicit information of their own choice, consequently restricting the availability of typical cues or patterns of cues.

In a study on teachers' assignments to reading groups, Niles and Borko (1983) found that grouping decisions were influenced when the access to typically available cues was restricted. Specifically, when asked to make grouping decisions about their own (real) versus hypothetical students, teachers relied more on informal reading information for their own (real) students than for hypothetical students. Niles and Borko attributed these differences to the richness of information (i.e., familiar patterns of interaction) that the teachers typically had available to them in their daily interaction with their students. Consequently, again, a difference in the typical context may have limited the validity of the findings in the Vinsonhaler reading studies.

A fourth factor deals with the operational definition of cue as a unit of analysis. In the medical diagnosis studies, a cue was a discrete piece of information (verbal or non-verbal) that a physician recognized in the diagnostic session (e.g., body temperature, specific symptoms verbalized by the patient). In Mitchell's (1978) study, the cue was the specific miscue or discrete reading error made by the child. In the Vinsonhaler studies, the cue was defined as "an entire category, including scores, comments, booklets, and recordings" (Lee & Weinshank, 1978, p. 18). Examples of individual cues include Dolch words, classroom information, and the Peabody Achievement test.

In summary, the major research on the cognitive processes involved in reading diagnosis revealed more information about the products of diagnosis rather than the processes. Cue selection, diagnosis, and prescription development were not interrelated nor consistent within

and across diagnosticians. In these studies, training and experience, as well as issues related to the presentation of the simulated cases, did not appear to be factors influencing these results. However, other factors related to the research questions, fidelity of the simulated cases, and the data analysis procedures may have inadvertently masked information about the richness of the reading diagnostic process that was apparent in the medical diagnosis research.

Recommendations

In light of the disparate results across the previous studies of diagnosis and the fact that the theoretical basis for the clinical problem-solving model has support for applicability in reading diagnosis (Elstein *et al.*, 1978b), further study of the thought processes of reading diagnosticians seems warranted, if not compelling. The basic cognitive processes which undergird the problem identification processes in reading need to be examined as they occur in controlled, but naturalistic, environments. Consequently, future research should focus on the on-going diagnostic process as well as the effects that the experimental tasks have on the processes and products. Recommendations for future research include the examination of:

1. Specific cues and how they are interpreted and used to develop and/or test hypotheses;
2. Strategies for hypothesis development and testing;
3. Internal or "participant" factors influencing the consistency or inconsistency of cue selection and hypothesis generation;
4. Alternative experimental contexts, and how the manipulation of task environment influences the interaction between the diagnostician and the client; and,
5. The influence of training, knowledge, and experience on the process and the products.

THE CUE SELECTION AND HYPOTHESIS GENERATION OF EXPERT READING DIAGNOSTICIANS

Perspective

In the area of cognitive science, what experts know about their work environment and how they use expert knowledge to identify problems have received increasing attention in recent years (Berliner, 1986; Bloom, 1986; Leinhardt & Greeno, 1986; Schön, 1983). Since DeGroot's (1966) initial study of chess masters, the cognitive orientation toward the study of expertise has maintained that qualitative as well as quantitative differences exist between the performance of experts and novices. Indeed experts tend to know (quantitatively) more information than relative novices, but they also perceive their contexts differently (Newell & Rosenbloom, 1981), organize information differently (e.g., Chase & Simon, 1973), plan for action differently (Schön, 1983), use different strategies (Larkin, McDermott, Simon & Simon, 1980), and evaluate their actions differently (Schön, 1983). In essence then, differences exist between experts and novices in terms of their declarative knowledge and procedural knowledge, as well as for the interaction among these knowledge structures. These differences have become the focus of investigations of human problem solving processes in a variety of domains including computer programming (e.g., Adelson, 1981), chess (e.g., Chase & Simon, 1973), physics (e.g., Chi, Feltovich & Glaser, 1981), and education (e.g., Housner & Griffey, 1985).

Problem solving is described as a complex thinking process involving goal-directed activity across a sequence of stages (Polya, 1957). Polya (1957, 1968) outlines four general stages of the process: (a) understanding the problem, (b) devising a plan, (c) carrying out the plan, and (d) looking back. Of these four stages, the first -- understanding the problem -- is arguably the most critical for a successful solution (Newell & Simon, 1972). The solver must

gather information about the problem, find out what is known and unknown, and assess the conditions in, and under, which the solution must be generated. Consequently, success at this stage requires the solver to be knowledgeable of the content area and to identify the relevant cues that will lead to an accurate identification of the problem (Neves & Anderson, 1981).

Cue relevance, and subsequent cue effectiveness, is based on the principle of encoding specificity (Tulving & Thomson, 1973), and is directly related to how information is initially learned. "Specific encoding operations performed on what is perceived determine what is stored, and what is stored determines what retrieval cues are effective in providing access to what is stored" (p. 369). Since cue effectiveness depends upon the stimulus conditions present at the time of attempted retrieval (which are likely to vary somewhat from the original encoding context), cues appearing in different contexts may access different bodies of information. The strength of the association between the cues and stored knowledge, developed through hours of reinforced practice, becomes a key factor. That is, cues that prove to be most effective in activating stored knowledge are naturally and strongly associated with the content of that knowledge base.

As the task environment becomes more complex and the number of competing cues increases, strategies for cue selection must be considered (Bruner, Goodnow & Austin, 1956). Strategies are implemented to obtain information relevant to the goals of the inquiry, reduce the amount of cognitive effort, and/or reduce the risk of making an error. Strategies will vary on each of these dimensions and what is eventually implemented will be based on the context and individual differences.

Basic to all strategies is the valence or marker of the available cue (Bruner *et al.*, 1956). That is, does the cue represent a positive or negative instance of the concept? For example, in identifying a canary, singing and yellow would carry positive valences, while a bill and talons would be marked with negative valences. Associated with the dichotomous cue judgment (i.e., positive versus negative) is the much "grayer" judgments made about the relative importance or salience of a particular cue under a particular set of circumstances (Trabasso, 1963). Undergirding both the notion of cue valence and salience is the amount of prior expe-

rience and/or training the individual has had in the particular domain. Cues are attended to and concepts identified according the set of learned "rules" the individual has developed through practice.

These rules, however, are not restricted to single cues judged in a linear, one-at-a time sequence (Seibel, 1963). When situations become complex (as would be found in naturally occurring contexts), people impose decision rules on the context to integrate or "chunk" the noticed information into multiple cue judgments, thereby decreasing the cognitive load. Due to systematic biases and random error, these decision rules or judgments often reflect the individual's desired rules and policies somewhat imperfectly (e.g., Hammond & Summers, 1972; Slovic & MacPhillamy, 1974). Most systematic biases, or perceptions about cue importance, will have been generated through the individual's prior experience or training in the task in the context (Trabasso, 1963). Consequently, consistent implementation of individual policy appears to be related to the degree of cognitive skill for the context and the task.

Epitomizing problem identification, or the understanding of the problem, is the process of diagnosis. Pioneering work in this area has been conducted by Elstein and colleagues (e.g., Elstein, Kagan, Shulman, Jason & Loupe, 1972; Elstein, Shulman, Sprafka, 1978a; Shulman & Elstein, 1978) using medical diagnosticians -- physicians. Their findings indicate that experienced physicians appear to leap directly to a small array of provisional hypotheses very early in their meetings with patients. Further, these provisional hypotheses seem to be generated out of the physicians' background knowledge of medicine, including their range of specific experiences, associated with the problematic cues recognized in the early stages of interaction with the patients.

Recent attempts to extend such work into the area of reading diagnosis by Vinsonhaler and colleagues (e.g., Gil, Hoffmeyer, VanRoekel, Vinsonhaler & Weinshank, 1979; Lee & Weinshank, 1978; Vinsonhaler, Weinshank, Wagner & Polin, 1983) has indicated that, unlike medical diagnosticians, reading diagnosticians evidence little, if any, intra- or interdiagnostician consistency (*Phi* = 0.20, *Phi* = 0.10, respectively). Furthermore, their prescriptions appear to be unrelated to their diagnoses. A close examination of this research

reveals that in order to maintain a controlled, experimental environment, Vinsonhaler and his colleagues severely restricted the availability of "extraneous" cues. This goal focused the studies away from the more "natural" settings which had succeeded in medicine (Elstein and colleagues [1972, 1978a] used "well-trained" actors in actual examination room settings) toward more discrete events and measures typified by the representations of "clients" by boxes of data. Individual cues (e.g., a test score) could be accessed only one-at-a-time in a sequential manner. This method made it virtually impossible to discern interactions between multiple cue judgments, pattern recognition and knowledge structures. In addition, these studies ignored the powerful effect of context (i.e., the availability of effective cues) on domain-specific, skilled memory.

Related to the limitations of Vinsonhaler's data collection procedures is the resultant limitations of the data analysis. "The major data for analysis was the set of statements in the written diagnosis" (Vinsonhaler *et al.*, 1983, p. 143). An excerpt from one of the diagnoses is below:

> Mike, a 12 year old seventh grader with the capacity and family experiences and background to perform at or above grade level in language related subjects, scores substantially below level on standardized and objective based tests.... Mike attempts to make sense from the book. Mike's weaknesses are inappropriate phrasing-fluency. Ignores punctuation. Reversals of letters both from when he hears the sound and encoding and when he sees the symbols and decodes... (Vinsonhaler *et al.*, p. 148).

While these statements indeed outline the data that support the diagnosis, the level of generality precludes the examination of the actual pieces of information used by the diagnosticians to formulate these statements. Consequently, the generative, diagnostic process, which would include such activities as specific cue selection and hypothesis generation and testing, was not examined.

With these apparent limitations in mind, our investigation was designed to replicate the work of Vinsonhaler and his colleagues and to extend the study of reading diagnosis into more ecologically valid settings. Specifically, this study examined the cue selection and hypothesis generation strategies of expert reading diagnosticians throughout the entire diagnostic process. Settings ranged from "boxed" client files to work with live clients. The specific questions which guided this research were:

1. What are the number and nature of cues selected by each diagnostician across the experimental sessions?

2. What are the number and nature of hypotheses generated by the selected cues?

3. What are the strategies used to select cues and generate hypotheses?

4. Are the cue selection and hypothesis generation strategies consistent within and across diagnosticians?

5. Is the diagnostic process (including cue selection, hypothesis generation, diagnosis and prescription) consistent across diagnosticians?

6. Are there differences in cue selection, hypothesis generation strategies, diagnoses, and prescriptions in live interaction contrasted with videotaped and "boxed" client sessions within and across diagnosticians?

Method

Participants

Five diagnosticians were selected from a pool of 48 educators who were initially recommended by their public school supervisors and/or university professors. The criteria for the recommendations included at least 5 years of successful teaching experience, a master's degree, and demonstrated, consistent expertise in diagnosing children's reading difficulties. These three main criteria satisfied a quantitative (in terms of time) and qualitative (knowledge and performance) definition of expertise.

The nominees were contacted by mail, asked if they would be interested in participating in the study and, if so, to complete an enclosed, brief information form and survey to be returned with a statement of interest. These two instruments were used as screening devices to ensure a diverse sample. The brief information form asked questions regarding their training, work experiences, typical reading-assessment procedures, and involvement in professional activities. The conceptions of reading survey, designed by Leu and Kinzer (1987),

elicited the nominee's opinions about how one reads and how reading ability develops. (See Appendix A for the letters, forms and surveys used to select the participants.)

From the original pool of 48 (all women), three reading specialists, a learning disabilities specialist, and a classroom teacher were asked to participate as the expert diagnosticians in this study. Each person in the final purposive sample had a master's degree in either reading or learning disabilities and at least seven years of teaching experience (range = 7 to 36 years). See Appendix B for a description of their educational backgrounds, typical diagnostic procedures and assessments, and conceptions of reading.

The clients (ages 8-11, 3 girls and 3 boys) with whom the diagnosticians worked were enrolled in a university reading clinic program. Each client had a history of reading problems in their public school experience and were recommended to the clinic program by their parents. (Appendix C outlines a basic description of each client, along with his/her school-based diagnosis and general remediation program.) Permission was requested from their parents or guardians specifically for this study. In return for their cooperation, the parents were given a report of the diagnosticians' activities and test results after all data collection was completed. (See Appendix D for the letter, permission form, and a copy of one of the reports.)

Prior to data collection, permission was granted by the Human Subjects Review Board for the use of human subjects in this research project.

Settings, equipment and materials

Settings. All of the experimental sessions in which the diagnosticians worked with the live client were held in the university clinic, in rooms familiar to the clients. Videotaped or "boxed" sessions were held either in the clinic, the diagnostician's classroom, or in their home, to ensure comfort and convenience for the diagnosticians. All settings were quiet, and relatively disruption-free.

Equipment. All sessions were both video and audiotaped; consequently, cameras and recorders were a part of every session. The clients were familiarized with the camera before data collection began by videotaping their sessions with their university-clinic tutors. Two cassette recorders place on opposite sides of the room were in operation at any one time to ensure an accurate recording of all verbalizations. The diagnosticians were made aware of the taping procedures during the orientation session.

Materials. The videotapes used in the experimental sessions were made during the first round of interactions with the live clients. For five of the clients (who would be diagnosed via all of the three different formats), the taped interaction from the first experimental session was used for the videotaped session. For the sixth client, who represented our control condition, the videotaped interaction consisted of this client with a diagnostician employed by the reading clinic. In all cases, these interactions represented the first time each client-diagnostician pair worked in a diagnostic session together.

Case information on each client was organized in a file box, and categorized by major source of information (e.g., general information, school records, health/medical information). These general categories were based on the case inventory categories used by Vinsonhaler and colleagues (1983). (A master list of the contents of clients' case information appears in Figure 2.) Each source within a category was printed on individual cue sheets, with specific pieces of information covered with removable, labeled and coded tags. As the diagnostician perused each cue sheet, she could see the name of the specific cue (e.g., Woodcock Reading -- Passage Comprehension subtest score), then would have to remove the coded tag to see the value for the cue (i.e., the specific grade equivalent score). This facilitated the accurate recording of selection of specific cues. (See Figure 3 for an illustration of the case assembly.)

FIGURES 2 AND 3 WILL APPEAR ABOUT HERE.

In order to remain faithful to their typical assessment procedures, the diagnosticians were allowed to use their own testing materials or any materials available at the clinic when

I. General Information

- I-A. Referral to the Reading Clinic (comments from the school)
- I-B. Referral for school-related special services
- I-C. General/family background

II. Health/medical Information

- II-A. History of childhood diseases
- II-B. Immunization history
- II-C. Height/weight records
- II-D. Vision
- II-E. Hearing
- II-F. Teeth
- II-G. Throat
- II-H. Speech

III. School Information

- III-A. Attendance
- III-B. Academic progress (report cards)

IV. Tests/assessments administered by the school

- IV-A. Kindergarten screening
- IV-A*. Kindergarten skills checklist (for one client only)
- IV-B. Metropolitan Readiness Test
- IV-C. Curriculum Referenced Tests of Mastery
- IV-D. SRA Skills Assessment
- IV-E. Open Court Headway/Virginia Standards of Learning
- IV-F. Woodcock-Johnson Psychoeducational Battery of Tests
- IV-G. Weschler Intelligence Scale for Children - Revised
- IV-H. Bender Gestalt Motor Test
- IV-I. Slingerland Screening for Specific Learning Disabilities
- IV-J. Test of Written Language
- IV-K. The Visual Aural Digit Span Test
- IV-L. Kaufman Assessment Battery for Children
- IV-M. Adaptive Behavior Evaluation Scale
- IV-N. Peabody Picture Vocabulary Test

V. Tests/information reported by the Reading Clinic

- V-A. Tutor's report
- V-B. Informal reading inventory
- V-C. Peabody Picture Vocabulary Test
- V-D. Bryant Diagnostic Test of Phonics Skills
- V-E. Woodcock Reading Mastery Tests

VI. Tests/information reported by independent reading diagnostician

- VI-A. Peabody Picture Vocabulary Test
- VI-B. Spache Informal Reading Inventory
- VI-C. Bryant Test of Phonics Skills
- VI-D. Informal written language assessment

Figure 2. The case information inventory master list of cues available to the diagnosticians for each experimental session (i.e., availability dependent upon individual client's actual file).

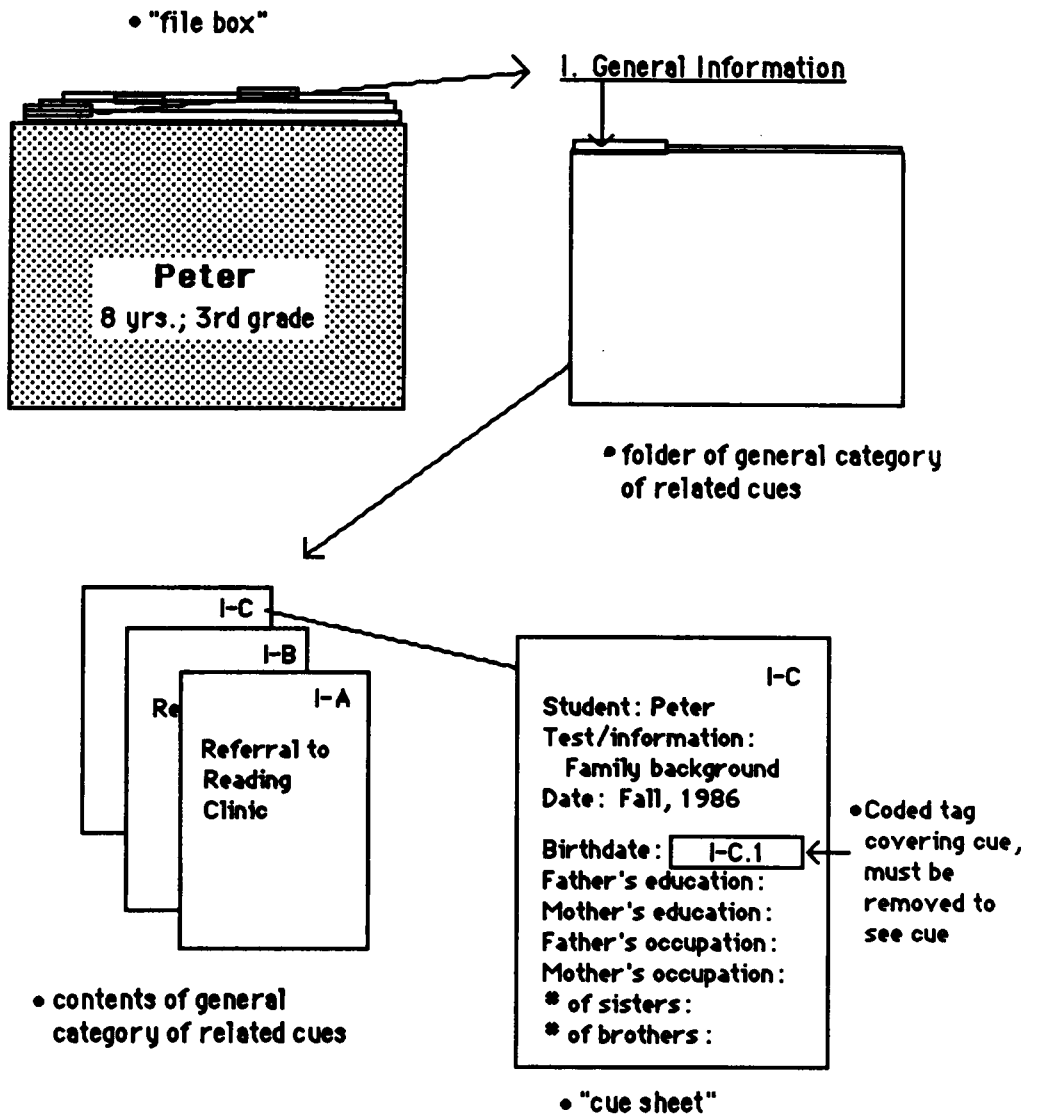

Figure 3. An illustration of a case assembly for one of the focal clients.

they were working with the live clients. These materials included such items as standardized reading tests, language assessments, informal assessments, trade books, paper, pencils, and drawing markers. Prior to each experimental session, the diagnosticians were free to peruse clinic materials to become familiar with what was available. During the interaction, additional materials could be selected and used at any time during their interaction with the client.

Procedures

Observer training. The principal investigator met with the two observers for three hours prior to data collection. The purpose of the meeting was to familiarize the two observers with the materials, equipment, and procedures. Time was spent practicing the collection and recording of cues, as well as the questioning procedures used to elicit the diagnosticians' ongoing thoughts.

The orientation session. A week before data collection began, the principal investigator met with the participants and observers in a two-hour orientation session. The purpose of this meeting was to introduce the participants to the observers and each other, and familiarize the diagnosticians with the basic experimental procedures and the reading clinic. After a brief introduction to the purpose of the study, approximately one-half hour was spent discussing and demonstrating the case inventory and the verbal reporting procedures. The diagnosticians were then given as much time as they needed to ask questions, peruse the clinic's facilities, and collect tentative diagnostic assessment materials that would be use in the upcoming weeks.

The verbal report. The basic procedure used to gain access to the diagnosticians' thought processes was the verbal report. In recent years, amid some controversy (e.g., Nisbett & Wilson, 1977), verbal reports have emerged as a rich source of information about the strategies and information individuals use to solve problems (Ericsson & Simon, 1980, 1984).

While a number of different methods of process tracing have been used (e.g., concurrent probing, stimulated recall, in-basket formats), the literature indicates that the concurrent probing or "think-aloud" procedures are the most accurate in revealing the information and processes being used in the task (Afflerbach & Johnston, 1984; Ericsson & Simon, 1984; Shulman & Elstein, 1975; Yinger, 1986). Using this procedure, researchers ask participants to think aloud as they are performing the task. The validity of this technique is based on the assumption that the attended to or heeded information that is in short-term memory is being verbalized either through direct articulation or by verbal encoding of information that is originally stored in a nonverbal code (Ericsson & Simon, 1980). Thus, with the think-aloud task, an indirect trace to the internal stages of the cognitive process is assumed to be obtained through the direct trace to the heeded information.

Another process-tracing method, stimulated recall, or retrospective reporting, asks the participant to reflect back on a problem solving process, often using videotapes or audiotapes to provide extensive retrieval cues (Ericsson & Simon, 1984). According to Ericsson and Simon, these verbal report data are not as complete as those extracted through the think-aloud procedure. Information must be brought back from long-term memory, and thus, may be decremented or distorted due to interference and/or inference. However, as Shavelson, Webb, and Burstein (1986) point out, stimulated recalls serve as an important alternative when studying interactive processes that cannot be interrupted for a researcher's probe question.

When using verbal reports, another critical issue to be considered is the nature of the thinking-aloud instructions (Ericsson & Simon, 1984). Three levels of verbalization can be generated depending upon the verbage of the instructions. The first level of verbalization is simply the utterance of a covert vocalization. Participants may be asked to say the correct choice, label the objects in a matrix, or name a visually portrayed object. A level-two verbalization involves a description of the thought content. Because this requires the participant to recode non-verbal content, verbalizing can be expected to occupy some time. However, such recoding is hypothesized not to change the *structure* of the process for performing the main task (Ericsson & Simon, 1980). A third level of verbalization requires the participants

to explain their thoughts, ideas, hypotheses or motives. This requires subjective interpretation in the form of some recoding of information in memory, as well as linking this information to earlier thoughts and cued information.

The level of verbalization and subsequent think-aloud protocol is influenced by the exact wording of the instructions. The main part of the instruction to think aloud is usually very short, for example, "Try to think aloud." An additional instruction like, "Think, tell me everything that passes through your head during your work searching for a solution, " cues a descriptive, or level two, verbalization. A level three instruction would require explanation, for instance, "In order to follow your thoughts we ask you to think aloud, explaining each step as thoroughly as you can." (Quotes are taken from Ericsson & Simon, 1984, p. 80-81).

Experimental session format. With these *caveats* about verbal reports in mind, five experimental sessions were designed and conducted with each of the five participants, yielding a total of 25 sessions (see Figure 4). Each session consisted of a preparation stage (i.e., examining the client's file), an interaction stage (i.e., working with that client in either live, videotaped, or "boxed"/audiotaped format), a written diagnosis stage, and a "wrap-up" stage that elicited a diagnostic summary statement, prescription, and reflection on each particular session. The tasks were varied by the mode of interaction with the client, the amount of time allocated to each stage (based on expert judgment), the nature of the verbalization (descriptive or explanatory), and whether a think-aloud or stimulated recall was employed.

FIGURE 4 WILL APPEAR ABOUT HERE.

The basic experimental session procedure. The participants in each session were the diagnostician, an observer and the "client." The observer was there to guide the diagnostician through the session, elicit the verbal report, and manage the taping process. The specific procedures and instructions used in each experimental session are located in Appendix E. The following is a brief description of the basic procedure used across sessions.

Session *	Nature of client and diagnostic interaction	Order of treatment stages *
I	Live client: each diagnostician works with a different client.	Preparation, interaction, written diagnosis, stimulated recall, wrap-up
II	"Boxed" client: replication of Vinsonhaler et al. studies; each diagnostician reviews the file and audiotapes of a different client.	Preparation, interaction with audiotaped reading, written diagnosis, stimulated recall, wrap-up
III	Live client: each diagnostician works with a different client (also different client than diagnosed in session I).	Preparation, interaction, stimulated recall, written diagnosis, wrap-up
IV	Videotaped client: using videotapes generated in session I, each diagnostician identifies the reading difficulty(ies) of clients who have worked with other diagnosticians in this study.	Preparation, interaction (both of these stages involve "think-aloud" verbal reports), written diagnosis, wrap-up
V	Videotaped client (control condition): all diagnosticians identify the reading difficulties of a child who is working with a diagnostician not in this study.	Preparation, interaction with videotaped client, written diagnosis, stimulated recall, wrap-up

* Descriptive think-alouds were used in all preparation and interaction stages, except where noted in experimental session IV.

Figure 4. Description of the five experimental sessions.

The observer would present the case to the diagnostician via the case inventory, hand each piece of information to the diagnostician upon request, and record the order of and time that the cue code tags were removed. (Cues could be re-examined at any time.) If the particular experimental session had a 30-minute time limit to the preparation stage, the observer would signal when 25 minutes had passed, allowing the last 5 minutes for the diagnostician to choose assessment materials. If no time limit was imposed, the diagnostician could peruse the files until she felt she was ready to interact with the client.

In the live sessions, the observer would begin the interaction stage with the diagnostician, then leave the diagnostician and client alone with the camera running. In the videotaped sessions, the observer would hand the diagnostician a log of what appeared on the videotape and copies of clean protocols on which the diagnostician could make any notes related to the activities she observed on the tape. In the "boxed" sessions, a log of what was available on the audiotapes and clean protocols were given to the diagnostician. In both the videotape and "boxed" sessions, the diagnostician could interact with any part of the tapes at any time (within time limits, if applicable). The counter footage numbers on the audio or videotape recorders (according to the experimental session) were documented on the log sheets with the specific assessment material. (See Figure 5 for a sample log sheet.)

FIGURE 5 WILL APPEAR ABOUT HERE.

For the written-diagnosis stage, the observer would first ask the diagnostician if she would like to see any additional cues from the case inventory. This was to allow her to have access to further information prompted by what they observed in the interaction stage. The diagnostician was prompted to remove the cue code tags and place them in order on the file folder marked for that particular experimental session. Then, equipped with paper, pencil, and all the cue sheets that she had requested, the diagnostician was given one hour in private to write up the diagnosis and prescription.

Videotape Log for Experimental Session #5 - Peter		
Counter #	Content	Page # in Protocol
000-623	Peabody Picture Vocabulary Test	1
624-837	Bryant Test of Phonics Skills	
624	a) vowel identification	front
702	b) consonant identification	"
777	c) short vowels (begun, but not finished)	"
838-640	Spache Informal Reading Inventory	
838	Word recognition, List 1-3	3-5
127	Level 2.4S: Mary and the Parade (oral reading and comprehension questions)	26
399	Level 2.8S: Mary and the Circus (oral reading and comprehension questions)	27
...		

Figure 5. Sample videotape log for experimental session #5.

The stimulated recall stage involved a "looking back" or reflection on the preparation stage and then the interaction stage, in order to explain her thinking regarding important cues and tentative hypotheses. The diagnostician had all of her notes, the cue sheets, assessment protocols and, if applicable, the written diagnosis in front of her as she thought aloud about the events on the videotape. This was to ensure that all possible retrieval cues would be available, hoping for the highest probability of an accurate reconstruction of the events. With an audiotape player recording the conversation, the observer prompted the diagnostician to explain what cues and hypotheses she was considering during the entire diagnostic procedure.

The wrap-up stage concluded the session with a summary of the diagnosis and the prescriptions. The diagnostician was asked to identify the key cues that helped her identify the problem. Questions were also asked about the fidelity of the particular session format to typical procedure. Specifically, the diagnostician was asked what was lacking (in terms of available information or time), what influenced her behavior in this session (e.g., training, the client, the task environment), and what, if any, changes in the cue selection or hypothesis generation process had occurred since the first session. This stage was also audiotaped.

The debriefing session. Two weeks after the last experimental session was completed, all participants met for a final debriefing session. The purpose of this session was to inform the diagnosticians about the school's and each other's diagnosis of each client. Also, cues selected by each diagnostician were compared to allow the participants to compare their own behaviors to each other's and discuss their diagnoses in the group. This session was audiotaped and transcribed, and the information was used as clarification and corroboration of statements made during the experimental sessions.

Client rotation and experimental session order. As shown in Figure 6, five of the clients were rotated through experimental sessions I-IV, allowing each client to be diagnosed via four diagnosticians and four different session procedures. All diagnosticians worked with the sixth client in experimental session V as a control condition. (This is Peter in Figure 6.) The ex-

perimental session order was counterbalanced within the constraints of the parents' schedules and inclement weather (see Figure 7). All sessions were completed within four weeks.

FIGURES 6 AND 7 WILL APPEAR ABOUT HERE.

Data sources and analyses

Data sources. The major data sources were the verbal reports extracted from the audio and videotape records from each diagnostic session, the diagnosticians' notes made during the preparation and interaction stages, and the written diagnoses. The data were analyzed on two levels: a descriptive analysis of what the diagnosticians did in terms of cue selection and hypothesis generation strategies, and an interpretive analysis of the process of how the diagnosticians identified the clients' problems (see Figure 8).

FIGURE 8 WILL APPEAR ABOUT HERE.

Data analyses. The first level of analysis involved a quantitative, descriptive analysis of the major variables and a qualitative assessment of the relational nature within each major variable (Spradley, 1980). Basically, the total number and nature of single cues, multiple cues, hypotheses, diagnoses, and prescriptions were examined and compared within and across diagnosticians and clients. A cue was defined as a discrete piece of information that was verbalized or written by the diagnostician. Examples include a WISC-R full scale IQ score, an oral reading miscue, or an observed non-verbal behavior such as the client rubbing his/her eyes. A multiple cue was any group of two or more single cues clustered or "chunked" together, either conjunctively or disjunctively, as one larger, connected piece of information. Examples include all the vision records, all reading grades for one year, and discrepancies in

	Order of client interaction				
Diagnostician	**1**	**2**	**3**	**4**	**5**
Amy	Brett	Tonita	Matt	Peter	Stepanie
Pat	Stephanie	Barbara	Peter	Matt	Tonita
Judy	Matt	Barbara	Peter	Brett	Tonita
Sarah	Tonita	Peter	Stephanie	Barbara	Brett
Bonnie	Barbara	Stephanie	Matt	Brett	Peter

Figure 6. Sequence with which the five diagnosticians interacted with the six clients.

	Order of experimental session				
Diagnostician	**1**	**2**	**3**	**4**	**5**
Amy	I	II	IV	V	III
Pat	I	II	V	III	IV
Judy	I	IV	V	II	III
Sarah	I	V	II	III	IV
Bonnie	I	IV	II	III	V

Figure 7. Sequence of experimental sessions across diagnosticians.

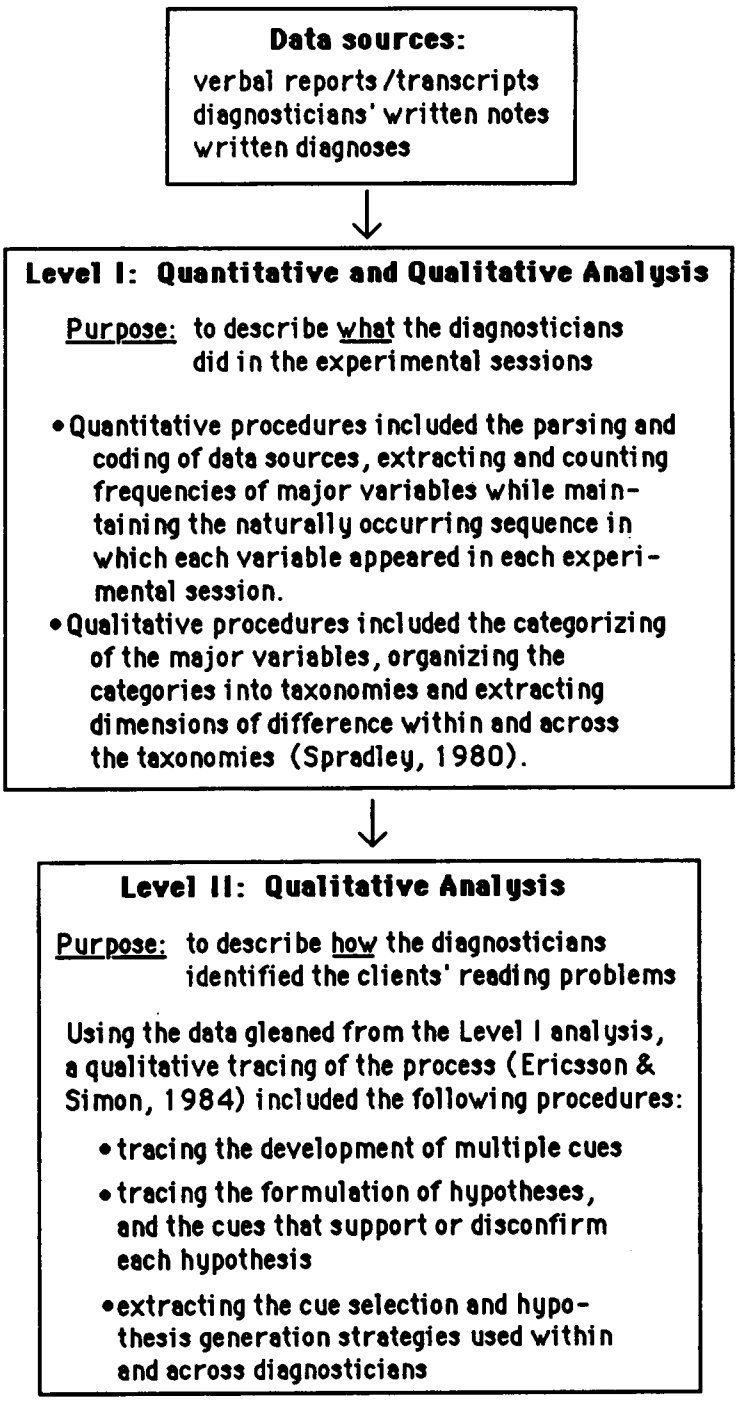

Figure 8. A descriptive schematic of the data analysis procedures.

the Woodcock Reading Mastery Test subtest scores. An hypothesis was defined as a conjecture about the client's reading ability, behavior, health, family situation, etc. based on selected cues. For example, given no observed problems with sound-symbol relationships, the client was hypothesized to have adequate word attack skills. Diagnoses were defined as the final conclusions about the clients' reading abilities that were stated either in the written diagnoses or during the wrap-up/summary stages. Prescriptions were suggestions for remediation.

Three additional variables viewed as critical to the cue selection and hypothesis generation processes emerged from the analysis of the protocols. From the analysis and subsequent conversations with the diagnosticians, two of the variables were found to be related to the ultimate decision of whether or not to identify the client's reading problem. These two variables were missing cues (i.e., information requested by the diagnostician, but not available) and inferred cues (inserted or inferred information for missing or unavailable cues, based on best available evidence and prior experience). The third variable emerged from the analysis of the protocols of a special, unplanned client situation: the diagnosis of the reading ability of a client whose twin had been diagnosed previously. This variable was examined because of the apparent application of the information learned about the twin who was first diagnosed to the twin who was subsequently diagnosed. While this process is considered to be inferential, it was isolated as a separate variable in order to examine which cues and hypotheses would be assumed identical for both twins, versus which information would be kept separate by the three diagnosticians who encountered this situation.

After the initial quantitative, descriptive analysis was completed, a qualitative analysis (Spradley, 1980) of the major variables was conducted. Each single cue and hypothesis was categorized and organized into a taxonomy to establish the relational nature of the data within each variable. Missing cues and inferences were not organized into taxonomies as these variables emanated from the diagnosticians, and many times were categorized as multiple cues. As multiple cues were chunks of information, any combination of single, missing, multiple cue, and/or inference may have merged to form a multiple cue. Due to this unpredictable

nature of the composition of the multiple cue, no taxonomy for this variable could be constructed. (However, a schematic for an observed development of a multiple cue is reported in the results section.) The results from this level of analysis were then used as the empirical base for the next level of analysis, an interpretive examination of the diagnostic process.

The second level of analysis involved the examination of the cue selection and hypothesis testing strategies, and the subsequent development of diagnoses and prescriptions (Ericsson & Simon, 1984). To these ends, a process-tracing analysis of the entire experimental session was conducted. This involved examining the points of the diagnostic procedures at which each major variable was cited, tracing the development of multiple cues and the formulation of hypotheses, and concluding with the final diagnosis and prescriptions. In addition, diagnoses and prescriptions were compared to the selected cues within the session, within clients across sessions, and across diagnosticians across sessions to assess intra- and interdiagnostician consistency. Intra-diagnostician consistency was defined as the degree to which the cues that were cited as most salient during an individual experimental session were the key evidence in the diagnostic statements and subsequently manifested in the prescription. Inter-diagnostician consistency was defined as the degree to which the same diagnoses and prescriptions were stated for the same client across the diagnosticians. To reiterate, the purpose of this extensive analysis involving tracing and comparison was to construct an ecologically valid picture of the diagnostic process in its entirety.

Results and Discussion

As indicated previously, the Level I analysis outlined what the diagnosticians did and the Level II analysis focuses on how they did it. To coincide with the data analyses procedures, the findings are presented and discussed on those two levels, respectively. First, the quantitative results from the discrete analysis of the five major variables (i.e., single cues, multiple

cues, missing cues, inferences, and hypotheses) are reported. Integrated into this discussion of the data are the findings from the qualitative analysis (Spradley, 1980) that examined the relationships among those data within each of these variables. The second level of findings addresses the process of reading diagnosis. Here, a more detailed analysis (Ericsson & Simon, 1984) of the cue utilization and selection, hypothesis generation strategies, and formulation of the final diagnoses and prescriptions is described.

Results from the Level I Analysis

The first level of analysis created a description of the number and nature of the major variables that composed the diagnostic process. Across all experimental sessions, three major sources of information provided the diagnosticians with these components:

1. the file information, including family background, health information, grades, standardized test results;
2. the observations of client behavior which took place during the interaction, including the nature and level of physical activity, oral reading, question/answer behavior; and,
3. the task environment, including the tests, the testing situation, the interaction between the client, diagnostician, tests, and testing situation.

The summary tables of data from which the following discussion is drawn is presented in Appendix F (Tables 1-3). In these tables, the total frequencies for single, multiple, and missing cues, inferences and hypotheses across experimental sessions (Table 1), diagnosticians (Table 2), and clients (Table 3) are reported. These raw data are presented along with other descriptive dat (time to first hypothesis, and whether a diagnosis was offered, in order to create a context for the time frame for initial problem formulations and ultimate identification of the problem.

Single cues. Across all conditions and diagnosticians, the mean number of different single cues considered by each diagnostician for each experimental session was 249. These cues were organized into six major categories: general/family background, health/medical information, school information, general intellectual ability, level of achievement, general interactions or events during the testing situation (see Appendix G). For all categories except the latter (related to the testing situation), cues were gleaned from information in the records and from the interaction through questioning and observation.

Table 4 compares the number of different single cues extracted from the file reports versus the interactions. In those cases where access to the client was most limited (session II, the audiotaped sessions), the diagnosticians extracted 68% of the single cues from the file reports. Across the two videotaped conditions (sessions IV and V), 59% of the single cues emanated from the files. In the live conditions (sessions I and III), the files yielded 53% of the single cues for the diagnosticians.

TABLE 4 WILL APPEAR ABOUT HERE.

The number of cues identified in the interaction stage is further divided into those cues that flowed directly from tests and specific, planned activities (e.g., oral reading miscues), compared the cues related to general behavior or conversation (e.g., yawning, playing with a bracelet). This use of informal, as well as formal, assessment cues emerged as an important dimension of the data and was often cited later in the written diagnoses and wrap-up stage.

Throughout the study, all five diagnostician concurred that the most important information was working with the client in the teaching situation. From the diagnosticians' perspective, the interaction served two purposes: (1) to test hypotheses or questions formulated from the file information, and (2) allow the diagnosticians to implement their own assessments that would render data particularly meaningful to the diagnostician.

Multiple cues. Across all conditions and diagnosticians, the mean number of multiple cues detected per session was 92. Due to their interactive nature across the various sources

Table 4. A comparison of total single cues extracted from the file reports and the diagnostician/client interactions across experimental sessions.

Session	Amy			Pat			Judy			Sarah			Bonnie		
	File	Interaction		File	Interaction		File	Interaction		File	Interaction		File	Interaction	
		Asses.	Beh.		Asses.	Beh.		Asses.	Beh.		Asses.	Beh.		Asses.	Beh.
1	212	168	43	153	77	25	161	218	42	239	185	83	74	145	44
2	409	422	0	582	90	1	72	7	0	217	87	4	185	83	5
3	328	147	63	380	82	83	178	84	43	239	111	73	114	121	30
4	416	183	30	352	107	23	144	74	25	90	66	20	170	68	70
5	237	267	12	335	127	5	132	79	59	131	205	91	180	157	8
TOTALS	1602	1187	148	1802	483	137	687	462	169	916	654	271	723	574	157

of information, multiple cues could not be organized into a taxonomy similar to the taxonomy reported for single cues. However, similar to the findings of Bruner and colleagues (1956), the basic dimension of difference in multiple cues emerged as the distinction between conjunctive and disjoint multiple cues. A conjunctive cue is one in which two or more single cues or multiple cues are joined positively. An example of conjunctive cue would be an SRA total reading score and a grade equivalent from an informal reading inventory. An example of a disjoint cue would be the client has an "A" for reading, yet his SRA score is two years below level. Table 5 reveals that the number of different conjunctive cues was far greater than the number disjoint cues cited by each diagnostician in each session. Further discussion about this finding is presented in the second part of the results section.

TABLE 5 WILL APPEAR ABOUT HERE.

As the diagnostic process was traced through the stages, the multiple cues built on each other and "grew" in size and complexity to form related chunks of information. For example, in diagnosing Brett, Amy built a picture of his general health (see Figure 9 for an illustration of this example). During the preparation stage, she began with grouping all information from the health file about vision, hearing, and speech separately. She then examined the kindergarten checklist that reported information about the client's visual and auditory discrimination, and oral expression. By the time of stimulated recall, Amy had grouped the health information on vision and hearing together, then hearing with speech, and compared it with the information found on the checklist. Finally, she grouped the fact that no deleterious childhood diseases were experienced with the total hearing and vision chunk (health plus checklist information) to negate any possibility of the client's health impacting on his ability to read. By the time Amy gave her final summary, she had drawn the conclusion that Brett had no problems with health related to reading. This process occurred in every experimental session with every diagnostician, and appears quite similar to the chunking of information

Table 5. The number of different conjunctive and disjoint multiple cues cited by each diagnostician in each experimental session.

Session	Amy		Pat		Judy		Sarah		Bonnie	
	Conj.	Disj.	Conj.	Disj.	Conj.	Disj.	Conj.	Disj.	Conj.	Disj.
1	53	36	53	9	91	21	94	15	70	14
2	70	5	50	35	53	15	105	14	81	14
3	63	9	85	11	98	7	114	13	83	6
4	78	7	97	12	68	10	58	1	75	18
5	61	13	95	20	87	13	89	13	71	15
TOTALS	325	70	380	87	397	66	460	56	380	67

demonstrated by experts in the studies cited in the introduction of this paper (e.g., Adelson, 1981; Chase & Simon, 1973; Leinhardt & Greeno, 1986).

FIGURE 9 WILL APPEAR ABOUT HERE.

Missing cues. Across all sessions, the mean number of missing cues requested by each diagnostician was 47. (See Appendix F for the summary report of the number of requested missing cues.) As missing cues were defined as pieces of unavailable information requested by the diagnostician, these "pieces" ranged in "size." A requested piece of information might be either a single cue (e.g., a test score) or a multiple cue (e.g., a writing sample). Consequently, a taxonomy for this variable could not be constructed. However, the nature of these cues paralleled the single cue categories as outlined in Appendix G. The major categorical emphasis on needed information was teacher input, classroom behavior, and results from preferred assessment procedures.

Three interrelated factors appeared to influence the number of missing cues requested across the sessions. The main factor was the nature of the interaction across experimental sessions. The diagnosticians wanted to interact with a live client in a normal school environment, and the cues that were requested, by and large, necessitated live interaction (e.g., conversation, completion of diagnostician's preferred assessments). A mean number of 37 missing cues were requested across the live sessions. Across the two videotaped sessions, a mean number of 54 missing cues were cited. In the "boxed" client session, a mean number of 52 missing cues were cited. Pat, a reading specialist with over 18 years of experience, complained that she felt "handstrung" [sic] without the ability to talk with the client's teachers and observe the client in the classroom setting.

A second and related factor was the consistency between different pieces of information found in the client's file. In those cases where specific, salient pieces of data did not correlate, the diagnostician was reticent to state hypotheses or conclusively reach a diagnosis. For example, Tonita did very well on the Metropolitan Readiness Test, ye did very poorly in

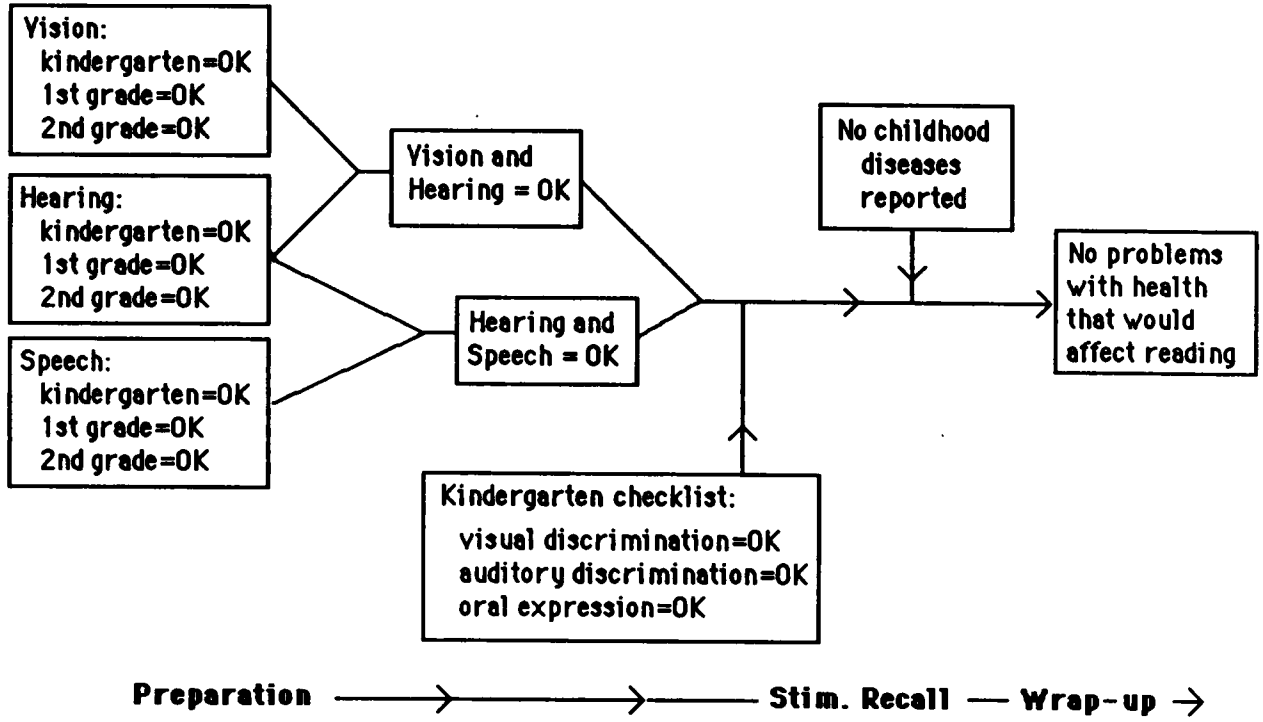

Figure 9. Illustration of the development of multiple cues using Amy's chunking of single cues related to Brett's health and its possible influence on reading ability.

reading in the second grade. The diagnosticians all stated that there was "more to this case" than was presented in the files. This dilemma became more critical in the sessions in which the diagnostician did not have access to the live client in order to support or disconfirm the file data.

The third factor was actual client. Depending upon the nature of the client (e.g., age, interactional style) and familiarity with the hypothesized problem, the diagnosticians raised questions that required additional information not available in the file. For example, from the file reports and observed behavior (live, audio-, and videotaped), Stephanie was unanimously diagnosed as a child with low average ability, who perhaps had experienced some cultural deprivation. The prescription for her was that she needed work on all comprehension skills and language development. In diagnosing this case, Bonnie, who had been teaching for 36 years in a number of settings that she described as culturally deprived, requested the 95 missing cues (see Appendix F, Table 1). The nature of her requested information related to the home environment, school context, past school experiences, and outside interests and hobbies – all cues that she had learned to be critical in diagnosis and prescription in a case such as this.

In contrast, Sarah requested 46 different pieces of information (see Table 3). In this case, however, Sarah was unfamiliar with and wanted information about many of the standardized test results in Stephanie's file. She noticed that much of the data in Stephanie's file were related to standardized tests, an unfamiliar area for her. Sarah felt that since so many tests were given, there must have been some reason and she needed to know how to interpret the results. Although she was somewhat familiar with clients of lower ability and cultural background, and requested many of the same cues Bonnie sought, she was unsure about creating a remedial program for a client with Stephanie's test history.

Inferences. Inferences were defined as specific pieces of information based on the diagnostician's prior knowledge, and instantiated and applied to a client's diagnosis. For example, in one session, Pat was perusing Tonita's report cards. When she looked at the information about reading, she noticed the grade level and book level. Pat inferred that the

teacher does not group her students for reading, based on the combined facts that Pat had already examined cues about Tonita's below grade-level reading scores with the notation that Tonita's grades were based on the grade and book levels appropriate for a student who was an average reader. Across all sessions, a mean number of 22 inferences were posited by the diagnosticians. (See Appendix F for the summary tables across session, diagnostician and client.)

The number of inferences appeared to be related primarily to experience with the diagnosed case. The most inferences appeared in Peter's case (the control condition, session V). The mean number of inferences was 28, with a range of 22 to 33. All diagnosticians reached the same general diagnosis (that Peter is learning disabled), with a relatively small number of tentative hypotheses cited during the session. All of the diagnosticians had experience with learning disabled students, and were well aware of the classic characteristics and typical remediation program for this problem. Across all diagnosticians, Peter was described as an average to above-average student intellectually, who needed constant challenge and motivation, and as a reader with poor word attack skills and comprehension strategies which relied on using context cues.

In contrast, Brett represented a less clear-cut case. A mean number of 14 inferences, with a range of 2 to 23, was cited in the case of this second grader. All diagnosticians concluded that Brett had a mild, if any, reading problem, and that perhaps his parents were overly concerned about his slow start in reading. Of the four diagnosticians who worked with Brett over the four sessions, there was a wide range in number of cited inferences. Amy made only 2 inferences, citing her lack of experience with children as young as Brett, and the fact that she teaches in a school without much parent involvement. Bonnie made 23 inferences, citing the fact that she had raised 3 boys, was comfortable with developmental lags, and was living and teaching in an area with high parental expectations.

In three sessions, one subset of inferenced cues was instantiated frequently, yet conservatively, across the two clients who happened to be twins. In two of these cases, the client rotation resulted in the situation where each of the twins was first diagnosed in a live

session by two different diagnosticians (please refer back to Figure 6). Then, in subsequent sessions, the sibling was diagnosed by the remaining diagnostician in a more cue restricted session. In the third case, the first interaction was with the "boxed" twin, then the subsequent interaction was with the the live sibling. In all three cases, the diagnosticians surmised that they were working with twins. This hypothesis was entertained when the standardized tests were examined, and subsequently confirmed when the cues related to family background were seen.

The most inferences were made by the diagnosticians who had met with the twins in a live interaction session (i.e., 19 and 14). The least (11) were made by the diagnostician who interacted with the twins in two of the cue-restricted settings (sessions II and IV). The kinds of information that was inferred most frequently (and subsequently not selected from the second twin's file) was ability test scores, reasons for referral, and details about the family situation. All 3 diagnosticians saw this as an opportunity to free themselves from spending time examining the previously mentioned cues in order to examine others that may be helpful. Similar to the observations of expert medical diagnosticians' use of acquired knowledge (Elstein *et al.*, 1978a), these findings exemplify the value that a knowledge base has for reducing the environmental search requirements, allowing for the more efficient use of short-term memory capacity for new or unexpected information.

Hypotheses. Three features of this analysis are reported in this section: the number of hypotheses, the nature of hypotheses, and the time to the first hypothetical statement. The mean number of hypotheses considered across all experimental sessions was 12, with a range of 6 to 23. These differences appear to be related to individual diagnostician differences in cue selection strategies. At the high end of the scale was Amy, who preferred to examine as many cues as possible and generated an average of 17 hypotheses per session. In fact, across all sessions, Amy selected the most single cues and spent the longest time in preparation and recall. Bonnie, on the other hand, consistently selected certain cues and generated only 9 hypotheses per session. She was more likely to end each timed session earlier than the time available. Yet her untimed, stimulated recall and wrap-up sessions were not appre-

ciably shorter compared to the other diagnosticians. The other three diagnosticians averaged about 11 hypotheses per session.

A taxonomy of the kinds of hypotheses generated by the diagnosticians is reported in Appendix H. The major categories include hypotheses about general/family background, health, the school context, ability to learn, reading skills, and a general category which included statements about self-concept and personality. The statements within any of these categories ranged in size and complexity, and could be composed of either conjunctive and/or disjunctive statements. That is, an individual hypothetical statement could represent a "mini" or tentative hypothesis based on one single or multiple cue, or any of these statements could be combined with other statements within or across categories to produce more substantive hypotheses that would later be finalized into a diagnosis and prescription.

For example, to reach a diagnosis that a client had poor word attack skills, a diagnostician would initially gather information about the client's knowledge of consonants, consonant blends, and vowels using real and nonsense word assessments. Then, additional information would be gathered to ascertain the client's knowledge about syllables, prefixes, and suffixes. This body of information would inform the diagnostician about the client's word attack skills, and would subsequently be compared against the information that the diagnostician gathered on the client's knowledge of sight words and word attack skills demonstrated in reading passages. Throughout this process, the diagnostician would verbalize tentative hypothetical statements regarding phonetic knowledge that she would attempt to confirm or disconfirm (e.g., "This client seems to have a problem with medial vowels.").

Across experimental sessions, the time to the first hypothesis varied from 17 seconds to 19 minutes. This variation could be attributed to the cue selection strategy, the client, and the diagnostician's experience with the client's problem and the experimental procedures. If the diagnostician engaged in a purposive selection strategy which yielded certain key cues, then hypotheses were posited more quickly. If, on the other hand, the diagnostician engaged in a total search of the file, the process required more time. For instance, Amy, who typically searched the entire file, averaged the most time to the first hypothesis (5:51). Judy, however,

most often went immediately to her preferred standardized tests which gave her a quick, normative picture of the client and consequently she averaged the fastest time (1:35).

Sarah took the longest to reach her first hypothesis about Stephanie. Using the "boxed" client procedure, Sarah had access only to the audiotape and file reports. While there were many standardized tests in Stephanie's file from which hypotheses could be drawn, Sarah, the classroom teacher, was not familiar with, and did not typically use, those sources of data. She preferred to interact with the client in a classroom setting on classroom tasks. The quickest hypothesis was reached in Judy's diagnosis of Brett. Judy, the learning disabilities specialist, relied on standardized test results to inform her about a client's problem. In the case of Brett, there were very few such scores and those available indicated no significant reading disability to her. In addition, this session also involved the "boxed" client procedure and, as such, Judy did not even have access to a videotape to assess observable behavior, let alone administer her assessments in person to Brett. The least amount of variance in time to first hypothesis across all diagnosticians was in the case of Matt. The range was 23 to 90 seconds, with a mean time of 50 seconds. All four diagnosticians had selected cues that indicated or implied some behavioral problem.

There was some indication of an order of treatment effect with this variable. That is, the average time across sessions per diagnostician seemed to decrease from the first through the fifth session. Following the session order, those averages were 5:22, 1:43, 5:46, 2:26, and 1:37. This observation could be attributed to the fact that the diagnosticians became familiar with the experimental procedures and materials, and could move through the task at a much quicker and more efficient rate.

Consistency among major variables within and across diagnosticians and summary. In contrast to the findings of Vinsonhaler and his colleagues (1983), the selected cues and hypotheses were, by and large, consistent within diagnosticians. Any variation within diagnosticians was attributable to the cues or time that was available in the different procedures, or to the individual client. As in the Vinsonhaler studies, the inter-diagnostician analyses revealed lower consistency. Unlike Vinsonhaler *et al.*, however, these process

differences did not result in marked differences in the final diagnoses or prescriptions. That is, the diagnosticians may have differed in the process or the labels given to observed reading difficulties, but they reached somewhat similar conclusions about diagnoses and prescription for a specific client. (A more detailed discussion of the entire process is presented in the results from the second level of analysis.) While Vinsonhaler reported his inter-diagnostician inconsistency to be unrelated to training experiences, prior experiences were often cited as reasons for cue selection and interpretation. In addition, the diagnosticians' present instructional assignments and their conceptions of reading were two other factors that appeared to account for inter-diagnostician inconsistencies.

The most interesting point of consistency across diagnosticians was related to the availability of cues. That is, in order to arrive at more accurate diagnoses and to conduct their typical diagnostic activities, in 16 of the 25 sessions the diagnosticians wanted more time to interact with the clients over a series of sessions. One diagnostician reported that "the most important information was working with her (the client), in the teaching situation." Further, the diagnosticians wanted to consult with other teachers, specialists, and the client's parents to gain a more complete picture of the clients as reader.

In five of the 25 sessions where critical cues were missing, the diagnosticians refused to make a diagnoses. Four of these refusals were due to missing information about the family or classroom behavior, two categories of cues that could not be extracted through files or an experimental interaction. In all cases the prescriptions or suggestions for further testing and instruction were directly related to the tentative hypotheses and diagnostic statements.

Results from the Level II Analysis

The second level of analysis focused on the actual diagnostic process. The emphasis of this discussion is on *how* the major variables were selected and used throughout the ex-

perimental session. The findings reported in the previous section on the number and nature of the variables are integrated in this discussion and are used to support interpretive statements about the cognitive activities that take place as diagnosticians attempt to identify reading problems. First, a general overview of the diagnostic process via the analysis of the frequency with which the major variable occurred across the stages of the process. Then, a more interpretive discussion of the cue utilization and selection, hypothesis generation strategies, and formulation of the final diagnoses and prescriptions is offered.

General overview of the diagnostic process. Appendix I (Table 6) reports the total frequencies of the major variables as they were cited in each experimental session across the stages of the process. Appendix J (Table 7-11) breaks down the frequencies according to the experimental session. Appendix K (Tables 12-17) reorganizes the raw data according to client. Appendix L (Tables 18-22) regroups the major variables by each session for each diagnostician for each variable. The numbers in these tables represent numbers of *different* cues and hypotheses considered during the entire process. The purpose of this detailed analysis was to view the observed and measured data from a variety of perspectives in order to reach the most verifiable interpretations about the covert cognitive process of diagnosis.

Across all of the tables (in Appendices I through L), and as illustrated on the next five pages in Figures 10 through 14, the stages of the most active data gathering and consideration are the initial preparation and interaction stages, as well as the stimulated recall stage. The horizontal axes for these figures corresponds with the all the stages and sources from which data were analyzed in the entire process. The vertical axes represent the frequencies of occurrence across all experimental sessions.

Although the stimulated recall is not a natural part of the diagnostic process, all five diagnosticians stated that before they write down the diagnosis they spend time going back through the files and the test results to look for any information they may have missed or discounted. In addition, they reported that they use this reflection time to step back and construct the larger, more wholistic picture of the client as a reader.

FIGURES 10, 11, 12, 13, AND 14 WILL APPEAR ABOUT HERE.

The majority of hypotheses were generated during the preparation stage, with each diagnostician stating that the interaction stage was the place for testing tentative hypotheses. Like the hypotheses formulated by the physicians in the latter stages of their examination (Elstein, Shulman & Sprafka, 1978a), new hypotheses that emerged in subsequent stages of the reading diagnostic process were often elaborations or refinements of initial hypotheses.

Relatively few notes were taken during the preparation stage. The diagnosticians had the selected cue sheets available to them during the written diagnosis stage. Only those specific cues that were deemed most salient or needed further investigation were noted. The notes taken during the interaction were related to the assessments and any behavioral observations that may have impacted on the reading performance.

Few additional cues were requested after the interactions. For the most part, additional cues were requested only in those sessions where a time limit on the preparation stage was set. In these cases, the diagnostician selected her most salient cues prior to the interaction stage. The additional cues served as secondary sources, or corroboration of initial findings.

Appreciably more new multiple cues, missing cues, and inferences were cited in later stages in the process. By this point across the session, the diagnosticians stated that they were "putting the pieces together," and could more clearly see where gaps in available information existed. Because the general picture of the client was coming together, the number of inferences increased in later stages of the process. Unlike Elstein, Shulman & Sprafka (1978a) who propose that physicians recall exact templates of problem categories, it appears that the diagnosticians had schematic prototypes of readers stored in their memories (e.g., Rosch & Mervis, 1975). That is, the diagnosticians developed a general picture of Peter as a learning disabled child once they saw the basic elements: a discrepancy between the verbal and performance sub-test scores on the WISC-R, obvious problems with sound-symbol relationships, reading well in context, and so on. These cues were the basic elements of the

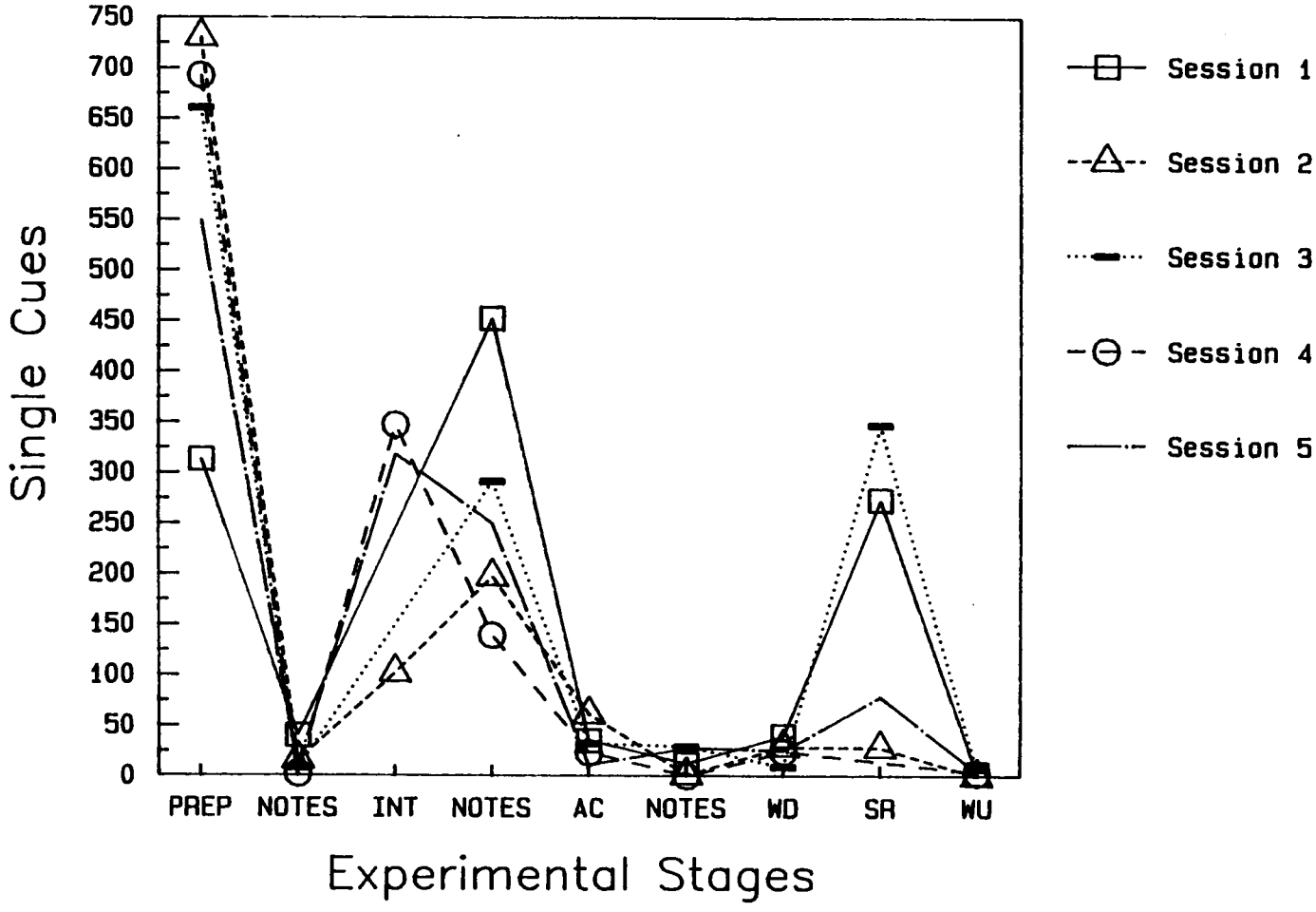

Figure 10. Frequency of single cues cited in each stage of each experimental session.

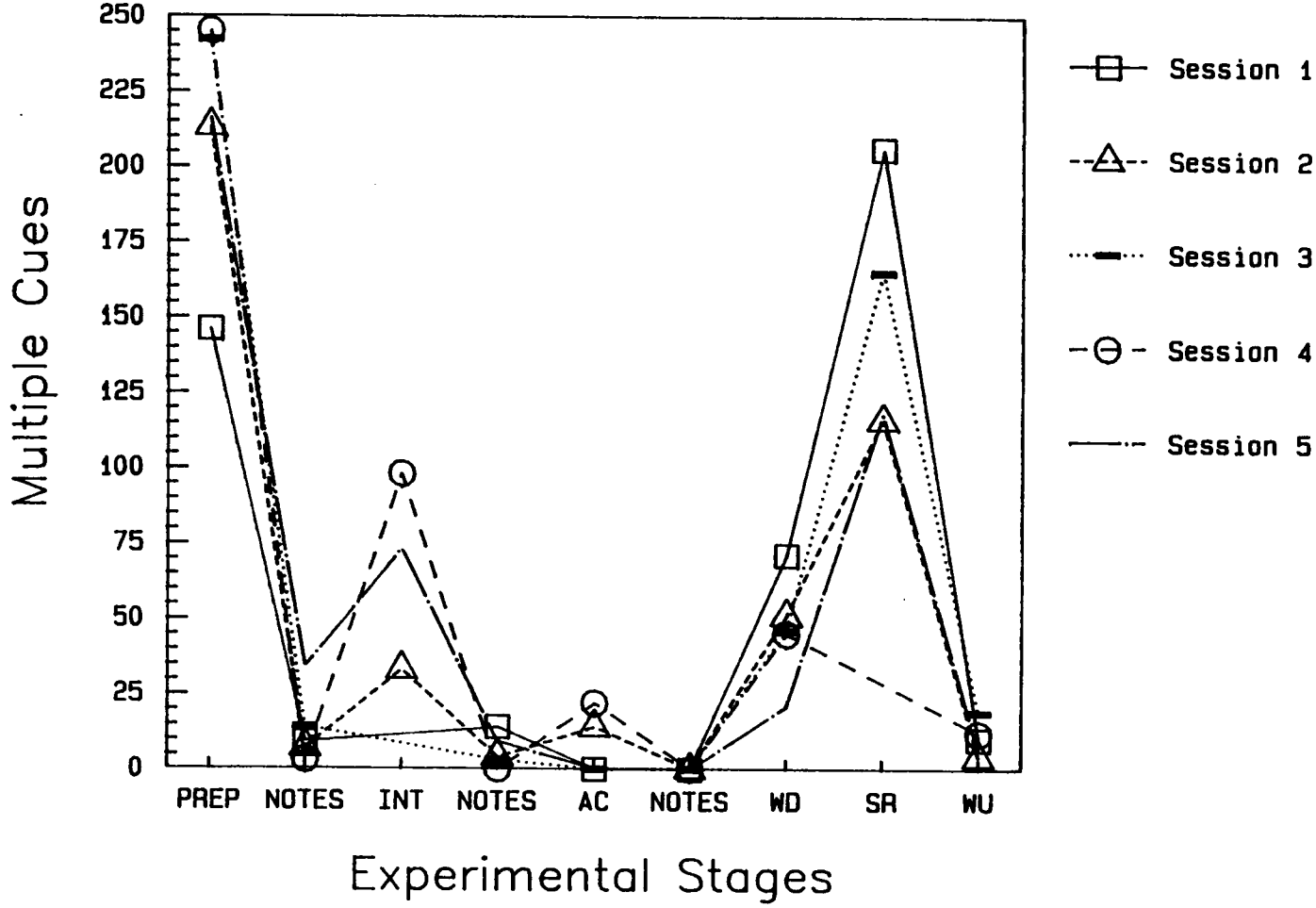

Figure 11. Frequency of multiple cues in each stage of each experimental session.

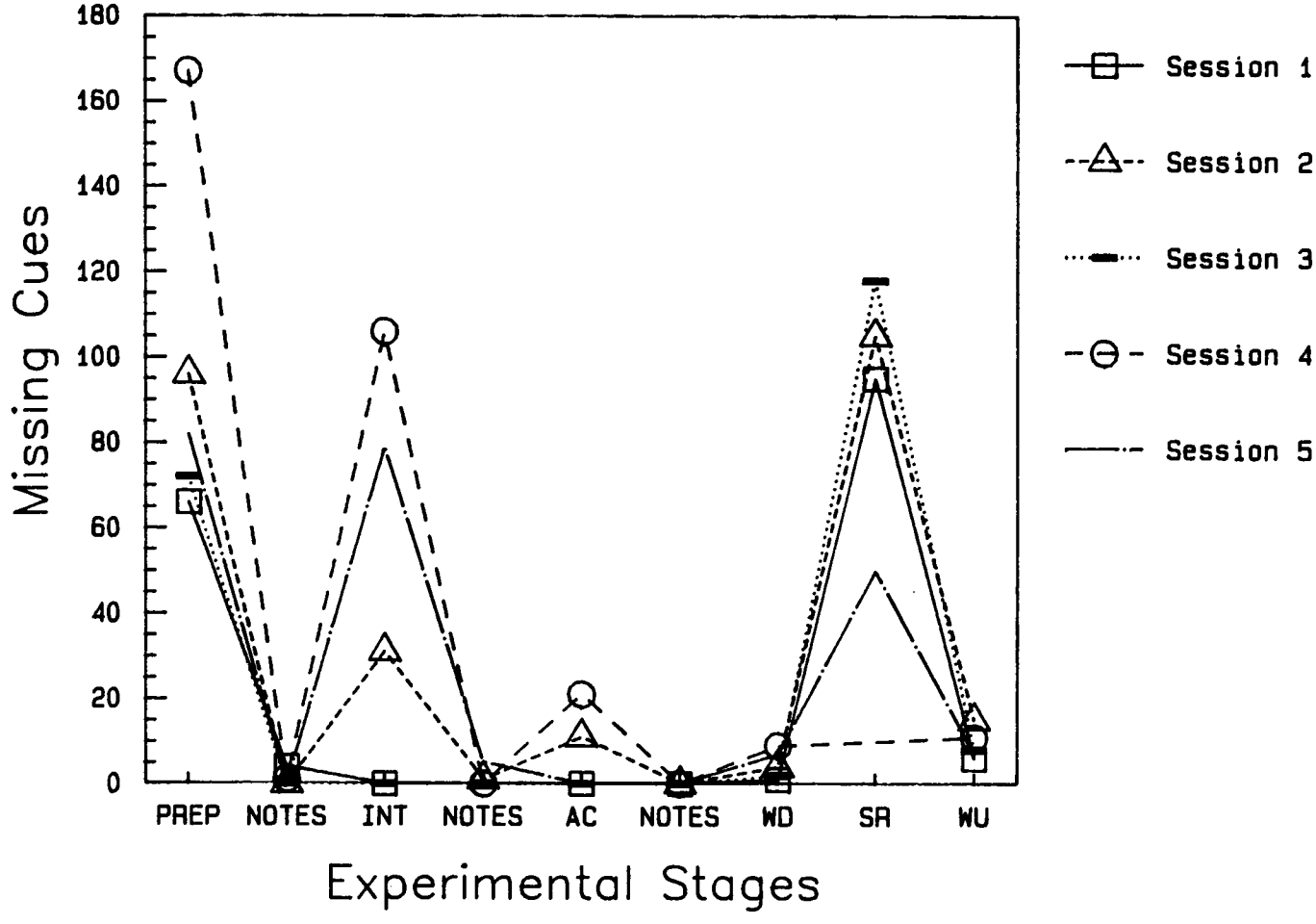

Figure 12. Frequency of missing cues in each stage of each experimental session.

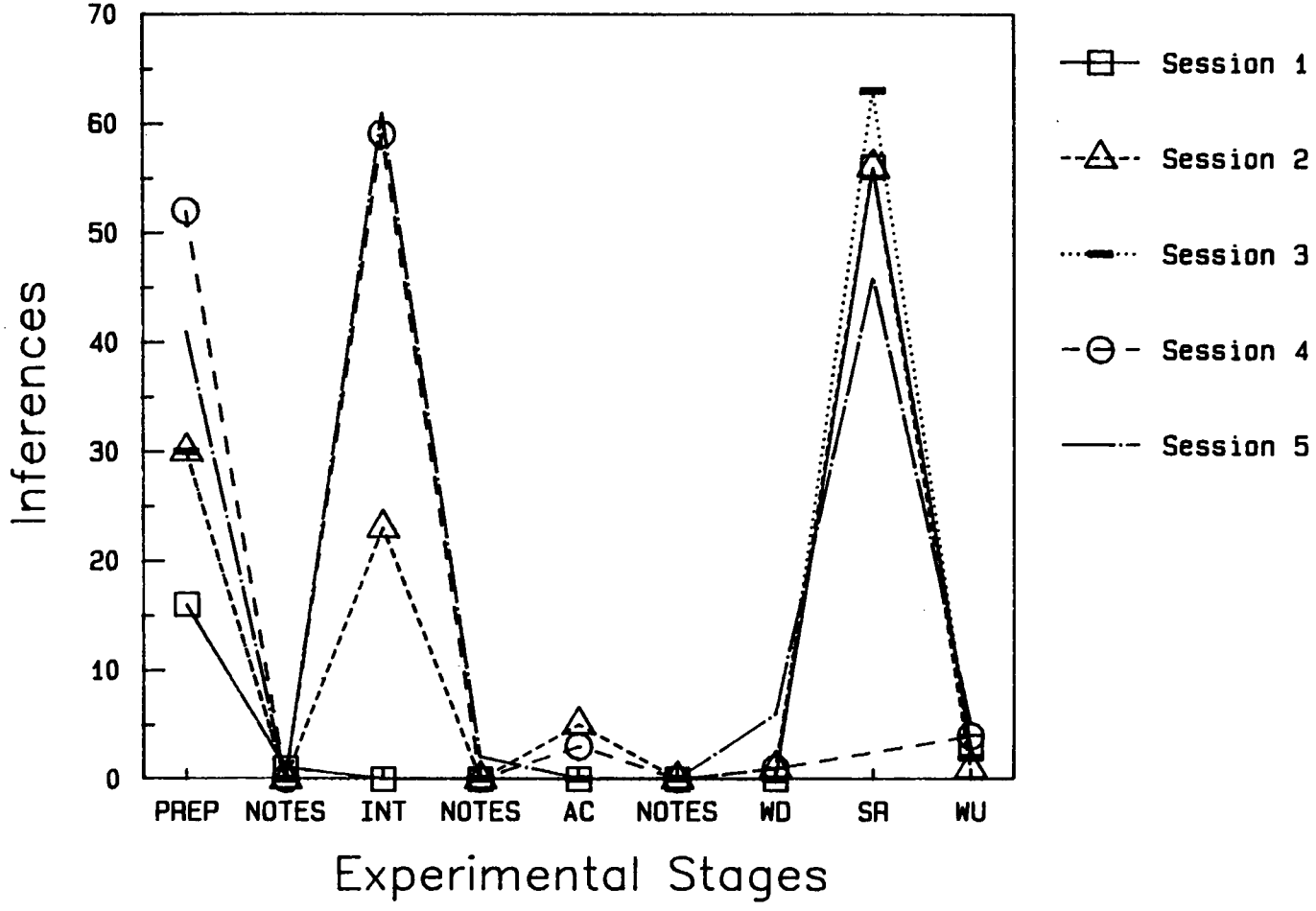

Figure 13. Frequency of inferences in each stage of each experimental session.

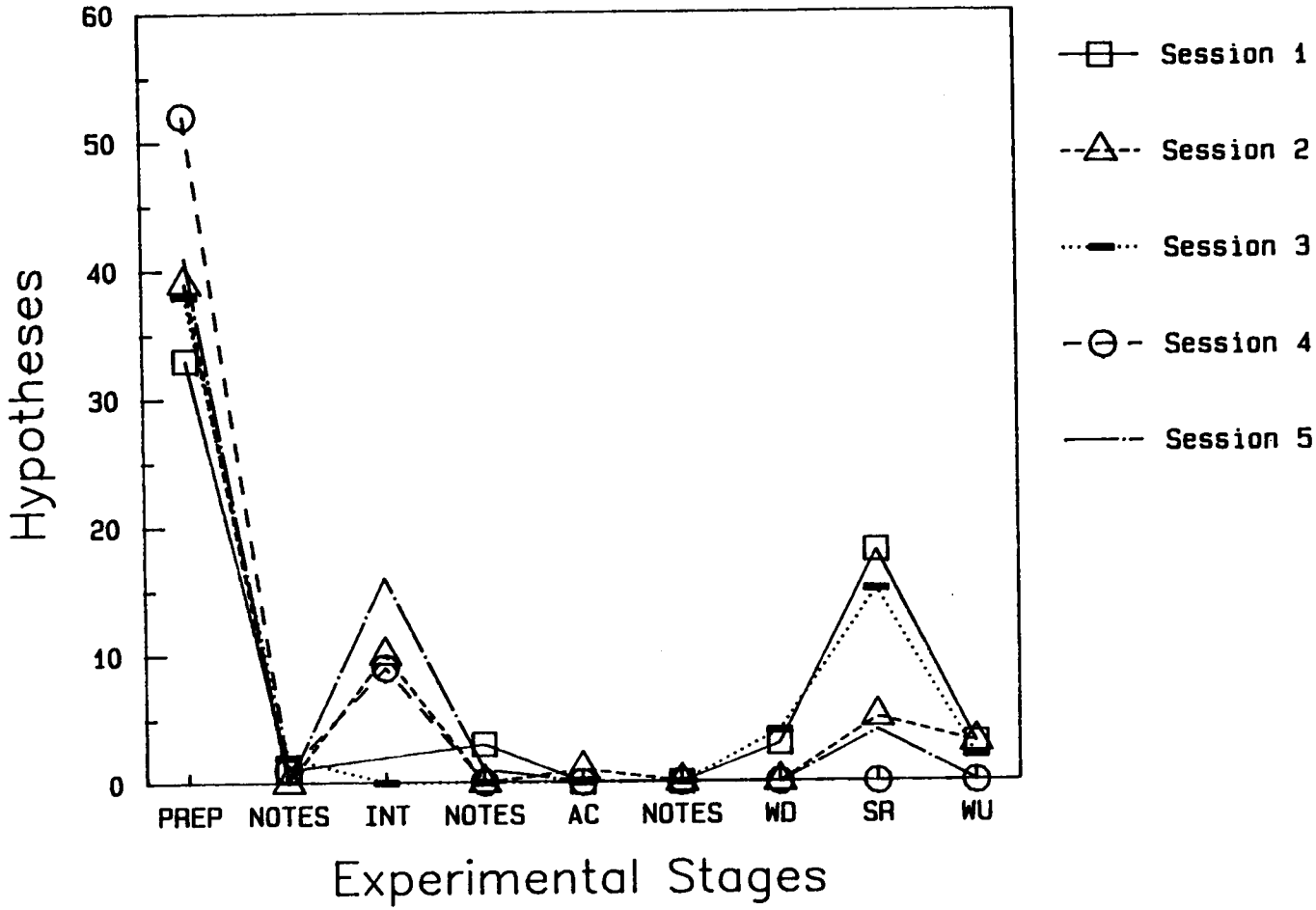

Figure 14. Frequency of hypotheses cited in each stage of each experimental session.

prototype that needed to be present for the problem identification. Other minor details were ignored, or cues left unexamined once these key cue were identified.

Very few new cues or hypotheses were cited in the wrap-up stage. Often these were minor observations about the client in general, but with no direct bearing on the diagnosis and prescription. For example, in the final stage, Amy stated that from the interaction she found that Brett liked physical education in school. While this information informed her that Brett was having some positive school experiences, the cue did not influence her reading diagnosis and prescription.

Cue selection and utilization strategies. New cues were detected, interpreted and used across the entire diagnostic process. A cue could represent a positive, negative, or neutral indicator of reading difficulty. Positive and negative cues were compared, interrelated, or stored depending upon the category of information that was being searched. Neutral cues were subsequently ignored. Inconsistent cues (i.e., cues that did not correspond with a confirmed set of multiple cues) were also ignored. As mentioned earlier, multiple cues contained positive and/or negative valences, resulting in conjunctive or disjoint units of information (Bruner *et al.*, 1956).

According to Mayer (1983), dominant cues are those elements of the environment that attract attention more readily than others, and are critical to the attentional process. This notion was clearly evidenced in the diagnosticians' cue selection processes. Again, as mentioned earlier, when given a choice between a test score and a live interaction, all diagnosticians expressed a preference for having one-on-one contact with the client. However, when cue choices had to be made, two factors, time and teaching position/experiential background, influenced cue dominance. Appendix M outlines the order that specific file cues were selected and the kinds of assessments administered by each diagnostician for each session.

Dominant cues were most apparent in those sessions in which the preparation time was limited (experimental sessions I, III, V). For instance, Pat, Judy and Bonnie quickly selected the standardized test scores, Amy requested the referral, and Sarah requested the report card

grades and teacher comments. In sessions II and IV where no time limit was imposed, most diagnosticians perused the entire file in the order outlined on the case inventory form.

Teaching position and experiential background were factors that pervaded cue selection and utilization (see Appendix B for an outline of the diagnosticians' backgrounds). As evidenced by their overt cue selection behavior, the five diagnosticians could be arrayed along a continuum that was anchored and labeled at one end as "test driven," and at the other end by "activity driven" (see Figure 20). On the test-driven anchor is Judy, the learning disabilities specialist. Throughout the study, her dominant cues were standardized test scores. Much like the field of education in which she works, these data represented the benchmarks from which diagnostic decisions were to be made.

FIGURE 20 WILL APPEAR ABOUT HERE.

On the activity-driven anchor is Sarah, the classroom teacher. She stated she didn't know much about standardized tests and testing, and that she based her diagnostic decisions on how a child performed. Her benchmarks were reading fluency, comprehension, client ease and confidence. To assess these dimensions, she engaged the client in a number of informal tasks such as reading trade books, discussions about books, learning and favorite hobbies.

The other three diagnosticians, all reading specialists, are arrayed in the middle of this continuum according to the emphasis each placed on clients' test scores and performance on activities. While individual client differences influenced the relative positions on the continuum from session to session, by and large, the diagnosticians' selection strategies and levels of importance are represented in this order.

The specific learned rules that denoted one cue as more salient than another in terms of relative positive versus negative valences was based more on specific diagnostic experiences. For example, once Bonnie discovered she had the twin's sibling, a set of rules by which subsequent cues were interpreted was instantiated. Once Pat saw that Peter had an average score on the Metropolitan Readiness Test, she instantiated her rule that "average on

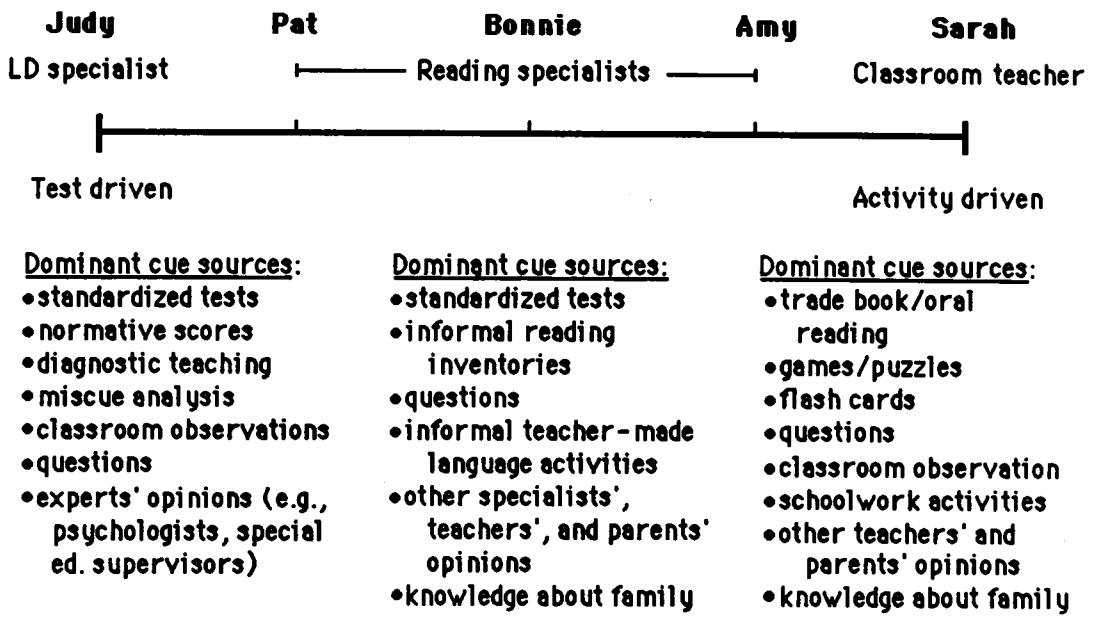

Figure 20. A conceptual representation of the five diagnosticians' dominant cue source preferences.

the Met meant a little below average on school activities." Much like the expert physicians' rapid associations between selected cues and problem categories stored in long-term memory (Elstein *et al.*, 1978a), certain salient cues immediately activated learned rules related to school performance. This automatic concept-identification process is indicative of the expert performance observed in contexts such as chess (e.g., Chase & Simon, 1973) and physics (e.g., Chi, Feltovich & Glaser, 1981).

The strategies used to select cues were based on time and cue availability. Referring to the strategies proposed by Bruner and colleagues (1956), the diagnosticians engaged in a simultaneous scanning strategy when given enough time (similar to Elstein and colleagues' physicians, 1978a). That is, they gathered all possible cues and considered a number of related hypotheses, eliminating untenable hypotheses as subsequent cues were selected. Given that this strategy taxes memory capacity, it is understandable that it would be used only when time permitted.

When time was limited, the diagnosticians used either, or both, the conservative-focusing and focused-gambling strategy. In the conservative-focusing strategy, the diagnostician would pick one positive instance and then verify it against subsequent choices. This method guaranteed that each comparison would be informative. When Pat, for instance, wanted to verify a client's general ability, she would begin with the IQ score, then engage in a selective search of all indices related to intelligence. In the focused-gambling strategy, the diagnostician would again pick one positive instance, but then change more than one variable at a time. This allowed for a faster process, but was more risky in terms of possible errors. Bonnie implemented this strategy at the end of a timed preparation stage in which the upcoming interaction was with the live client. By randomly choosing report card grades, she missed some teacher comments that would have informed her about the client's ability to decode vowels.

Notwithstanding the mistakes incurred when the diagnosticians were rushed through the cue selection process, subsequent errors in the diagnosticians' cue selection mirrored those of the physicians (Elstein *et al.*, 1978a). The most common error was over-interpretation; that

is, the diagnosticians gave too much credence to single or multiple cues. This often occurred in audio and videotaped sessions because verification with the client was not possible. Other errors were under-interpretation, misinterpretation, and "uninterpretation" (i.e., cue not selected). These errors also occurred more frequently in the simulated versus live sessions, but, in addition, were attributable to the diagnostician's experiential background.

Hypothesis-generation strategies. The diagnosticians generated hypotheses in much the same manner as the physicians (Elstein *et al.*, 19781). Both general and specific hypotheses were generated simultaneously. Appendix N illustrates the nature of the hypotheses that were generated for each client across each stage of the experimental sessions. The varied levels of generality are apparent as the listed hypotheses are phrased in the diagnosticians' own terms. And, as mentioned earlier, new hypotheses which appear later in the sessions seem to be either elaborations or refinements of earlier hypotheses.

Again paralleling the problem identification processes found in medical diagnosis (Elstein *et al.*, 1978a), the basic hypothesis-generation strategy followed one of two rules, with the first being the preferred case. First, select and support the hypothesis with the maximum number of positive cues. If this strategy isn't possible, the second rule states to select and support the hypothesis with the maximum difference between positive and negative cues. In general, the more positive, available, relevant cues, the more likely the client's problem was diagnosed by all diagnosticians. Such was the case with Peter (the control condition). The cues that were available were powerful enough to prompt all five diagnosticians to begin to reach tentative hypotheses early, and a similar diagnosis in the end.

A related basic strategy used by all five diagnosticians (and parallel to the physicians in the Elstein *et al.* [1978a] study) was the "quick rule-out." This strategy enabled the diagnostician to eliminate quickly any single or multiple cue, leaving capacity in short-term memory to consider other, more speculative hypotheses. The mean number of quick rule-outs across sessions was 1.6, with a range of 1 to 5. Across all sessions, all diagnosticians sought first to eliminate health as a factor contributing to the reading problem. Other rule-outs were

related across a variety of categories. Five rule-outs were recorded in Amy's first session, in which she generated 21 hypotheses. Amy's subsequent sessions had 12 or fewer hypotheses.

Formulation of final diagnoses and prescriptions. In order to examine the actual formulation of the diagnoses and prescriptions within diagnosticians, the diagnoses were traced back through the hypotheses and forward into the prescriptions. Appendix O reports the formulation of hypotheses and the subsequent diagnoses and prescriptions. In all cases where diagnoses were offered, the hypotheses, diagnoses, and prescriptions were related. In those sessions where no diagnosis was offered, the further tests and missing information cited by the diagnosticians are reported. In all of these cases, a clear relationship among hypotheses and missing cues was seen. In those instances where it was not possible to remediate the diagnosed problem (e.g., Tonita's home situation), no diagnoses and prescriptions were offered.

Summary and Conclusions

The rationale for this study was based on the apparent discrepant representations of the cognitive process of diagnosis across two contexts: medicine (i.e., Elstein *et al.*, 1978a) and reading (i.e., Vinsonhaler *et al.*, 1983). Both bodies of research were grounded in the information-processing approach to human problem solving. Each conceptualized the diagnostic process as problem-initiated and problem-directed. Yet, while the medical literature describes diagnosis as a complex, generalizable process driven by fairly elaborate, but clearly definable, cue selection and hypothesis testing strategies, the reading literature describes the process as idiosyncratic, individualistic, and inconsistent. Further, while the medical literature could attribute differences to training, experience, or the case specifics, the reading literature could not pinpoint possible explanations for inconsistent diagnoses and prescriptions across or within diagnosticians.

As mentioned earlier, the research questions and methodology across the two contexts were different. The medical diagnosis research focused more on the diagnostic process (i.e., the cue selection and utilization, and hypothesis-generation strategies), while the reading diagnosis research focused more on the products (i.e., the final diagnosis). Further, the medical research employed live simulated patients and contrived a realistic diagnostic setting in which the physicians identified the patients' problems. The reading research employed "boxed" client simulated cases, which restricted the access to the natural diagnostic interaction, reducing the cue availability or relevant knowledge from which an accurate and consistent diagnosis could be developed. The questions and methodology used in this study of reading diagnosis are more closely aligned with the questions and methodology used in the medical diagnosis research. Not surprisingly, then, the results from this study parallel the medical diagnosis findings (Elstein *et al.*, 1978a) and, for the most part, disagree with the findings reported by Vinsonhaler and colleagues (1983).

This conclusion begins with comments about the methodology used in this study. The main focus then turns to the total picture of reading diagnosis as observed and conceptualized in from the data collected in this research. First, an overview of the cognitive process of reading diagnosis is described. Then, a brief discussion of the typical diagnostic assessment activities reported and used by the diagnosticians is given. Finally, a summary of the general nature of reading diagnosis as it occurs in typical clinical settings is presented.

Methodology

The diagnosticians expressed a clear preference to work with the live client as opposed to the simulated cases. However, throughout the study, the diagnosticians demonstrated a keen ability to adapt to the experimental procedures and requirements. They quickly learned the cue inventory and the data collection process, consequently this data collection procedure

became more efficient for all diagnosticians. They were very explicit about what they thought was important and why they paid attention to it.

As the study progressed, the difference between the descriptive and explanatory think-alouds became less apparent. Consequently, the differences may not be due so much to level of explanation as to the order in which the tasks were done in terms of when cues were selected, chunked into multiple cues, or formulated into hypotheses. In addition, the diagnosticians became very comfortable with explaining what they did and why they did it. This was not true in the first experimental session, and thus, the results from that session may not be as representative.

Reading Diagnosis

The diagnostic process. The findings from this investigation portray the expert reading diagnostician as an active, and somewhat predictable, problem solver. This individual engages in a problem identification sequence similar to the one outlined by Polya (1968). Cues are selected from the environment based on one's prior knowledge and experience in diagnosis (Newell & Simon, 1972). The selection strategies are influenced by the availability of cues in the task environment (Norman, 1969). Dominant cues (with dominance related to prior experience) are sought first (Underwood & Richardson, 1956). Based on rules guiding cue salience (Trabasso, 1963), less preferred cues are selected and utilized only if time permits or the dominant cues are not available.

The "knowns" and "unknowns" are assessed. Inferences about missing cues are instantiated and used to reduce the "unknowns" (Anderson & Pearson, 1984). More data is selected, evaluated and, depending upon the evaluation, either chunked with the developing knowledge about the specific problem, or ignored (Elstein *et al.*, 1978a). Prior knowledge related to the selected, salient data is accessed and assimilated where appropriate (Neves &

Anderson, 1981). Thus, the original single or multiple cues or pieces of information develop into the beginnings of a representation of the problem. During this process, questions are raised and hypothetical statements about the reading problem are entertained (Polya, 1957).

This cyclical process continues until a decision to diagnose or not to diagnose is reached. If a diagnosis is reached, it often takes the form of a set of descriptive statements, rather than a single, identified problem. Prescriptions are tentative plans to be used to remediate the identified problematic reading behaviors. The prescriptions are tentative "first steps," based on the hypotheses that have received the greatest support. These tentative plans may be implemented on a trial basis, evaluated, and continued, revised, or discarded (Polya, 1968).

Typical diagnostic assessment. In the original examination of the process of reading diagnosis (as summarized in Vinsonhaler *et al.*, 1983), the available cues were for the most part derived from standardized assessments of reading ability. In this study, however, that corpus of information was found to be only a part of the data (and for some, a very small part) needed to identify the client's reading problem. As seen in Appendix G, standardized test results comprised only about 14 percent (21 out of 150)
of the kinds of information the diagnostician gleaned from the files and client interaction. The self-reported typical assessments and assessment procedures outlined in Appendix B further substantiate the minor role that standardized tests play in formulating diagnoses.

While not the specific focus of this study, alternative assessments and assessment procedures were noted in the live, as well as simulated, experimental sessions. Examples of assessments used by this study's diagnosticians include trade books, informal written language samples, games and activities with multiple directions and rules, and client observation in regards to other environmental stimuli and non-reading related task requirements. These observations support Johnston's (1984) notion that alternative means of assessment are taking place in real diagnostic settings, and that this kind of informal, unstructured assessment deserves study. But relevant to this study is the subsequent support to the original proposal that the typical, and perhaps dominant, cues upon which diagnosticians base decisions were

not available in Vinsonhaler and colleagues' (1983) original study of diagnosis via "boxed" client, simulated cases.

The nature of reading diagnosis. As revealed in this study, reading diagnosis is a complex and interactive cognitive process. It is complex in that the task requires a quantitative and qualitative level of expertise on the part of the diagnostician. This expertise involves knowledge of reading, human development and learning, assessment, contextual constraints and possibilities, and the strategies that enable this knowledge to come together to identify a client's reading problem. In addition, the task is not linear, it requires the diagnostician to constantly return to the task environment (including client, assessments, files, etc.) for new and/or supportive information. Because problems are identified based on prior knowledge and experiences (Newell & Simon, 1972), training and experience are essential to accurately identify important and ignore irrelevant cues.

Reading diagnosis is an interactive process in that the product (i.e., the diagnosis) is based on the nature of the interaction between the diagnostician, the client, and the assessments. It is more than the selection of cues such as test scores as characterized by previous research (cf. Vinsonhaler *et al.*, 1983). This interaction can be seen in this study's data in terms of what the diagnosticians observed (e.g., see Appendix G, taxonomy of single cues) and the subsequent hypotheses that were generated (see Appendices H and N). A classic example of this point was observed in this study.

In one experimental session, Pat was not able to conduct her planned assessments with Matt. He was so distracted that morning that to conduct an informal reading inventory and extract any semblance of valid results was ludicrous. She subsequently changed her plan, focusing more on trade books and games. She reported that she was not able to get the kind of information she prefers, but equally important was the fact that she was able to experience and attempt to deal with the behaviors reported by the school in the file records.

Amy, on the other hand, interacted with Matt via a videotape. While she was able to see his behavior two-dimensionally, the full impact of working with Matt was not experienced.

Consequently, her diagnosis focused on basic reading skills, with little attention paid to Matt's apparent hyperactivity.

This example was not the only one of its kind that occurred in this study. The fine nuances to the interactions of each experimental session indicated that future study of the diagnostic process must attend to the rich, interactive nature of diagnosis. The preferred methodology to study real diagnosis must include real clients, in real settings. More controlled procedures may be implemented, but this must be done with the knowledge of the limitations.

Final Comments

In closing, the most important implication of the current investigation may be that reading diagnosticians are not as internally inconsistent as the Vinsonhaler research seemed to indicate. Further, in order to capture the essence of diagnosis, the process must be conceptualized as rich, generative, and interactive. It appears likely that earlier studies may have actually created intra-diagnostician differences as artifacts of the artificial client simulations. This study's findings indicate that expert diagnosticians rely on many kinds of cues and their complex permutations and interactions when formulating hypotheses about a client's reading problem. When information is not available, they will infer their best guess based on the evidence or withhold the diagnosis altogether. Given the restricted setting of the Vinsonhaler studies and the emphasis on the production of a written diagnosis for each clinical encounter, the participants may have had to make a number of inferences, resulting in the inconsistent diagnoses and prescriptions.

The findings of this study indicate that by tracing the entire problem-identification process in more contextually valid situations, diagnoses as well as prescriptions, were largely consistent. Further, a more complete picture of the diagnostic process was constructed in this

study by focusing on that process. This process was found to begin with the examination of single cues, the subsequent building and grouping of cues into multiple cue chunks, the generating and testing of hypotheses, and in most cases, concluded in the identification of the problem.

On the other hand, the data that indicated inter-diagnostician differences, similar to the Vinsonhaler studies, but different from Elstein and colleagues' medical diagnosis work, is perhaps neither surprising nor negative. As Kingsbury (1987) points out, medical schools tend to teach science as a set of facts rather than a method of inquiry. Given this orientation, differences in the training of physicians are minimal. In addition, diagnosis is a particular emphasis of medical schools since diagnosis often implies treatment in rather direct fashion. Reading, however, is embedded in the social sciences with a wide range of theories and applications. Consequently, it would not be unlikely that reading diagnosticians would vary widely in orientation as a result of diverse training and experience.

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Appendix A

Letters and forms for diagnosticians

December 3, 1986

Name
Address

Dear _____,

Reading diagnosis is a fascinating and complex area of problem solving. Past research has focused on a variety of content areas such as chess, physics, and computer programming and has found that experts are quite unique relative to novices in how they go about solving problems in their areas of expertise. As part of my doctoral degree research, I wish to find out how expert reading diagnosticians typically think through the process of diagnosis and identify clients' reading difficulties. This kind of information can be invaluable in understanding diagnostic activities and finding out which activities lead to more efficient and accurate diagnoses.

I would like you to help me further understand this area of interest by agreeing to participate in my study. The study focuses on expertise in problem solving, and you have been nominated for this study by an administrator or university professor who views your ability in this field to be on an expert level. Specifically, you will be asked to work with five clients (children ranging in ages 8-11) at Virginia Tech's reading clinic during the month of January. (Because three of the five diagnoses will be based on taped and written records of children's performances, arrangements can be made for completing the tasks at your school.) You will be able to examine background information, have the child read or listen to a tape of his or her reading, test the child with the materials of your choice (in two of the five sessions), and write up a diagnosis. The five diagnostic tasks, along with brief orientation and debriefing sessions scheduled at your convenience, will take a maximum 25 hours of your time. You will be reimbursed in terms of money ($150) or graduate credit (3 credits) for your involvement in this project, whichever you prefer.

Your identity, as well as the children's identities, will be kept confidential. This task is in no way evaluating how well you diagnose, rather the focus is on what you as an expert diagnostician are attending to while you identify reading difficulties.

If you have any questions about this project or the specific tasks, please call me at home (381-0497) or my office (961-4863). I will be glad to give you whatever information you need. Due to the depth of the study, in terms of your time and the amount of data that will be generated, and the cost of the project, the number of participants will be limited. Also, because the study examines differences among experts, participants will be selected based on differences in background experiences and methods and materials typically used in diagnosis. If you would like to participate, please complete the enclosed form and brief surveys and return them in the enclosed stamped envelope by December 15, 1986. I will notify all respondents, whether or not you are selected for the study, by December 18, 1986. If you do not wish to participate, please return this letter in the enclosed stamped envelope.

Thank you for your time and consideration.

Sincerely,

Susan Magliaro
Doctoral Candidate

John K. Burton
Doctoral Advisor

A Study of Expert Reading Diagnosticians
Participant Information Form

Name:_____
Address:_____
_____
Home Telephone:_____ Work Telephone:_____

Employment History

Beginning with your present place of employment, please complete the following information regarding each position you have had related to reading diagnosis (e.g., teacher, clinician, teacher's aide, student teacher). If you need extra space, please use the back of this form.

1) Place of employment:_____
Position/title:_____ Number of years:_____
Brief description of duties:_____
_____
_____

2) Place of employment:_____
Position/title:_____ Number of years:_____
Brief description of duties:_____
_____
_____

3) Place of employment:_____
Position/title:_____ Number of years:_____
Brief description of duties:_____
_____
_____

Educational History

Please complete the following for each level of training beginning with your undergraduate degree, up to, and including, the institution you have attended most recently. If you need extra space please use the back of this form.

1) Name of institution:_____
Number of years attended:_____
Major:_____ Minor:_____
Courses related to reading diagnosis:_____
_____
_____
_____
_____
Degree or certification:_____

2) Name of institution:_____
Number of years attended:_____
Major:_____ Minor:_____
Courses related to reading diagnosis:_____
_____

Degree or certification:_____

3) Name of institution:_____
Number of years attended:_____
Major:_____ Minor:_____
Courses related to reading diagnosis:_____

Other Professional Activities

Professional journals read:_____

Conferences or Workshops attended in last three years:

Diagnostic Tests or Tasks

Please list those reading diagnostic tests or tasks you typically use when you are attempting to identify a client's problem.

"Beliefs about Reading" Surveys

Directions: On the next two pages you will find two sets of statements. Set A contains statements about how one reads. Set B contains statements about how reading ability develops. In *each* set of fifteen questions, select the five that *best* represent your beliefs about reading. Circle only *five* statements in each list.

Set A

1. Before children can comprehend they usually must be able to recognize all of the words on a page.

2. Children's knowledge about the world plays a major role in their comprehension during reading.

3. Children who are weak at word recognition skills usually cannot overcome this weakness with strengths at other levels of the comprehension process.

4. Before young children read about something, it is often useful for them to share an experience similar to that depicted in the text.

5. There is usually only one acceptable answer to a question from a story.

6. Teachers should normally give equal emphasis to instruction aimed at developing each knowledge source.

7. If children are weak in one knowledge source important to the comprehension process, it is still possible for them to read and comprehend.

8. The meaning of a text is usually a joint product of text and reader.

9. Teachers should normally expect and encourage children to have different interpretations of a story.

10. If a reader does not comprehend a text in the way an author intended, we can usually say that they have mis- understood the text.

11. Teachers should normally inquire what children know about the topic of each story before they begin reading.

12. When children retell a story, they should usually attempt to use the author's words.

13. Expectations are often as important as accurate recognition of words during the reading process.

14. Readers use a variety of strategies as they read -- from sounding out unfamiliar words to guessing familiar words in rich context.

15. The best readers are usually those who have learned to be accurate in their expectations of upcoming text.

Set B

1. It is important for teachers to provide clear, precise presentations during reading instruction.

2. Children should receive many opportunities to read materials unrelated to specific school learning tasks.

3. In deciding how to teach reading, one should carefully consider the nature of the children.

4. Reading, writing, speaking, and listening are closely related learning tasks.

5. Children learn reading best when the task is broken down into specific skills to be taught by the teacher.

6. Children should be tested frequently to determine if they have learned what was taught. These tests should match very closely the nature of the instruction.

7. Some children learn best by reading widely and often; others learn best through direct instruction.

8. Children should be frequently read to while they are young so they acquire a "feel" for what reading is like.

9. Opportunities should be created in the classroom to provide children with a reason to read.

10. Less proficient readers often benefit from more direct and structured learning experiences.

11. Teachers should have a list of separate reading skills appropriate for their grade level and make certain that each student masters these skills, and only these skills.

12. Much of what children learn about reading can be attributed directly to what a teacher taught in the classroom.

13. It is important to individualize reading instruction as much as possible by taking into consideration the children's reading abilities.

14. Children learn a great deal about reading by watching their parents at home.

15. A teacher should generally spend greater time in the class- room with less proficient readers than with more proficient readers.

A Study of the Problem Identification Processes of
Expert Reading Diagnosticians

CONSENT FORM

This project involves diagnosing the reading difficulties of five students who are presently enrolled in the Virginia Tech Reading Clinic. In all cases you will be able to request information that would typically found in a student's cumulative and confidential file. For two of the cases, you will meet and work one-to-one with the children. In two other cases, you will observe videotapes of the children working with other diagnosticians. In the fifth case, you be able to listen to audiotapes of the child reading. After you have familiarized yourself with each case, you will be asked to write a diagnostic report of the child's reading difficulties. Throughout the sessions, at different times, you will be asked to talk or "think aloud" about those details that you are noticing to be important and your hunches about the child as a reader.

Each of the five sessions should take from three to five hours to complete.

From this project I hope to learn more about the problem identification processes of those individuals who have been recommended as experts in the area of reading diagnosis. This will add to our knowledge of what successful practitioners are doing in their interactions with cases of reading difficulties, and hopefully aide us in designing our college reading courses to be more appropriate and effective.

For your participation in this project, you will receive either $150 in cash, the same amount toward three (3) quarter-hour graduate credits, or three (3) free quarter-hour credits toward recertification.

As with all psychological studies, you are free to withdraw from this project at anytime without prejudice. However, you must complete all of the five sessions to receive the aforementioned reimbursement. For each missed session, either $30 or a half-credit will be deducted.

This project has been approved by the Human Subjects Committee (HSC) and the Institutional Review Board. If you have any questions, you may call or visit Susan Magliaro (961-4863, CEDARS), John K. Burton (961-5428, 400 War Memorial Gym), or Thomas M. Sherman (961-5121, 307 War Memorial Gym).

I hereby agree to voluntarily participate in the research project described above and under the conditions described above.

_____ Signature

_____ Date

January 5, 1987

Permission to Retain Videotapes and Audiotapes
for Future Research Purposes

____ I hereby grant permission for Susan Magliaro to retain the videotapes and audiotapes of me that were collected in her study of reading diagnosticians for later use in other research projects.

Signature _____

____ I do not grant permission for Susan Magliaro to retain the videotapes and audiotapes for me that were collected in her study of reading diagnosticians for use in other research projects.

Signature _____

____ I would like the audiotapes and videotapes of me erased.

____ I would like copies of my audiotapes and videotapes.

January 31, 1987

Hi,

This will be the last task that I'll ask you to do. Would you please fill out this brief survey again, now that you've completed all the sessions? Again, there are two sets of statements. Set A contains statements about how one reads. Set B contains statements about how reading ability develops. In EACH set of fifteen questions, select the five that BEST represent your beliefs about reading. Circle only FIVE statements on each list.

When you have completed this task, please mail the survey back to me (with your name on it), in the enclosed, stamped envelope. Please try to complete the survey as soon as possible after the last session. I will be compiling the main part of the data (i.e., what you all chose to look at, and your diagnoses for each child), then call all of you for a final debriefing set-together -- probably around February 21 or 22. Thanks again for your help; without you, we wouldn't have had a project. See you in a couple of weeks.

Sincerely,

Appendix B

Diagnosticians' educational backgrounds and typical diagnostic procedures and assessments

Amy (reading specialist):

Background experiences:

M.S. in Reading; 17 years teaching experience (4 years in the regular classroom, 13 years as a reading specialist).

Typical procedures:

"I like to get impressions of kids. Usually I'll know the kids and the teachers. The first week of school I take the whole grade level's folders, flip through, looking for the SRA score, a pattern of scores (may have had one bad year). Then I like to do my own inventory, I like to make up my own mind then I would go to the files to look at the further testing. I collect information until something tends to be a picture. For instance, not noticing one score that seemed to stand out, not noticing the differences in the teacher's grades, but consistently all the way through.... To some degree, I don't pay much attention to the previous reading, I do my inventories because I know the teacher and I might not evaluate the same."

Typical assessments:

Teacher-made individual reading inventory (IRI), IRI from basal series, or Silvaroli IRI (used with student from other schools, using other textbooks); teacher-made inventory of pre-reading and reading skills (e.g., phonetic and structural analysis); sight word list (e.g., Dolch); classroom observations

Conceptions of reading:

How one reads: 3 statements = reader-based; 2 statement = interactive (text- + reader-based)
How reading ability develops: 4 statements = holistic language; 1 statement = differential acquisition (specific skills + holistic language)

Pat (reading specialist):

Background experiences:

M.S. in Elementary Education, specialization in reading; 22 years teaching experience (10 years in the regular classroom, 6 years as a reading specialist, 6 years as a language arts coordinator)

Typical procedures:

"Typically, I take a folder and go through everything, taking notes on significant findings. I've got to look at the whole folder. I've got to get an overall picture from the folder first. Then I'll do the silent part of the IRI first to let the child feel at ease. Then I'll do the oral and listening tasks. I will also do other informal exercises if I see a need or by teacher request. I really feel "handstrung" [sic] without that teacher information because it is vital for me for the job that I do at the school. Sometimes the teacher information is far more insightful than the testing information. The prescription of remediation for each pupil referred is based on a compilation of information gathered by the classroom teacher and the reading specialist."

Typical assessments:

Examination of SRA results; basal series placement test; Johns Informal Reading Inventory; consultation with classroom teachers; informal reading in trade books; games and puzzles; classroom observation; Peabody Picture Vocabulary Test; writing samples; standardized ability tests

Conceptions of reading:

How one reads: 3 statements = reader-based; 2 statements = interactive (text- and reader-based)
How reading ability develops: 2 statements = holistic; 2 statements = differential acquisition (specific skills + holistic); 1 statement = specific skills

Judy (LD specialist):

Background experiences:

M.S. in Elementary Education, specialization in learning disabilities; 7 years teaching experience with the learning disabled.

Typical procedures:

"I tend to pull out the file and read it on Tuesday and test the child on Wednesday. I'm a real 'stew it over a while' person. I've always given myself a couple of hours. Normally I go through everything in their files and figure out what to do before ever selecting a test. I try to find a major weak area and match a test to that area. If there is any question in my mind, I don't want to stop. I always want to rule health problems out first. It's fun because when you're testing, it's like being a detective. Before every step, I formulate questions, then look for answers. The most important information is in working with the child, in the teaching situation. I usually do four hours of testing over a month, using informal and diagnostic teaching and classroom observations, kids can have bad days."

Typical assessments:

Woodcock Reading Mastery Tests, Woodcock-Johnson Psycho-educational Battery of Tests, Key Math, Slingerland Test for Learning Disabilities, Peabody Picture Vocabulary Test, informal (diagnostic) teaching sessions, miscue analyses, teachers', supervisor's, and psychologist's input, classroom observations.

Conceptions of reading:

How one reads: 2 statements = reader-based; 2 statements = interactive (text- and reader-based); 1 statement = text-based
How reading ability develops: 2 statements = holistic; 1 statement = differential acquisition (specific skills + holistic); 2 statements = specific skills

Sarah (classroom teacher):

Background experiences:

M.S. in Elementary Education; 17 years experience in the regular classroom.

Typical procedures:

"I don't put a lot of worth on past tests, the day-to-day interaction with the child is what I tune into a lot more. The one-on-one, I feel I get a lot more out of that, just put me with a child and let me talk with her for 10 minutes. I like to have a picture of the child to know what they might want to read. I want to see how she does on interacting with me on the stories. I like to hear them read. I also do the Dolch words and blends/cluster flash cards. An hour is too long, I usually work in smaller periods of time (5-15 minutes). I do a lot of observing and asking. I get ideas from the Chapter I teacher."

Typical assessments:

Dolch sight words, flash cards, phonics kit, oral reading from basal reader or trade book (most often reading is from library books chosen by the child and/or the teacher), guided questioning after silent reading, classroom observations.

Conceptions of reading:

How one reads: 3 statements = reader-based; 2 statements = interactive (text- + reader-based)
How reading ability develops: 3 statements = holistic language; 2 statements = differential acquisition (specific skills + holistic language)

Bonnie (reading specialist):

Background experiences:

M.A. in Reading; 32 years teaching experience (20 years in the regular classroom, 12 years as a reading specialist)

Typical procedures:

"I like to get a lot of information in working with the children and then go back and get some more information as we need it. I carry on a conversation -- the interview is important. It gives you an idea of their intellectual ability. I ask questions about their reading series, stories. I look at the expression on their faces to see if they are aware of the questions and the testing situation. Typically I give the Woodcock Reading Mastery Test or (basal) placement test and based on the information I get from that, then I have them read something and get them started with something. You develop a program as you go along. I pay very close attention to the word attack on the Woodcock (nonsense words). I like to use the cloze procedure, to see if they can generate their own words in the space. I do a classroom observation. It's nice when you can talk with the teachers or have the paragraphs or "epistles" the teachers write about children (on the report cards)."

Typical assessments:

Woodcock Reading Mastery Test, Barnell-Loft Specific Skills Series; word recognition test, word attack skills test, silent reading inventory, oral reading inventory, spelling samples, close observation during test taking, interview with the subject; non-reading informal assessments for ability to follow directions, miscue analysis, standardized ability tests

Conceptions of reading:

How one reads: 3 statements = reader-based; 2 statements = interactive (text- + reader-based)
How reading develops: 3 statements = holistic language; 2 statements = differential acquisition (specific skills + holistic language)

Appendix C

Basic descriptions of clients and their school-based diagnosis and remediation programs

Client	Age	Gender	Grade	School-diagnosed learning problem	Present remediation services
Brett	8	M	2	Problems w/ phonics (sound-symbol relationships, oral reading disfluency; recommended for LD testing	Chapter I Reading
Matt	9	M	2	Severe attentional problem, inappropriate classroom/ social behaviors; expressive, receptive, and written language problems	LD Resource
Barbara	10	F	4	Severe expressive and receptive language difficulties; mentally retarded; inattentive; poor comprehension skills	Chapter I Reading and Speech/Lang. Therapy
Stephanie	10	F	4	Severe expressive and receptive language difficulties; mentally retarded; extremely poor comprehension skills	Chapter I Reading and Speech/Lang. Therapy
Tonita	10	F	3	Expressive and receptive language difficulties; auditory memory problems; family/ home confounds	Speech/Lang. Therapy
Peter (control)	8	M	3	Auditory processing problem; sight learner; very poor phonics skills	LD Resource

Appendix D

Letters and forms for parents

December 1, 1986

Name
Address

Dear _____:

Reading diagnosis is a fascinating and complex area of problem solving. Past problem solving research has focused on a variety of content areas such as chess, physics, and computer programming and has found that experts are quite unique relative to novices in how they go about solving problems in their areas of expertise. As part of my doctoral degree research, I wish to find out how expert reading diagnosticians actually think through the process of diagnosis and identify clients' reading difficulties. This kind of information can be invaluable in understanding diagnostic activities and finding out which activities lead to more efficient and accurate diagnoses.

I would like you to help me understand this area of interest by granting permission for your child to participate in my study. Specifically, your child will work with two expert reading diagnosticians who have been nominated by school division administrators or university professors. These people will each spend approximately 1 hour with your child on two separate days in early January (before the scheduled clinic sessions begin), in either reading or testing activities. The sessions will be scheduled either after school or on Saturday mornings, whichever times mutually suit you and the diagnostician. These sessions will be videotaped and the first session will be shown to one other diagnostician who will also attempt to identify reading strengths and weaknesses. All three experts will write diagnoses containing the results of their interactions with your child.

I am also asking for your permission to look at your child's school records in order to gather information on family and medical background (e.g., number of brothers and sisters, hearing ability, childhood diseases), standardized test results, and classroom behavior. This background information will allow me to construct a setting as close as possible to what typically occurs in real life (e.g., school settings). If you wish to pass this information on to me yourself, please let me know. Your child's identity will remain anonymous to the diagnosticians, they will be aware only of his or her first name. Please note that the focus of this study is NOT your child specifically, but what diagnosticians do and how they identify readers' problems. All data about your child will serve as informational clues, and my purpose is to see which clues are more important than others for the diagnosticians.

Besides helping me to conduct my research, this study is an opportunity for your child to work with individuals who are known as expert diagnosticians. Of course, their findings will be made available to you, and to the tutor at the clinic who is assigned to your child, if you so desire.

Please respond to this letter by checking and signing the appropriate choice below and returning the letter in the enclosed stamped, addressed envelope, or with your child on her or his next visit to the clinic. If you agree to allow your child to participate, I will contact you within the week regarding background information and tentative dates for the diagnostic sessions. If you have any questions or concerns, please call me at home (381-0497) or at the clinic (961-4863). I do appreciate your time and consideration.

Sincerely,

Susan Magliaro

Doctoral Candidate

John K. Burton
Doctoral Advisor

A Study of Problem Identification
in Reading Diagnosticians
Susan G. Magliaro

Parent Permission Form

____ I give permission for my child _____ to participate in the study on expert reading diagnosticians. Susan Magliaro may have access to my child's records at school

Signed _____

____ I give permission for my child _____ to participate in the study on expert reading diagnosticians. I would like to give Susan Magliaro the background information that she needs for her study. Susan should contact me for that information.

Signed _____

____ I do not give permission for my child _____ to participate in the study on expert reading diagnosticians.

Signed _____

Sample Report Sent Back to the Parent

March 11, 1987

Barbara

Barbara visited the Reading Clinic on January 10 and 31, 1987 to participate in a project that focused on how reading diagnosticians identify children's reading difficulties. On both of those days, Barbara was given an Individual Reading Inventory (IRI) along with other diagnostic assessments to pinpoint areas of strengths and weaknesses in her reading.

On both occasions, Barbara's reading scored between a 3(1) and 3(2) grade level, with work recognition results much higher than comprehension. On the word recognition tests, she demonstrated an adequate knowledge of phonics, with a few errors in vowel rules. The majority of her errors were when she seemed to overlook the word endings. Both diagnosticians noted that Barbara either knew the word right away, or she said, "I don't know that one." She did not attempt to use her phonics knowledge to "sound out" the word. In one session, she told the diagnostician that she doesn't "like to sound out the words," so she doesn't do it.

Barbara's oral reading was fluent, but did not have much expressions. She did move around in her chair quite a bit. It was clear when she was tired or when the reading material was too difficult: she leaned forward or backward a lot, looked uncomfortable with facial expressions, grabbed her head and hair with her hands, and read in a much softer voice.

In the oral reading, Barbara used the context to assist her in word attack. Her errors were mainly partial mispronunciations, repetitions, and self-corrected errors. Barbara showed no difficulty with basic sight words. Her comprehension was good at factual questions, but she had some problems drawing inferences.

Other assessments conducted during the sessions were an informal spelling test and the Word Attack and Passage Comprehension Subtests of the Woodcock Reading Mastery test. On the spelling test, Barbara began to experience some difficulty with words on a third grade level. Her errors were found in words with silent letters (e.g., often > offen), inflectional endings (e.g., helps > helpes), and letter order (e.g., family > flamiy, twenty > tentwy).

On the Word Attack Subtest, Barbara scored at the 2.0 grade level. She did well with consonants and short vowel sounds, but omitted consonant clusters and seemed unsure of long vowel rules. Barbara's Passage Comprehension score was 3.6, which is consistent with the findings on the IRI.

Recommendations

On her word attack skills,

1. Concentrate on learning vowel rules as strategies for word attack, but conduct these reviews in short (time) sessions.
2. Learn rules for multi-syllabic words (e.g., compound words).
3. Use sight word cards and sight words in phrases on cards to develop reading vocabulary, as her strength seems to be in sight learning.

On her oral and silent reading,

1. Use high interest content.
2. Use tape recorded stories to develop listening skills.
3. Record Barbara reading orally, for motivation and to practice her expression.

For comprehension,

1. Again, use high interest content.
2. Use a variety of activities related to skills -- game cards, sequence strips, activities with manipulatives.
3. Read with Barbara, discuss the story and the pictures.
4. Encourage Barbara to predict what will happen in the story, have her explain her reasons for her predictions.

Appendix E

Instructions to diagnosticians for experimental sessions

EXPERIMENTAL SESSION ONE

(preparation, live interaction, written diagnosis, stimulated recall)

A. Before actual session begins:

1. Set up camera in room. Focus lens on work area where the diagnostician and you will be sitting. Load videotape, make sure diagnostician's name, date, and E.S. #1 are marked on tape. Make sure the "display" button is on so that the frame numbers appear on the screen.
2. Load two cassette recorders, again make sure the tapes are marked. Locate cassette recorders near where you will be sitting.
3. Have at least 10 cue recording sheets available to record the cue and time it was chosen. Have an LCD watch or stop-watch available to record the time each cue was chosen. Set the watch to zero time, record the elapsed time.
4. Use the index cards that outline the sequence of activities for this session. This session is to be conducted one-on-one, in same room that is to be used during the entire treatment session. Allow the diagnostician to keep the cards during the entire experimental session as a guide.
5. Allow 15 minutes for instructions and questions.
6. Read the following instructions to the diagnostician:

This experimental session will be divided into four main stages. In STAGE I, I will present you with an actual case of a child who has difficulty with reading. You will be given 30 minutes to examine the file, make notes of information that will be important during your interaction with the child and in the final diagnosis, then choose those tests and reading materials you feel would be most helpful in gathering additional information to diagnose that child's difficulties.

You will be allowed to use your notes and the child's records for the final written diagnosis. You will also be able to get other tests and materials during the session with the child, if you need them. Throughout this preparation stage, please describe what you are doing,

what information you find to be important, and any hunches you have about the child's problem.

On the information sheets in the child's file, the specific bits of information are covered with cue code tags. You will need to remove the tags to uncover the data. Please hand the tag to me so that I may record the order of the information that you choose. I will be writing down the specific cue you chose and the time that you chose it. This is not a speed test, I only wish to record how long you look at and consider each bit of information. This stage will be videotaped for later discussion and analyses.

During Stage II, you will have an hour to work with the client whose file you saw in stage one. You can use the first 10 minutes of the session to build rapport, and get to know the child. Also, you may take a 5-minute break during the session if you or the child desires to do so. You may use those materials and tests you picked out during Stage I, or you may choose other materials, if you need them. This session will be audiotaped and videotaped, and we will be viewing this tape afterwards to discuss your activities with the child. I would like you to interact as much as possible with the child, unless this really does not represent your typical diagnostic activities. In later sessions, the videotape will be viewed by one other diagnostician, who will use the tape to attempt to identify the child's reading problems.

After your hour of interaction with the child, you have an hour to write up a diagnostic report (Stage III). Before you sit down to write, you may request additional information from the child's file. You may use all of your notes and the child's records you have requested, but no audio or videotapes, to assist you in reporting your identification of the child's reading difficulty(ies).

During the final stage (Stage IV), we'll review the videotapes of your preparation and interaction with the child. I'll ask you to talk about those things you chose as important, and your thoughts, hunches, etc. that you considered at that time. You may stop and start the tape whenever you wish, and tell more about any aspect of your activities that you feel are important. This stage will be audiotaped for later analysis. This stage will be concluded with a short (5-10) "wrap-up" summary.

B. Preparation (30 minutes prior to scheduled appointment with child)

1. Read these instructions to the diagnostician. Please emphasize the time limitation, the need to focus on the MOST IMPORTANT information, and the selection of tests and materials.

(Using the case abstract card clipped to the front of the child's folder, introduce the child to the diagnostician.)

For this session, you will need to diagnose the reading problem of _____. S/he is ____ years old and is in the _____ grade.

I want you to tell me everything that passes through your head during this examination of the child's records. This document (hand the diagnostician the "Case Information Inventory") indicates the information available on our case. Please note that the numbers in the boxes are NOT grade levels; they are code numbers for locating requested materials. You may request information by referring to the Inventory. For example, by asking for IV-A, you would get the child's Kindergarten Screening Test results. An asterisk in the box means that the information is not available. Take a few moments to study this inventory before we proceed. (Pause 60 seconds.)

Think aloud as you are examining the data; describe what you are looking at and thinking about. Remember that you have only 30 minutes to prepare for your session with the child.

2. Remind diagnostician to describe what she is doing, to talk about what she is finding that is important, and to take notes for the written report. DO NOT request explanations for choices or activities. Sample probes for when the diagnostician is not speaking (i.e., after 15-20 seconds):

   "What are you noticing now?"

   "Please tell me what you are thinking about."

3. Begin videotape and audiotapes.
4. Have cue sheets and LCD watch ready, record the code name of each cue and the time during the session that the cue is chosen.

5. At about 15 minutes into this session, remind the diagnostician that she needs to select her materials and tests.
6. If, after the diagnostician gets her tests and materials together, there is any of the 30 minutes left, she may go back to the cue inventory and ask to see other information.
7. Stop the session after 30 minutes. Stop the videotape and audiotapes. Leave the videotape in the camera for the interaction phase. Take out the audiotapes and check to see if they are labeled with diagnostician's name, date and E.S. #1, Stage I. Insert new audiotapes in the machine if needed, making sure they are labeled with diagnostician's name, date, and E.S. #1, Stage II. (Or, if you have a 90 or 120 min. tape, leave tapes in and re-label as E.S. #1, Stages I/II.)
8. Go with the diagnostician to meet the assigned child.

C. Interaction (one hour)

1. Introduce the child to the diagnostician, briefly tell the child what will happen in the next hour (s/he will have already been told, but repeat anyway), ask if any questions. For example:

   "Hi, Barbara. I'd like you to meet Sarah. She will be working with you today, trying to find out about how you read. She'll work with you up in one of rooms you've worked in over the past few months. In fact, you can probably show Sarah around the clinic. You're reading session will be videotaped. Only Sarah and I will look at it later. You may look at it some day soon, if you'd like. Let's get started. Why don't you lead the way upstairs, and we'll all find the right room."
2. Go back to the "experimental" room, situate child next to or perpendicular to diagnostician (not across from), make sure both are in view of camera's lens.
3. Make sure diagnostician has everything she needs to begin including a time piece so that she can pace her activities, ask for any further questions.
4. Begin videotape and the audiotapes. Leave room with door ajar.
5. Locate self near door to monitor first 10-minute rapport-building interval and 5-minute break interval, and to be available for any needs that arise.

6. The session may end when the diagnostician feels she has enough information. Please stay with the child downstairs until his/her parent comes. The diagnostician may go right into the next stage.
7. Stop session after one hour. Stop the audio and video- tape machines. Make sure both tapes are marked with the diagnostician's name, date, and E.S. #1. Rewind the videotape for the stimulated recall.
8. Go with child and diagnostician back downstairs, parent should be waiting. If not, wait with child until the parent comes.
9. Allow the diagnostician to take a break then return to the experimental room to write up her diagnosis.

D. Written Diagnosis (one hour)

1. Ask the diagnostician if she would like to see any more of the child's records. Give her a couple of minutes to look back at the Case Inventory.
2. Remind the diagnostician of the procedure for recording her own viewing of the data (i.e., putting tags in order, stuck to the inside of her folder).
3. Diagnostician may use the requested child's records and her notes to develop her diagnostic report.
4. She may write as much as she wants, and either in narrative or outline form or both.
5. She does not have to use up the full hour, but may not take more than one hour. Stress again that she needs to report the most important information that will support the problem she has identified.
6. When she is done, make sure her name, the date, and E.S. #1 are on all pages.
7. Put all notes, test protocols, and the written diagnosis in the folder with her name, the date, and E.S. #1 marked on the folder tab.
8. Take a 10-15 minute break, if desired.

E. Stimulated Recall

1. Hook up the camera to the monitor. Rewind the videotape to the beginning, if not already done. Make sure the display numbers appear on the screen.

2. Load two audio cassette recorders with tapes, marked with diagnostician's name, the date, and E.S. #1, Stage IV. Situate the audiotapes next to where the diagnostician and you will sit.

2. Get comfortable. Begin the audiotapes. Read these instructions as the cognitive set for the diagnostician:

Let's look back at this diagnostic session, beginning with the initial preparation stage. I'd like you to do most of the talking. Attempt to recall what you were thinking about as you gathered information and attempted to diagnose this child's reading difficulty(ies). Please focus on the cues you found to tell you something important about this child as a reader, the kinds of hypotheses you developed, and, as you went on, those cues that supported or ruled out your hypotheses. Please explain each step as thoroughly as you can so that I may be able to follow your thoughts. You may stop and start the tape whenever you feel it is important to review or elaborate on an event.

I shall record your recall with notes and the audio tape recorders. Again, these tapes will be retained only long enough to record and analyze the data, unless you have given permission for other research-oriented uses.

Do you have any questions so far?

3. Show the diagnostician how to stop and start the videotape machine. Begin the tape.

4. Take notes on information that may not be picked up on the audiotape, such as particular aspects of the taped interaction that were pointed out.

5. Use the following questions for probes, when needed (i.e., after 15-20 seconds of silence):

   What did you notice here?

   Why did you notice or ask for this piece of information?

   What did it tell you?

   Did you have any hunches that were supported or ruled out? What cues prompted these changes?

6. The diagnostician may fast forward or rewind to any part of the preparation or interactions stages that she felt were particularly important for her diagnosis.
7. If the diagnostician is not verbalizing or is ignoring cues that the interviewer is curious about, the interviewer may ask if specific cues mean anything (i.e., also look for non-examples of important cues).
8. Monitor the audiotapes. Turn over or change when needed.
9. At the end of the stimulated recall, ask: Is there anything more you'd like to tell me about this child as a reader or this child's reading problems?
9. The stimulated recall session is ended when the entire tape has been viewed. DO NOT turn off the audiotapes. Go right into the "Wrap-up" stage.

F. Wrap-up

1. Ask the diagnostician to again summarize the diagnosis. For example: "Before we end this session, would you please briefly summarize your diagnosis of the child's reading problems?"
2. Ask: Did the "preparation, interaction, and write-up" stages that you completed in this treatment resemble your typical diagnostic procedures?
3. Ask: Is the model (or procedures) of diagnosis that you followed were reflective of your training, or is the procedure is something that you developed on your own?
4. Ask: Do you have any questions?
5. Verify time and date of next experimental session.
6. Make sure all tapes and papers from this experimental session are marked with the diagnostician's name, the date, and E.S. #1. Place papers in the marked folder.

EXPERIMENTAL SESSION TWO

(paper and pencil preparation/interaction,

written diagnosis, stimulated recall)

A. Before the actual session begins.

1. Set up the camera. Load a videotape, marked with the the diagnostician's name, the date and E.S. #2. Load two cassette recorders with marked tapes, and place them near where the diagnostician and you will be sitting. Have a third cassette recorder available for the diagnostician if she wishes to hear the audiotapes in the child's file.
2. Use the index cards that outline the sequence of activities for this session. This session will be conducted one-on-one, in the room that will be used for the entire treatment session. Allow 15 minutes for instructions and questions.
3. Read these instructions to the diagnostician.

The experimental session will be divided into three stages. In Stage I, I shall present you with an actual case of reading difficulty. The case consists of the school records, test scores, audio reading recordings of test sessions, etc. for a child who has been a client at this Reading Clinic. You are requested to attempt to diagnose this case in much the same manner you would use in diagnosing a real case. Assume that you are working with the child in a one-to-one setting. Think aloud -- verbalize your analysis of this case. Stop whenever this interferes with your work. During Stage I, a videotape record will be made as you examine the case. We will not permanently retain this tape unless you have given us permission on the written form.

After you have collected all the information that you need to identify the child's reading difficulty, I will ask you to write a diagnostic report (i.e., Stage II).

In Stage III, we shall jointly view the videotape while you attempt to recall what you were thinking about as you attempted the diagnosis. I shall record your recall with notes and an audio tape recorder. Again, this tape will be retained only long enough to record data, unless you have given us permission for other research uses.

In Stage IV, I shall ask you to review this procedure and name those aspects of it that would have made this session better for you in your task. We are especially interested in any information which should be added to the case, such as additional tests or information, that you typically find to be critical for an accurate diagnosis.

Do you have any questions so far?

B. Preparation/Interaction Stage (no time limit)

1. Begin audio and videotapes.

2. Read these instructions to the diagnostician.

Let's get started.

(Using the case abstract card clipped to the front of the child's folder, introduce the child to the diagnostician.)

For this session, you will need to diagnose the reading problem of _____. S/he is ____ years old and is in the _____ grade.

I have a set of materials comprising our particular case. Your task is to request information about this case and to use this information to determine the most likely diagnosis and to suggest a general program of remediation. (Hand the diagnostician the "Case Information Inventory.")

This document indicates the information available in our case... Please note that the numbers in the boxes are NOT grade levels; they are code numbers for locating requested materials.

You may request information by referring to the Inventory. For example, by asking for _____, you would get the _____. An asterisk in the box means that the information is not available. Take a few moments to study this inventory before we proceed. (Pause 60 seconds.)

There is no right or wrong amount of information to request for your diagnosis. Use the same procedure you usually employ when diagnosing a case. When you request a FORM OF INFORMATION, I will give it to you. You may keep all items requested throughout the session. Do you have any questions?

3. Begin the session. Make sure the diagnostician asks for the information by code and by name. Do not participate in any way other than to provide the requested information or to clarify procedural questions.
4. Remind the diagnostician to think aloud. Sample probes:

   "What are you noticing now?"

   "Please tell me what you are thinking about?"
5. There is no time limit, the case is considered completed when the diagnostician collects as much information as desired. Monitor the audiotapes, turn over or change when needed.
6. Turn off the videotape and rewind. Turn off the audiotapes.

C. Written Diagnosis

1. When the diagnostician has collected as much information as desired, ask her to write a diagnostic report.
2. She may use all notes and records that she has requested from our file to help her to develop this report.
3. There is no time limit.
4. Take a 10-15 minute break, if desired.

C. Stimulated Recall

1. Rewind the videotape. Hook up the camera to the monitor, or load the videotape into the VCR. Load new, marked audiotapes into two cassette recorders. Place the recorders near where the diagnostician and you will sit to view the videotape.
2. Get comfortable. Begin the audiotapes. Read these instructions as the cognitive set for the diagnostician:

Let's look back at this diagnostic session, beginning with the initial preparation stage. I'd like you to do most of the talking. Attempt to recall what you were thinking about as you gathered information and attempted to diagnose this child's reading difficulty(ies). Please focus on the cues you found to tell you something important about this child as a reader, the kinds of hypotheses you developed, and, as you went on, those cues that supporte d or ruled

out your hypotheses. Please explain each step as thoroughly as you can so that I may be able to follow your thoughts. You may stop and start the tape whenever you feel it is important to review or elaborate on an event.

I shall record your recall with notes and the audio tape recorders. Again, these tapes will be retained only long enough to record and analyze the data, unless you give permission for other research-oriented uses.

Do you have any questions so far?

3. Show the diagnostician how to stop and start the videotape machine. Begin the tape.
4. Take notes on information that will not be picked up on the audiotape, such as particular aspect of the taped interaction that were pointed out.
5. Use the following questions for probes, when needed:

   What did you notice here?

   Why did you notice or ask for this piece of information?

   What did it tell you?

   Did you have any hunches that were supported or ruled out? Which cues prompted these changes?
6. The diagnostician may fast forward or rewind to any part of the preparation or interactions stages that she felt were particularly important for her diagnosis.
7. If the diagnostician is not verbalizing or is ignoring cues that the interviewer is curious about, the interviewer may ask if specific cues mean anything (i.e., also look for non-examples of important cues).
8. The stimulated recall session is ended when the entire tape has been viewed. Monitor the audiotapes, turn over or change when needed.
9. DO NOT turn the audiotapes off. Leave on for wrap-up stage. Go right into "Wrap-up" stage.

F. Wrap-up

1. Ask the diagnostician to again summarize the diagnosis.

2. Ask the diagnostician to describe her typical diagnostic procedures and compare this treatment to her procedures. Focus on important techniques that were not used in this session.
2. Ask if the model (or procedures) of diagnosis that she followed were reflective of how she was trained, or if the procedure is something that she developed independently or has changed as a result of this project.
3. Ask for any questions.
4. Verify time and date of next experimental session.
5. Make sure all tapes and papers from the experimental session are marked with the diagnostician's name, the date, and E.S. #2. Place papers in a labeled folder.

EXPERIMENTAL SESSION THREE

(preparation, live interaction, stimulated recall, written diagnosis)

A. Before actual session begins:

1. Set up camera in room. Focus lens on work area where the diagnostician and you will be sitting. Load videotape, make sure diagnostician's name, date, and E.S. #3 are marked on tape. Make sure the "display" button is on so that the frame numbers appear on the screen.
2. Load two cassette recorders, again make sure the tapes are marked with name, date, E.S. #3, Stage I. Locate the recorders near where you will be sitting.
3. Have at least 10 cue recording sheets available to record the cue and time it was chosen. Have an LCD watch or stopwatch available to record the time each cue was chosen. Set the watch to zero time, record the elapsed time.
4. Use the index cards to illustrate the order of activities for this session. This session will be conducted one-on-one, in the same room that is to be used during the entire experimental treatment. Allow the diagnostician to keep the cards during the entire experimental session as a guide.
5. Allow 15 minutes for instructions and questions.
6. Read these instructions to the diagnostician.

This experimental session will be much like the first experimental session, except that we will review your interaction with the client before you write up the diagnostic report. Like the first experimental session, this session is divided into four stages. In Stage I, I will present you with the file of an actual case of a child who has difficulty reading and an inventory of the information available on that child. You will be given 30 minutes to ask for information from the file, make notes of important data, then choose those tests and reading materials you feel would be most helpful in gathering additional information to diagnose the child's difficulties.

You may use your notes and the child's records for the final written diagnosis. Also, you may get other tests and materials during the session with the child, if you need them. Throughout this preparation stage, I'd like you to describe what you are doing, what informa-

tion you find to be important, and any hunches you may be considering before you meet the child.

As in the first session, the specific bits of data on the information sheets in the child's file are covered with cue code tags. You will need to remove the tags to uncover the data. Please hand the tag to me so that I may record the order of cues that you choose. I will be writing down the specific cue you choose and the time that you choose it. This is not a speed test, I only wish to record how long you look at and consider each cue. This stage will be videotaped for later discussion and analyses.

During Stage II, you will have an hour to work with the child whose file you just examined. You can use the first 10 minutes of the session to build rapport, and get to know the child. Also, you may take a 5-minute break during the session if you or the child desires to do so. You may use those materials and tests you picked out during Stage I, or you may choose other materials, if you need them. I would like you to interact as much as possible with the reader, unless this really does not represent your typical diagnostic activities. This session will be audiotaped and videotaped.

Immediately after you work with the child, we'll review the videotapes of your preparation and diagnostic interaction (i.e., Stage III). I'll ask you to talk about those cues you chose as important, and your thoughts, hunches, etc. at that time. You may stop and start the tape whenever you wish, and talk more about any of your activities or the child's behavior that you feel are important. This stage will be audiotaped.

After we review the videotape, you will have one hour to write up a diagnostic report (Stage IV). Before you sit down to write, you may request additional information from the child's file. You may use all of your notes and the child's records you have requested, but no audio or videotapes, to assist you in reporting your identification of the child's reading difficulty(ies). This stage will be concluded with a short (5-10 minute) "Wrap-up" summary.

Do you have any questions so far?

B. Preparation (30 minutes prior to scheduled appointment with child)

1. Read these instructions to the diagnostician (emphasize the time limitation, the need to focus on the MOST IMPORTANT information, and the selection of tests and materials).

(Using the case abstract card clipped to the front of the child's folder, introduce the child to the diagnostician.)

For this session, you will need to diagnose the reading problem of _____. S/he is ____ years old and is in the _____ grade.

I want you to tell me everything that passes through your head during this examination of the child's records. Here is the "Case Information Inventory" for this child. Please choose from the available information. As you remove the cue code tag from the information sheets, name the piece of information that you are examining and describe what you are looking at and thinking about. Remember that you have only 30 minutes to prepare for your session with the child. If there is any of the 30 minutes left after you have chosen your tests and materials, you may look back at your inventory and ask me for more information on the child.

Do you have any questions before we start?

2. Remind diagnostician to describe what she is doing, to talk about what she is finding that is important, and to take notes for the written report. DO NOT request explanations for choices or activities. Sample probes for when the diagnostician is not speaking (i.e., after 15-20 seconds):

   "What are you noticing now?"

   "Please tell me what you are thinking about."

3. Begin videotape and audiotape.
4. Have cue sheets and LCD watch ready, record the code name of each cue, the time during the session that the cue is chosen, and any pertinent comments or observations that you feel will not be picked up on the tapes.
5. At about 15 minutes into this session, remind the diagnostician that she needs to select her materials and tests.

6. If, after the diagnostician gets her tests and materials together, there is any of the 30 minutes left, she may go back to the cue inventory and ask to see other information.
7. Stop the session after 30 minutes. Stop the videotape and audiotape. Leave the videotape in the camera for the interaction phase. Take out the audiotape and check to see if it is labeled with diagnostician's name, date and E.S. #3, Stage I. If needed, insert a new audiotape in the machine, making sure it is labeled with diagnostician's name, date, and E.S. #3, Stage II.
8. Go with the diagnostician to meet the assigned child.

C. Interaction with child (one hour)

1. Introduce the child to the diagnostician, briefly tell the child what will happen in the next hour (s/he will have already been told, but repeat anyway), ask if any questions. For example:

   "Hi, Barbara, I'd like you to meet Sarah. She will be working with you today, trying to find out about how you read. She'll work with you up in one of the rooms you've worked in over the past few months. In fact, you can probably show Sarah around the clinic. Your reading session will be videotpaed. Only Sarah and I will look at it later. You may look at it some day soon, if you'd like. Let's get started. Why don't you lead the way upstairs, and we'll find the right room."
2. Go back to the "experimental" room, situate child next to or perpendicular to diagnostician (not across from), make sure both are in view of camera's lens.
3. Make sure diagnostician has everything she needs to begin including a time piece so that she can pace her activities, ask for any further questions.
4. Begin the videotape and audiotapes. Leave room with door ajar.
5. Locate self near door to monitor first ten-minute rapport-building interval and 5-minute break interval, and to be available for any needs that arise.
6. Stop session after one hour. Stop the audio and video- tape machines. Make sure both tapes are marked with the diagnostician's name, date, and E.S. #3.

7. Go with child and diagnostician back downstairs, parent should be waiting. If not, wait with child until the parent comes.
8. Allow the diagnostician to take a 10-15 minute break, then return to the experimental room for the stimulated recall stage.

D. Stimulated Recall

1. Hook up the camera or a VCR to the monitor. Rewind the videotape to the beginning. Make sure the display numbers appear on the screen.
2. Load two audio cassette recorders with tapes, marked with diagnostician's name, the date, and E.S. #3. Situate the audiotapes next to where the diagnostician and you will sit.
3. Get comfortable. Begin the audiotapes. Read these instructions as the cognitive set for the diagnostician:

Let's look back at this diagnostic session, beginning with the initial preparation stage. I'd like you to do most of the talking. Attempt to recall what you were thinking about as you gathered information and attempted to diagnose this child's reading difficulty(ies). Please focus on the cues you found to tell you something important about this child as a reader, the kinds of hunches you considered, and, as you went on, those cues that supported or ruled out your hunches. Please explain each step as thoroughly as you can so that I may be able to follow your thoughts. You may stop and start the tape whenever you feel it is important to review or elaborate on an event.

I shall record your recall with notes and the audio tape recorders. Again, these tapes will be retained only long enough to record and analyze the data, unless you have given permission for other research-oriented uses.

Do you have any questions so far?

4. Show the diagnostician how to stop and start the videotape machine. Begin the videotape.
5. Take notes on information that may not be picked up on the audiotape, such as particular aspects of the taped interaction that were pointed out.

6. Use the following questions for probes, when needed: (i.e., after 15-20 seconds of silence):

   What did you notice here?

   Why did you notice or ask for this piece of information?

   What did it tell you?

   Did you have any hunches that were supported or ruled out? What cues prompted these changes?

7. The diagnostician may fast forward or rewind to any part of the preparation or interactions stages that she felt were particularly important for her diagnosis.
8. If the diagnostician is not talking, or if you notice cues that may be considered important, stop the tape and probe (e.g., what did you think about this...); i.e., look for non-examples, too.
9. At the end of the stimulated recall, ask: Is there anything more you'd like to tell me about this child as a reader or this child's reading problems?
10. The stimulated recall session is ended when the entire tape has been viewed. Turn off the tape recorders, but leave the tapes in for the final Wrap-up.
11. Allow the diagnostician to take a 10-15 break before she writes up her final diagnosis.

D. Written Diagnosis (one hour)

1. Ask the diagnostician if she would like to see any more of the child's records. Give her a couple of minutes to look back at the Case Inventory.
2. Remind the diagnostician of the procedure for recording her own viewing of the data (i.e., putting tags in order, stuck to the inside of her folder).
3. Diagnostician may use the requested child's records and her notes to develop her diagnostic report.
4. She may write as much as she wants, either in narrative or outline form or both.
5. She does not have to use up the full hour, but may not take more than one hour.
6. When she is done, make sure her name, the date, and E.S. #3 are on all pages.

7. Put all notes, test protocols, and the written diagnosis in the folder with her name, the date, and E.S. #3 marked on the folder tab.
8. Allow a brief break, if needed. If not, go right into the "Wrap-up" session.

F. Wrap-up

1. Turn on both audio cassette recorders. (This stage may be taped right at the end of the stimulated recall session.)
2. Ask: Before we end this session, would you please briefly summarize your diagnosis of the child's reading problems?
3. Ask: Did the "preparation, interaction, reflection, and write-up" stages that you completed in this session resemble your typical diagnostic procedures.
4. Ask: Did you do anything in this diagnostic session that was different from your typical procedures. (Attempt to elicit any change prompted by take more than one hour.
6. When she is done, make sure her name, the date, and E.S. #3 are on all pages.
7. Put all notes, test protocols, and the written diagnosis in the folder with her name, the date, and E.S. #3 marked on the folder tab.
8. Allow a brief break, if needed. If not, go right into the "Wrap-up" session.

EXPERIMENTAL SESSION FOUR

(preparation w/ think aloud, videotaped interaction w/

think aloud, written diagnosis)

A. Before actual session begins:

1. Set up camera in room. Focus lens on work area where the diagnostician and you will be sitting. Load videotape, make sure diagnostician's name, date, and E.S. #4 are marked on tape. Load two cassette recorders, again make sure the tapes are marked with name, date, E.S. #4, Stage I. Locate the recorders near where you will be sitting.
2. Use the index cards to illustrate the order of activities for this session. Allow 15 minutes for instructions and questions. (This session will be conducted one-on-one, in the same room that is to be used during the entire experimental treatment.)
3. Read these instructions to the diagnostician.

This experimental session will be somewhat different from the first session in which you interacted with the child in person. In this session, you will attempt to identify a child's problem by watching a videotape of the child as he or she works with another diagnostician. The session begins like the first, with you gathering what you believe to be the most important information about the child from his or her cumulative folder. Please describe aloud the information you are selecting and what about that information you are noticing as most important. For this session, I would like you also to take the time to explain as thoroughly as you can why this information is important, and how it is leading you to tentative hunches about the child as a reader.

You will have an inventory of the information available on the child. In this Stage I, you will have 30 minutes in which you may ask me for specific pieces of information. During this time you will also need to describe the tests and materials that you would use if you were going to be meeting with the child.

In Stage II, you will "interact" with the child by viewing a videotape of the child working with another diagnostician. During this interaction, I would like you to think aloud about what

you are noticing to be important about the CHILD's performance. Also, please take notes on the information that you will need for the written diagnosis, as this tape will not be available during that stage.

Please focus on the information you think are most important, your thoughts about the child's reading difficulty(ies), and as you go on, tell me which cues are supporting or ruling out your initial thoughts. Please explain your thinking as best as you can. Feel free to stop, rewind, and re-start the tape whenever you wish. Also, feel free to pause to reflect aloud about your thinking, or elaborate on specific behaviors or cues you find to be particularly important. Don't be afraid to ponder or guess out loud.

You may stop when you feel that you have all the information that you need to write a diagnosis. You may use the information that you selected from the file and your written notes, but not the tapes, during this stage. You will have one hour to complete this last stage of this session.

When you have finished the written diagnosis, we'll talk a short while about the tests and/or materials you would have used if you were able to work with this child. In this wrap-up session, I would like you to tell me what kinds of information you would have expected to get and how it would have helped you to better identify the child's reading problem.

Do you have any questions so far?

B. Preparation w/ think aloud (no time limit)

1. Read these instructions to the diagnostician (emphasize the need to primarily focus on the MOST IMPORTANT information about the CHILD, and the selection of tests and materials).

(Using the case abstract card clipped to the front of the child's folder, introduce the child to the diagnostician.)

For this session, you will need to diagnose the reading problem of _____. S/he is ____ years old and is in the _____ grade.

I want you to tell me everything that passes through your head during this examination of the child's records. Here is the "Case Information Inventory" for the child. You will need

to ask for the information you wish to examine. Remember, the asterisk indicates that that specific information is not available. Once you have a sheet of information, remove the cue code tags to see the data. As you remove the cue code tag, name the piece of information that you are examining and describe what you are looking at and thinking about. Please tell me why each bit of information is important and what it is telling you about this child as a reader.

Before we look at the videotape of the child, I would also like you to choose the tests and materials you would be using if you were really going to be working with this child. The preparation session continues until you state that you have enough information, and are ready to "interact" with the child.

Do you have any questions before we start?

2. Remind diagnostician to describe what she is doing, to talk about what she is finding that is important, explain why the information is important, what it's telling her, and to take notes for the written report. Sample probes for when the diagnostician is not speaking (i.e., after 15-20 seconds of silence):

   "What are you noticing now?"

   "Please tell me what you are thinking about."

   "Why did you choose this cue?"

   "Do you still think the child has a problem with ...?"

3. Begin the videotape and audiotapes.
4. Have cue sheets and LCD watch ready, record the code name of each cue and the time during the session that the cue is chosen, and any pertinent comments or observations that you feel will not be picked up on the tapes.
5. At about 20-25 minutes into this session, remind the diagnostician that she needs to select her materials and tests.
6. Continue the session until the diagnostician states that she is ready to view the child's videotape.

7. Stop the videotape and audiotapes. Take out the audiotapes and check to see if they are labeled with diagnostician's name, date, and E.S. #4, Stage I. Insert new audiotapes (if needed) in the machine, making sure they are labeled with the diagnostician's name, date, and E.S. #4, Stage II.
8. Allow the diagnostician to take a short break while you load the videotape of the assigned child into the VCR.

C. Videotaped interaction w/ think aloud (no time limit)

1. Load two audio cassette recorders with tapes, marked with diagnostician's name, the date, and E.S. #4, and Stage II. Make sure the "display" button is on.
2. Situate the audiotapes next to where the diagnostician and you will sit.
2. Get comfortable. Begin the audiotapes. Read these instructions as the cognitive set for the diagnostician:

As we analyze the child's reading behavior in this diagnostic session, I'd like you to do most of the talking. Please focus on the CHILD as you gather information and attempt to diagnose his or her reading difficulty(ies). Please think aloud about what you are seeing or hearing that tells you something important about this child as a reader, the kinds of hunches you are considering, and, as you go on, the cues that support or rule out your hunches. Please explain each step as thoroughly as you can so that I may be able to follow your thoughts. You may stop and start the tape whenever you feel it is important to review or elaborate on an event.

I shall record your think aloud with notes and the audio tape recorders. Again, these tapes will be retained only long enough to record and analyze the data, unless you have given permission for other research-oriented uses.

Do you have any questions so far?

2. Show the diagnostician how to stop and start the videotape machine. Begin the tape.
3. Remind diagnostician to describe what she is doing, to talk about what she is finding that is important, explain why the information is important, what it's telling her, and

to take notes for the written report. Sample probes for when the diagnostician is not speaking: (i.e., after 15-20 seconds of silence):

"What are you noticing now?"

"Please tell me what you are thinking about."

"Why did you choose this piece of information?"

"Do you still think the child has a problem with ...?"

"Tell me more about how you interpreted that (behavior)."

4. Remind the diagnostician that she can stop and start the tape whenever needed. You may also stop the tape to probe the diagnostician about an observed cue or tentative hypothesis.
5. Continue the think aloud until the tape is finished.
6. At the end of the stimluated recall, ask: Is there anything more you'd like to tell me about this child as a reader or this child's reading problems?
6. Turn off the audiotapes and rewind the videotape. Make sure the audiotapes are marked with the diagnostician's name, date, E.S. #4, and Stage II. Leave audiotapes in the machines to record the "Wrap-up" session.
7. Allow a 10-15 minute break before the next stage (written diagnosis).

D. Written Diagnosis (one hour)

1. Ask the diagnostician if she would like to see any more of the child's records. Give her a couple of minutes to look back at the Case Inventory.
2. Remind the diagnostician of the procedure for recording her own viewing of the data (i.e., putting tags in order, stuck to the inside of her folder).
3. The diagnostician may use the requested child's records and her notes to develop her diagnostic report.
2. She may write as much as she wants, either in narrative or outline form or both.
3. She does not have to use up the full hour, but may not take more than one hour.
4. When she is done, make sure her name, the date, and E.S. #4 are on all pages.

5. Put all notes, test protocols, and the written diagnosis in the folder with her name, the date, and E.S. #4 marked on the folder tab.

F. Wrap-up

1. Turn on both audio cassette recorders. (This stage may be taped right at the end of the stimulated recall session.)
2. Ask: Before we end this session, would you please briefly summarize your diagnosis of the child's reading problems?
3. Ask: Did the "preparation, interaction, reflection, and write-up" stages that you completed in this session resemble your typical diagnostic procedures.
4. Ask: Did you do anything in this diagnostic session that was different from your typical procedures. (Attempt to elicit any change prompted by take more than one hour.
5. Ask: Do you have any questions?
6. Verify time and date of next experimental session.
7. Make sure all tapes and papers from the experimental session are marked with diagnostician's name, the date, and E.S. #4. Place papers in marked folder.

EXPERIMENTAL SESSION FIVE

(preparation, videotaped interaction, written diagnosis,

stimulated recall)

A. Before actual session begins:

1. Set up camera in room. Focus lens on work area where the diagnostician and you will be sitting. Load videotape, make sure diagnostician's name, date, and E.S. #5 are marked on tape. Make sure the "display" button is on so that the frame numbers appear on the screen.
2. Load two cassette recorders, again make sure the tapes are marked with name, date, E.S. #5, Stage I. Locate the recorders near where you will be sitting.
3. Have at least 10 cue recording sheets available to record the cue and time it was chosen. Have an LCD watch or stopwatch available to record the time each cue was chosen.
4. Set up the VCR with the monitor in order that you will be ready to view the videotape during Stage II. Make sure you have the videotape of the correct child in the machine, ready to view.
5. Use the index cards to illustrate the stages in this treatment. This experimental session will be conducted one-on-one, in the same room that is to be used during the entire treatment. Allow the diagnostician to keep the cards during the entire experimental session as a guide.
6. Allow 15 minutes for instructions and questions.
7. Read these instructions to the diagnostician.

This experimental session will be somewhat different from the first session in which you interacted with the child in person. In this session, you will attempt to identify a child's problem by watching a videotape of the child working with another diagnostician. The session begins like the first, with you gathering what you believe to be the most important information about the child from his or her cumulative folder. Please describe aloud the cues that you are

selecting, what information you are noticing as most important, and any tentative hunches you may be considering.

As in the preparation stages of the other experimental treatments, you will have an inventory of the information available on the child. You will have 30 minutes in which you may ask me for specific pieces of information. During this time you will also need to describe the tests and materials that you would use if you were going to actually meet with the child.

In Stage II, you will "interact" with the child by viewing a videotape of the child working with another diagnostician. During this interaction, I would like you to think aloud about what you are noticing to be important about the CHILD's performance. Also, please take notes on the information that you will need for the written diagnosis, as this tape will not be available during that stage.

Please focus on the cues you think are most important, your tentative thoughts about the child's reading difficulty(ies), and as you go on, tell me which cues are supporting or ruling out tentative hunches. Feel free to stop, rewind, and re-start the tape whenever you wish in order to further describe or elaborate on specific behaviors or cues you find to be particularly important.

You may stop when you feel that you have all the information that you need to write a diagnosis. Before you sit down to write, you may request additional information from the child's file. You may use any of the information that you have requested from child's file and your notes, but no tapes, during this stage. You will have one hour to complete this stage of this session.

When you have finished the written diagnosis, we'll go back and review the videotapes of your preparation and videotape interaction with the child. I'll ask you to reflect back on the information you thought to be most important, and to explain why you noticed the specific information, your tentative hunches, and what cues supported or ruled out those hunches. You may stop and start the tape whenever you wish, and elaborate on any aspect of your activities that you feel are especially important. Finally, we'll end this session with a short (5-10 minute) "Wrap-up" summary.

Do you have any questions so far?

B. Preparation (30 minutes)

1. Read these instructions to the diagnostician (emphasize the time limitation and the need to focus on the MOST IMPORTANT information about the CHILD, and the selection of tests and materials):

(Using the case abstract card clipped to the front of the child's folder, introduce the child to the diagnostician.)

For this session, you will need to diagnose the reading problem of _____. S/he is ____ years old and is in the _____ grade.

I want you to tell me everything that passes through your head during this examination of the child's records. Here is the "Case Information Inventory" for this child. Please choose from the available information, missing data is coded with an asterisk. As you remove the cue code tag from the information sheets, name the piece of information that you are examining and describe what you are looking at and thinking about. Remember that you have only 30 minutes to gather the most important information and describe the tests and materials you would use if you were really going to be working with this child. If there is any of the 30 minutes left after you have chosen your tests and materials, you may look back at your inventory and ask me for more information on the child.

Do you have any questions before we start?

2. Remind diagnostician to describe what she is doing, to talk about what she is finding that is important, and to take notes for the written report. DO NOT request explanations for choices or activities.

   Sample probes for when the diagnostician is not speaking (i.e., after 15-20 seconds):

   "What are you noticing now?"

   "Please tell me what you are thinking about."

3. Begin videotape and audiotapes.

4. Have cue sheets and LCD watch ready, record the code name of each cue and the time during the session that the cue is chosen, and any pertinent comments or observations that you feel will not be picked up on the tapes.
5. At about 15 minutes into this session, remind the diagnostician that she needs to select her materials and tests.
6. If, after the diagnostician gets her tests and materials together, there is any of the 30 minutes left, she may go back to the cue inventory and ask to see other information.
7. Stop the session after 30 minutes. Stop the videotape and audiotapes. Take out the audiotapes and check to see if they are labeled with diagnostician's name, date, and E.S. #5, Stage I. Insert new audiotapes in the machines if needed, making sure they are labeled with diagnostician's name, date, and E.S. #5, Stage II.
8. Allow the diagnostician to take a short break while you load the videotape of the assigned child into the VCR.

C. Videotaped interaction w/ descriptive think aloud (one hour)

1. Load two audio cassette recorders with tapes (if needed), marked with diagnostician's name, the date, and E.S. #5, and Stage II. Situate the audiotapes next to where the diagnostician and you will sit.
2. Focus the camera onto your work area, trying to get both the diagnostician and a bit of the monitor into view (the diagnostician is the most important.) Make sure the "display" button is on.
2. Get comfortable. Begin the audiotapes and the camera. Read these instructions as the cognitive set for the diagnostician:

As we analyze the child's reading behavior in this diagnostic session, I'd like you to do most of the talking. Please focus on the CHILD as you gather information and attempt to diagnose his or her reading difficulty(ies). Please think aloud about the cues that tell you something important about this child as a reader, the kinds of hunches you are considering, and, as you go on, the information that supports or rules out those hunches. You may stop and start the tape whenever you feel it is important to review or elaborate on an event.

I shall record your comments with notes and on the audio and videotape recorders. Again, these tapes will be retained only long enough to record and analyze the data, unless you have given permission for other research-oriented uses.

Do you have any questions so far?

3. Show the diagnostician how to stop and start the VCR. Begin the tape in the VCR.
4. Remind diagnostician to describe what she is doing, to talk about what she is finding that is important, and to take notes for the written report. Sample probes for when the diagnostician is not speaking:

   "What are you noticing now?"

   "Please tell me what you are thinking about."
5. Remind the diagnostician that she can stop and start the tape whenever needed. You may also stop the tape to ask the diagnostician to give further description or to clarify briefly what she is focusing on.
6. Continue viewing the tape until it is finished.
7. Turn off the audiotapes and rewind the videotape. Make sure all tapes are marked with the diagnostician's name, date, E.S. #5, and Stage II or I/II.
8. Allow a 10-15 minute break before the next stage (written diagnosis).

D. Written Diagnosis (one hour)

1. Ask the diagnostician if she would like to see any more of the child's records. Give her a couple of minutes to look back at the Case Inventory.
2. Remind the diagnostician of the procedure for recording her own viewing of the data (i.e., putting the tags in order, stuck to the inside of her folder).
3. The diagnostician may use the requested child's records and her notes to develop her diagnostic report.
2. She may write as much as she wants, either in narrative or outline form or both.
3. She does not have to use up the full hour, but may not take more than one hour.
4. When she is done, make sure her name, the date, and E.S. #5 are on all pages.

5. Put all notes, test protocols, and the written diagnosis in the folder with her name, the date, and E.S. #5 marked on the folder tab.

E. Stimulated Recall

1. Remove the child's videotape from the VCR and put in the videotape of the diagnostician. Make sure the "display" button is on.
2. Situate the audiotapes near where the diagnostician and you will sit. Make sure the tape is marked with the diagnostician's name, the date, E.S. #5, Stage IV.
2. Get comfortable. Begin the audiotapes. Read these instructions as the cognitive set for the diagnostician:

Let's look back at this diagnostic session, beginning with the initial preparation stage. I'd like you to do most of the talking. Attempt to recall what you were thinking about as you gathered information and attempted to diagnose this child's reading difficulty(ies). Please focus on the information that supported or ruled out your hunches. Please explain each step as thoroughly as you can so that I may be able to follow your thoughts. You may stop and start the tape whenever you feel it is important to review or elaborate on an event.

I shall record your recall with notes and the audio cassette recorders. Again, these tapes will be retained only long enough to record and analyze the data, unless you have given permission for other research-oriented uses.

Do you have any questions so far?

3. Show the diagnostician how to stop and start the videotape machine. Begin the tape.
4. Take notes on information that may not be picked up on the audiotape, such as particular aspects of the the taped interaction that were pointed out.
5. Use the following questions for probes, when needed: (i.e., after 15-20 seconds of silence):

What did you notice here?

Why did you notice or ask for this piece of information?

What did it tell you?

Did you have any hunches that were supported or ruled out? What cues prompted the changes?

6. Continue until the tape is finished.
7. At the end of the stimulated recall, ask: Is there anything more you'd like to tell me about this child as a reader or this child's reading problems?
6. DO NOT turn off the tape recorders, go right into the Wrap-up session.

F. Wrap-up

1. Check the tapes in the audiotape cassette recorders. Change if needed.
2. Ask: Before we end this session, would you please briefly summarize your diagnosis of the child's reading problems?
3. Ask: Did the "preparation, interaction, reflection, and write-up" stages that you completed in this session resemble your typical diagnostic procedures.
4. Ask: Did you do anything in this diagnostic session that was different from your typical procedures. (Attempt to elicit any change prompted by take more than one hour.
5. Ask: Do you have any questions?
6. Verify time and date of next experimental session.
7. Make sure all tapes and papers from the experimental session are marked with diagnostician's name, the date, and E.S. #5. Place papers in marked folder.

Appendix F

Summary Tables of Major Variables

(Tables 1 - 3)

Table 1. Summary table of totals of major variables across experimental sessions and sub-divided across diagnosticians.

Session/ Diag.		Single cues	Multiple cues	Missing cues	Infer's.	Hypo's.	Time to 1st hypothesis	Diagnosis offered ?
1	Amy	259	89	21	2	23	11:08	yes
	Pat	190	62	15	7	6	10:30	yes
	Judy	229	112	35	19	13	:23	no
	Sarah	289	109	69	28	10	2:05	yes
	Bonnie	204	84	32	20	9	2:43	yes
Sub-total		1,168	456	172	76	61		
2	Amy	431	75	42	20	21	4:02	no
	Pat	303	85	64	28	12	1:30	yes
	Judy	51	68	46	12	7	:17	yes
	Sarah	211	119	46	19	8	19:00	yes
	Bonnie	168	95	64	37	10	:52	yes
Sub-total		1,164	442	262	116	58		
3	Amy	367	72	22	11	12	2:46	yes
	Pat	313	96	50	25	12	1:30	no
	Judy	214	105	27	16	13	1:13	yes
	Sarah	298	127	57	20	14	2:40	yes
	Bonnie	193	89	44	23	10	6:45	yes
Sub-total		1,385	489	200	95	61		
4	Amy	366	85	55	25	16	:36	yes
	Pat	343	109	69	31	14	2:25	no
	Judy	172	78	48	22	11	:22	no
	Sarah	144	59	47	19	13	1:12	yes
	Bonnie	205	93	95	35	8	:30	yes
Sub-total		1,230	424	314	132	62		
5	Amy	348	74	43	22	14	:57	yes
	Pat	292	115	46	29	12	1:50	yes
	Judy	197	100	44	28	11	6:30	yes
	Sarah	213	102	51	29	16	2:10	yes
	Bonnie	223	86	46	33	10	:30	yes
Sub-total		1,273	477	230	141	63		
TOTAL		6,220	2,288	1,178	560	305		

Table 2. Summary table of totals of major variables across diagnosticians and sub-divided across experimental sessions.

Diagnos./ Session		Single cues	Multiple cues	Missing cues	Infer's.	Hypo's.	Time to 1st hypothesis	Diagnosis offered ?
	1	259	89	21	2	23	11:08	yes
	2	431	75	42	20	21	4:02	no
Amy	3	367	72	22	11	12	2:46	yes
	4	366	85	55	25	16	:36	yes
	5	348	74	43	22	14	:57	yes
Sub-total		1,771	395	183	80	86		
	1	190	62	15	7	6	10:30	yes
	2	303	85	64	28	12	1:30	yes
Pat	3	313	96	50	25	12	1:30	no
	4	343	109	69	31	14	2:25	no
	5	292	115	46	29	12	1:50	yes
Sub-total		1,441	467	244	120	56		
	1	229	112	35	19	13	:23	no
	2	51	68	46	12	7	:17	yes
Judy	3	214	105	27	16	13	1:13	yes
	4	172	78	48	22	11	:22	no
	5	197	100	44	28	11	6:30	yes
Sub-total		863	463	200	97	55		
	1	286	109	69	28	10	2:05	yes
	2	211	119	46	19	8	19:00	yes
Susan	3	298	127	57	20	14	2:40	yes
	4	144	59	47	19	13	1:12	yes
	5	213	102	51	29	16	2:10	yes
Sub-total		1,152	516	270	115	61		
	1	204	84	32	20	9	2:43	yes
	2	168	95	64	37	10	:52	yes
Bonnie	3	193	89	44	23	10	6:45	yes
	4	205	93	95	35	8	:30	yes
	5	223	86	46	33	10	:30	yes
Sub-total		993	447	281	148	47		
TOTAL		6,220	2,288	1,178	560	305		

Table 3. Summary table of totals of major variables across clients, and sub-divided across experimental sessions and diagnosticians.

Client/ Ses/Diag.		Single cues	Multiple cues	Missing cues	Infer's.	Hypo's.	Time to 1st hypothesis	Diagnosis offered ?
Brett	1-Amy	259	89	21	2	23	11:08	yes
	2-Judy	51	68	46	12	7	:17	yes
	3-Bon.	193	89	44	23	10	6:45	yes
	4-Sar.	144	59	47	19	13	1:12	yes
Sub-total		647	305	158	56	53		
Matt	1-Judy	229	112	35	19	13	:23	no
	2-Bon.	168	95	64	37	10	:52	yes
	3-Pat	313	96	50	25	12	1:30	no
	4-Amy	366	85	55	25	16	:36	yes
Sub-total		1,076	388	204	106	51		
Barb.	1-Bon.	204	84	32	20	9	2:43	yes
	2-Pat	303	85	64	28	12	1:30	yes
	3-Sar.	298	127	57	20	14	2:40	yes
	4-Judy	172	78	48	22	11	:22	no
Sub-total		977	374	201	90	46		
Step.	1-Pat	190	62	15	7	6	10:30	yes
	2-Sar.	211	119	46	19	8	19:00	yes
	3-Amy	367	72	22	11	12	2:46	yes
	4-Bon.	205	93	95	35	8	:30	yes
Sub-total		973	346	178	72	34		
Tenni.	1-Sar.	286	109	69	28	10	2:05	yes
	2-Amy	431	75	42	20	21	4:02	no
	3-Judy	214	105	27	16	13	1:13	yes
	4-Pat	343	109	69	31	14	2:25	no
Sub-total		1,274	398	207	95	58		
Peter	5-Amy	348	74	43	22	14	:57	yes
	5-Pat	292	115	46	29	12	1:50	yes
	5-Judy	197	100	44	28	11	6:30	yes
	5-Sar.	213	102	51	29	16	2:10	yes
	5-Bon.	223	86	46	33	10	:30	yes
Sub-total		1,273	477	230	141	63		
TOTAL		6,220	2,288	1,178	560	305		

Appendix G

Taxonomy of Single Cues

Taxonomy of Single Cues Identified across All Experimental Sessions across All Diagnosticians

General/Family Background

From the records:

- Age
- Grade
- Birthdate
- Birthplace
- Father's education
- Mother's education
- No. of brothers, ages
- No. of sisters, ages
- Family status
- Misc. information (e.g., rides the bus)

From interaction:

- Interests
- Favorite toys, games, books
- Bedtime
- Television watching habits
- Time spent on homework or pleasure reading, or play
- Parents' speech patterns
- Living arrangements and visitation habits with divorced parents
- Responsibilities at home

Health/Medical Information

From the records:

- Childhood diseases
- Immunization
- Height/weight
- Vision
- Hearing
- Teeth
- Throat
- Speech

From interaction:

- Physical characteristics
- Cleanliness
- Neatness
- Clothing
- Physical well-being
- Consistency of wearing prescribed glasses

School Information

From the records:

- Academic progress
  - -grading system
  - -grades
  - -effort
  - -textbook series
  - -book/grade level
  - -teacher comments
    - academic
    - behavioral
    - suggestions for improvement
    - encouragement/ warnings
  - -retention history
- Attendance
- Special services
  - -referrals
  - -dates of referrals
  - -teacher comments
    - academic
    - behavioral
    - tentative hypotheses
  - -present placements
  - -parent involvement
  - -history (years in programs)

From interaction/general knowledge:

- Information about the school division
- Community socio-economic status
- Comparison of client to classmates
- Expectations of students in school division or by the teacher
- Availability of programs and special assistance
- General attitude toward school, school subjects, teachers
- Size of reading group

General Intellectual Ability

From records/stand. tests:

- Name of test
- Nature of test
- Grade equivalent
- Percentile
- Raw scores
- Errors
- Subtest scores
- Examiner's interpretations
- Examiner's notes about client's behavior during test
- Examiner's diagnosis
- Examiner's recommendations

From interaction:

- Ease, clarity, and depth of conversation
- Reactions to questions
- Reaction time to answer questions
- Number of prompts used
- Kinds of prompts used
- No. of times questions had to be restated
- Speech patterns
- Vocabulary
- Use of details and explanations
- Depth of prior knowledge
- Humor
- Ability to follow a complex set of directions

Level of Achievement

From standardized tests on record:

Criterion referenced tests
- -grade equivalent
- -standard scores
- -percentiles
- -skills mastered/not mastered
- -raw score

Norm-referenced tests
- -grade equivalent
- -standard score
- -percentiles
- -subtest scores
- -miscues

From tutor's report:

- No. of books read, examples
- Sight word performance
- No. of stories written
- Attitude
- General comments
- Recommendations

From informal inventories (on record or administered during session:

Word recognition list
- -miscues related to phonetic and structural analysis
- -reading level
- -order words are read
- -raw score
- -percent correct

Comprehension passages
- -reading level
- -miscues
- -use of context
- -corrections
- -if errors made sense
- -responses to comp. questions
  - type missed
  - depth of answer
  - completeness
  - speech patterns
  - speed of response

Oral reading behavior
- -effort
  - desire to continue task
  - attempt to attack words
  - attempt to answer ques.
- -fluency
  - ran out of breath
  - swallows
  - phrasing, word-by-word reading
  - hesitations, stops
  - pauses
- -expression
  - voice
  - intonations
  - attention to punctuation
- -humming during silent reading
- -sighs
- -escape behavior when asked to respond
- -use of finger, etc. as placeholder

Other Cues from the Testing Situation

Contextual cues:

- Lighting
- Table/chair height
- Time of day
- Time to gather information
- Availability of information
- Time to test
- Nature of tests (e.g., nonsense vs. real words)
- Testing materials (e.g., scoring)
- Examiner (in audio/video sessions)
  - -background
  - -present assignment
  - -interaction w/ client

Body language/non-verbal cues:

- Attention to the situation (e.g., looking around the room)
- Listening
- Proximity to testing materials and/or diagnostician
- Head movement during reading
- Order pictures are examined
- Use of fingers for reading
- Looking at diagnostician, pausing for help
- Restlessness
- Visible signs of stress (e.g., facial contortions)
- Yawning, stretching
- "Fiddling" with glasses

Appendix H

Taxonomy of Hypotheses

Taxonomy of Hypotheses Generated across All Experimental Sessions across All Diagnosticians

General/Family Background

- Number of siblings, birth order
- Twin effects
- Parental expectations, overprotective nature, willingness to accept child's problems
- Stability of family (two vs. single parent home, divorces/remarried parents
- Quality/amount of intellectual stimulation in home environment

Health/Medical/Organic Problems

- Lasting impact of childhood diseases (e.g., high fever) or injuries (e.g., concussion)
- Allergies
- Hearing, vision and/or speech deficits
- Attentional disorder
- Large/small muscle coordination
- Immaturity, delayed development
- Neurological disorders (e.g., brain damage, seizures)
- Attendance/illnesses
- Perceptual disorders
- History of medications, if on medication presently for allergies or hyperactivity

School Context

- Compatibility with the teacher
- Compatibility with peers
- Compatibility with the reading series
- Expectations of the teacher, peers, school, community
- School's sensitivity to child's special needs
- Change of school context (e.g., due to moving, change in classroom structure)
- Ability to work in a large group
- Motivation to learn in school; working up to potential; general effort

Intellectual Ability/ Ability to Learn

- Ability level/potential
- General knowledge/ experiences
- Learning disability
- Memory deficit/disorder (i.e., recall, recognition, reconstruction)
- Metacognitive abilities
- Learning modality
- Language disorder (i.e., expressive or receptive)
- Ability to be taught

Level of Achievement

Reading skills:
- Phonics
- Comprehension
- Oral reading habits (e.g., fluency, "page turner," word-by-word reader
- Sight vocabulary
- Use of strategies (e.g., context)

Relation of reading to skill in other content areas (e.g., math, social studies)

Skill in mathematics

Written language skills (form and content)

Tests / Testing Situations

Cooperation during testing; willingness to respond to questions

Appropriateness of tests or manner in which they were administered

Client's understanding of test instructions or requirements

General

Self-concept; self-image

Ability and strategies used to handle frustration

Willingness to please adults

Influence of reading clinic on client's present reading ability and attitude

Appendix I

Summary Table of Total Frequencies of Main Variables Cited Across the Entire Experimental Session

(Table 6)

Table 6. Summary table of the total frequencies of the major variables as cited across the stages of each experimental session.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	1	313	40	--	452*	35	12	40	273	3	1,168
	2	730	16	102	197	61	1	29	28	0	1,164
	3	660	8	--	291	32	29	9	347	7	1,385
	4	692	2	347	139	23	0	24	**	3	1,230
	5	549	10	318	249	11	28	25	79	4	1,273
Total		2,944	76	767	1,328	162	70	127	727	17	6,220
Multiple cues	1	146	9	--	14	0	0	71	206	10	456
	2	213	7	33	4	14	0	51	116	4	442
	3	242	14	--	3	0	0	46	165	19	489
	4	245	3	98	0	22	0	45	**	12	424
	5	216	34	73	9	0	0	21	118	6	477
Total		1,062	67	204	30	36	0	234	605	51	2,288
Missing cues	1	66	4	--	0	0	0	1	95	6	172
	2	96	0	31	1	11	0	4	105	15	262
	3	72	0	--	0	0	0	2	118	8	200
	4	167	1	106	0	21	0	9	**	11	314
	5	82	0	79	5	0	0	7	50	7	230
Total		483	5	216	6	32	0	23	368	47	1,178

* Personal notes for Pat in experimental session I are missing.

-- Verbalizations were not recorded for this stage of this experimental session.

** A stimulated recall was not part of this experimental procedure.

Table 6. Summary table of the total frequencies of the major variables as cited across the stages of each experimental session (continued).

Variable/ session		Stage									TOTAL
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Infer-ences	1	16	1	0	0	0	0	0	56	3	76
	2	30	0	23	0	5	0	1	56	1	116
	3	30	0	--	0	0	0	0	63	2	95
	4	65	0	59	0	3	0	1	**	4	132
	5	33	0	61	2	0	0	6	46	5	141
	Total	174	1	143	2	8	0	8	221	15	560
Hypo-theses	1	33	1	--	3	0	0	3	18	3	61
	2	39	0	10	0	1	0	0	5	3	58
	3	38	2	--	0	0	0	4	15	2	61
	4	52	1	9	0	0	0	0	**	0	62
	5	41	0	16	1	0	0	0	4	0	63
	Total	203	4	35	4	1	0	7	42	8	305

* Personal notes for Pat in experimental session I are missing.
-- Verbalizations were not recorded for this stage of this experimental session.
** A stimulated recall was not part of this experimental procedure.

Appendix J

Frequencies of Major Variables Analyzed by Experimental Session

(Tables 7 - 11)

Table 7. Summary table of the frequencies of the major variable cited by each diagnostician across the stages of experimental session I.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	Amy	65	32	--	113	0	12	8	29	0	259
	Pat	82	*	--	42	24	*	0	42	0	190
	Judy	69	5	--	82	7	0	10	56	0	229
	Sarah	73	1	--	113	0	0	13	85	1	286
	Bonnie	24	2	--	102	4	0	9	61	2	204
	Total	313	40	--	452	35	12	40	273	3	1,168
Multiple cues	Amy	23	7	--	0	0	0	31	23	5	89
	Pat	22	*	--	0	0	*	12	27	1	62
	Judy	47	0	--	0	0	0	11	54	0	112
	Sarah	38	0	--	6	0	0	7	55	3	109
	Bonnie	16	2	--	8	0	0	10	47	1	84
	Total	146	9	--	14	0	0	71	206	10	456
Missing cues	Amy	15	0	--	0	0	0	1	3	2	21
	Pat	4	*	--	0	0	*	0	11	0	15
	Judy	10	0	--	0	0	0	0	24	1	35
	Sarah	33	2	--	0	0	0	0	33	1	69
	Bonnie	4	2	--	0	0	0	0	24	2	32
	Total	66	4	--	0	0	0	1	95	6	172

-- Verbalizations not recorded for this stage.

* Personal notes for Pat in experimental session I are missing.

Table 7. Summary table of the frequencies of the major variables cited by each diagnostician across the stages of experimental session I (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	Amy	2	0	--	0	0	0	0	0	0	2
	Pat	1	*	--	0	0	*	0	6	0	7
	Judy	2	0	--	0	0	0	0	17	0	19
	Sarah	10	1	--	0	0	0	0	16	1	28
	Bonnie	1	0	--	0	0	0	0	17	2	20
	Total	16	1	--	0	0	0	0	56	3	76
Hypotheses	Amy	7	1	--	0	0	0	3	9	3	23
	Pat	4	*	--	0	0	*	0	2	0	6
	Judy	8	0	--	0	0	0	0	5	0	13
	Sarah	7	0	--	3	0	0	0	0	0	10
	Bonnie	7	0	--	0	0	0	0	2	0	9
	Total	33	1	--	3	0	0	3	18	3	61

-- Verbalizations not recorded for this stage.

* Personal notes for Pat in experimental session I are missing.

Table 8. Summary table of the frequencies of the major variable cited by each diagnostician across the stages of experimental session II.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	Amy	285	1	57	61	0	0	25	2	0	431
	Pat	194	12	5	71	6	1	0	14	0	303
	Judy	43	0	1	0	0	0	2	5	0	51
	Sarah	155	3	2	48	1	0	0	2	0	211
	Bonnie	53	0	37	17	54	0	2	5	0	168
	Total	730	16	102	197	61	1	29	28	0	1,164
Multiple cues	Amy	34	1	13	0	0	0	5	19	3	75
	Pat	67	1	0	2	0	0	6	9	0	85
	Judy	39	0	1	0	0	0	8	20	0	68
	Sarah	56	3	1	1	0	0	20	38	0	119
	Bonnie	17	2	18	1	14	0	12	30	1	95
	Total	213	7	33	4	14	0	51	116	4	442
Missing cues	Amy	22	0	8	0	0	0	2	9	1	42
	Pat	38	0	5	0	0	0	0	19	2	64
	Judy	10	0	4	1	0	0	0	23	9	46
	Sarah	13	0	2	0	0	0	1	30	0	36
	Bonnie	13	0	12	0	11	0	1	24	3	64
	Total	96	0	31	1	11	0	4	105	15	262

Table 8. Summary table of the frequencies of the major variables cited by each diagnostician across the stages of experimental session II (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	Amy	8	0	9	0	0	0	0	3	0	20
	Pat	14	0	3	0	0	0	0	11	0	28
	Judy	1	0	1	0	0	0	0	9	1	12
	Sarah	3	0	0	0	0	0	0	16	0	19
	Bonnie	4	0	10	0	5	0	1	17	0	37
	Total	30	0	23	0	5	0	1	56	1	116
Hypotheses	Amy	11	1	0	0	0	0	3	3	3	21
	Pat	8	0	0	0	0	0	0	1	0	12
	Judy	7	0	0	0	0	0	0	0	0	7
	Sarah	7	0	0	0	0	0	0	1	0	8
	Bonnie	6	0	0	1	0	0	0	0	0	10
	Total	39	1	0	1	0	0	3	5	3	58

Table 9. Summary table of the frequencies of the major variable cited by each diagnostician across the stages of experimental session III.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Stim.Rec.	Add. Cues	Notes/AC	Wr.Diag.	Wrap	
Single cues	Amy	163	1	--	43	99	27	29	2	1	367
	Pat	164	1	--	49	89	5	0	2	3	313
	Judy	91	1	--	49	73	0	0	0	0	214
	Sarah	161	0	--	71	66	0	0	0	0	298
	Bonnie	81	5	--	79	20	0	0	5	3	193
	Total	660	8	--	291	347	32	29	9	7	1,385
Multiple cues	Amy	38	6	--	0	20	0	0	4	4	72
	Pat	33	3	--	0	51	0	0	8	1	96
	Judy	67	0	--	0	18	0	0	13	7	105
	Sarah	76	0	--	3	38	0	0	5	5	127
	Bonnie	28	5	--	0	38	0	0	16	2	89
	Total	242	14	--	3	165	0	0	46	19	489
Missing cues	Amy	13	0	--	0	9	0	0	0	0	22
	Pat	18	0	--	0	30	0	0	2	0	50
	Judy	9	0	--	0	16	0	0	0	2	27
	Sarah	14	0	--	0	39	0	0	0	4	57
	Bonnie	18	0	--	0	24	0	0	0	2	44
	Total	72	0	--	0	118	0	0	2	8	200

-- Verbalizations not recorded in this stage of this session.

Table 9. Summary table of the frequencies of the major variables cited by each diagnostician across the stages of experimental session III (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Stim.Rec.	Add. Cues	Notes/AC	Wr.Diag.	Wrap	
Inferences	Amy	8	0	--	0	3	0	0	0	0	11
	Pat	8	0	--	0	17	0	0	0	0	25
	Judy	4	0	--	0	12	0	0	0	0	16
	Sarah	4	0	--	0	15	0	0	0	1	20
	Bonnie	6	0	--	0	16	0	0	0	1	23
	Total	30	0	--	0	63	0	0	0	2	95
Hypotheses	Amy	4	0	--	0	5	0	0	1	2	12
	Pat	10	0	--	0	2	0	0	0	0	12
	Judy	8	0	--	0	5	0	0	0	0	13
	Sarah	11	0	--	0	3	0	0	0	0	14
	Bonnie	5	2	--	0	0	0	0	3	0	10
	Total	38	2	--	0	15	0	0	4	2	61

-- Verbalizations were not recorded in this stage of this experimental session.

Table 10. Summary table of the frequencies of the major variable cited by each diagnostician across the stages of experimental session IV.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	TA	N./TA	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	Amy	187	0	105	57	0	0	15	--	2	366
	Pat	262	0	53	28	0	0	0	--	0	343
	Judy	83	1	57	25	0	0	6	--	0	172
	Sarah	83	0	47	13	0	0	0	--	1	144
	Bonnie	77	1	85	16	23	0	3	--	0	205
	Total	692	2	347	139	23	0	24	--	3	1,230
Multiple cues	Amy	44	3	14	0	11	0	9	--	4	85
	Pat	78	0	25	0	0	0	4	--	2	109
	Judy	43	0	18	0	0	0	16	--	1	78
	Sarah	29	0	21	0	2	0	7	--	1	59
	Bonnie	51	0	20	0	9	0	9	--	4	93
	Total	245	3	98	0	22	0	45	--	12	424
Missing cues	Amy	22	0	23	0	9	0	0	--	1	55
	Pat	51	0	15	0	0	0	1	--	2	69
	Judy	21	1	17	0	0	0	6	--	4	48
	Sarah	19	0	24	0	0	0	0	--	4	47
	Bonnie	54	0	27	0	12	0	2	--	0	95
	Total	167	1	106	0	21	0	9	--	11	314

-- Verbalizations were not recorded in this stage of this experimental session.

Table 10. Summary table of the frequencies of the major variables cited by each diagnostician across the stages of experimental session IV (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	TA	N./TA	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	Amy	13	0	10	0	1	0	0	--	1	25
	Pat	20	0	11	0	0	0	0	--	0	31
	Judy	10	0	9	0	0	0	1	--	2	22
	Sarah	7	0	11	0	0	0	0	--	1	19
	Bonnie	15	0	18	0	2	0	0	--	0	35
	Total	65	0	59	0	3	0	1	--	4	132
Hypotheses	Amy	12	0	4	0	0	0	0	--	0	16
	Pat	12	1	1	0	0	0	0	--	0	14
	Judy	10	0	1	0	0	0	0	--	0	11
	Sarah	10	0	3	0	0	0	0	--	0	13
	Bonnie	8	0	0	0	0	0	0	--	0	8
	Total	52	1	9	0	0	0	0	--	0	62

-- Verbalizations were not recorded in this stage of this experimental session.

Table 11. Summary table of the frequencies of the major variables cited by each diagnostician across the stages of experimental session V.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	Amy	115	0	45	134	1	28	1	24	0	348
	Pat	187	4	37	33	7	0	3	21	0	292
	Judy	82	2	79	20	0	0	4	10	0	197
	Sarah	87	2	94	0	0	0	10	16	4	213
	Bonnie	78	2	63	62	3	0	7	8	0	223
	Total	549	10	318	249	11	28	25	79	4	1,273
Multiple cues	Amy	34	0	8	6	0	0	2	22	2	74
	Pat	63	4	15	0	0	0	7	25	1	115
	Judy	51	0	27	3	0	0	2	17	0	100
	Sarah	35	29	1	0	0	0	4	30	3	102
	Bonnie	33	1	22	0	0	0	6	24	0	86
	Total	216	34	73	9	0	0	21	118	6	477
Missing cues	Amy	19	0	8	1	0	0	0	3	0	14
	Pat	26	0	7	0	0	0	0	1	0	12
	Judy	13	0	28	2	0	0	0	0	0	11
	Sarah	10	0	26	2	0	0	0	0	0	16
	Bonnie	14	0	10	0	0	0	0	0	0	10
	Total	82	0	79	5	0	0	0	4	0	63

Table 11. Summary table of the frequencies of the major variables cited by each diagnostician across the stages of experimental session V (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	Amy	8	0	7	0	0	0	0	6	1	22
	Pat	12	0	5	0	0	0	0	10	2	29
	Judy	5	0	23	0	0	0	0	0	0	28
	Sarah	4	0	16	2	0	0	4	5	0	29
	Bonnie	4	0	10	0	0	0	2	15	2	33
	Total	33	0	61	2	0	0	6	36	5	141
Hypotheses	Amy	7	0	3	1	0	0	0	3	0	14
	Pat	10	0	1	0	0	0	0	1	0	12
	Judy	5	0	6	0	0	0	0	0	0	11
	Sarah	13	0	3	0	0	0	0	0	0	16
	Bonnie	6	0	4	0	0	0	0	0	0	10
	Total	41	0	17	1	0	0	0	4	0	63

Appendix K

Frequencies of Major Variables Analyzed by Client

(Tables 12 - 17)

Table 12. Summary table of the frequencies of the major variables cited for Brett by each diagnostician in each experimental session.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	1-Amy	65	32	--	113	0	12	8	29	0	259
	2-Judy	43	0	1	0	0	0	2	5	0	51
	3-Bon.	81	5	--	79	0	0	5	20	3	193
	4-Sar.	83	0	47	13	0	0	0	**	1	144
	Total	272	37	48	205	0	12	15	54	4	647
Multiple cues	1-Amy	23	7	--	0	0	0	31	23	5	89
	2-Judy	39	0	1	0	0	0	8	20	0	62
	3-Bon.	28	5	--	0	0	0	16	38	2	112
	4-Sar.	29	0	21	0	2	0	7	**	1	109
	Total	119	12	22	0	2	0	62	81	8	305
Missing cues	1-Amy	15	0	--	0	0	0	1	3	2	21
	2-Judy	10	0	4	1	0	0	0	23	9	46
	3-Bon.	18	0	--	0	0	0	0	24	2	44
	4-Sar.	19	0	24	0	0	0	0	**	4	47
	Total	62	0	28	1	0	0	1	50	17	158

-- Verbalizations were not recorded for this stage of this experimental session.
** A stimulated recall was not included in experimental session IV.

Table 12. Summary table of the frequencies of the major variables cited for Brett by each diagnostician in each experimental session (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	1-Amy	2	0	--	0	0	0	0	0	0	2
	2-Judy	1	0	1	0	0	0	0	9	1	12
	3-Bon.	6	0	--	0	0	0	0	16	1	23
	4-Sar.	7	0	11	0	0	0	0	**	1	19
	Total	16	0	12	0	0	0	0	25	3	56
Hypotheses	1-Amy	7	1	--	0	0	0	3	9	3	23
	2-Judy	7	0	0	0	0	0	0	0	0	7
	3-Bon.	5	2	--	0	0	0	3	0	0	10
	4-Sar.	10	0	3	0	0	0	0	**	0	13
	Total	29	3	3	0	0	0	6	9	3	53

-- Verbalizations were not recorded for this stage of this experimental session.

** A stimulated recall was not included in experimental session IV.

Table 13. Summary table of the frequencies of the major variables cited for Matt by each diagnostician in each experimental session.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	1-Judy	69	5	--	82	7	0	10	56	0	259
	2-Bon.	53	0	37	17	54	0	2	5	0	51
	3-Pat	164	1	--	49	5	0	2	89	3	193
	4-Amy	187	0	105	57	0	0	15	**	2	144
	Total	473	6	142	205	66	0	29	150	5	647
Multiple cues	1-Judy	47	0	--	0	0	0	11	23	5	89
	2-Bon.	17	2	18	1	14	0	12	20	0	62
	3-Pat	33	3	--	0	0	0	8	38	2	112
	4-Amy	44	3	14	0	11	0	9	**	1	109
	Total	141	8	32	1	25	0	40	81	8	305
Missing cues	1-Judy	10	0	--	0	0	0	0	24	1	35
	2-Bon.	13	0	12	0	11	0	1	24	3	64
	3-Pat	18	0	--	0	0	0	2	30	0	50
	4-Amy	22	0	23	0	0	9	0	**	1	55
	Total	63	0	35	0	11	9	3	78	5	204

-- Verbalizations were not recorded for this stage of this experimental session.

** A stimulated recall was not included in experimental session IV.

Table 13. Summary table of the frequencies of the major variables cited for Matt by each diagnostician in each experimental session (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	1-Judy	2	0	--	0	0	0	0	17	0	19
	2-Bon.	4	0	10	0	5	0	1	17	0	37
	3-Pat	8	0	--	0	0	0	0	17	0	25
	4-Amy	13	0	10	0	0	1	0	**	1	25
	Total	27	0	20	0	5	1	1	51	1	106
Hypotheses	1-Judy	8	0	--	0	0	0	0	5	0	13
	2-Bon.	6	0	3	0	1	0	0	0	0	10
	3-Pat	10	0	--	0	2	0	0	0	0	12
	4-Amy	12	0	4	0	0	0	0	**	0	16
	Total	36	0	7	0	3	0	0	5	0	51

-- Verbalizations were not recorded for this stage of this experimental session.

** A stimulated recall was not included in experimental session IV.

Table 14. Summary table of the frequencies of the major variables cited for Barbara by each diagnostician in each experimental session.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	1-Bon.	24	2	--	102	4	0	9	61	2	204
	2-Pat	194	12	5	71	6	1	0	14	0	303
	3-Sar.	161	0	--	71	0	0	0	66	0	298
	4-Judy	83	1	57	25	0	0	6	**	0	172
	Total	462	15	62	269	10	0	15	141	2	977
Multiple cues	1-Bon.	16	2	--	8	0	0	10	47	1	84
	2-Pat	67	1	0	2	0	0	6	9	0	85
	3-Sar.	76	0	--	3	0	0	5	38	5	127
	4-Judy	43	0	18	0	0	0	16	**	1	78
	Total	202	3	18	13	0	0	37	94	7	374
Missing cues	1-Bon.	4	2	--	0	0	0	0	24	2	32
	2-Pat	38	0	5	0	0	0	0	19	2	64
	3-Sar.	14	0	--	0	0	0	0	39	4	57
	4-Judy	21	1	17	0	0	0	6	**	4	48
	Total	77	3	22	0	0	0	6	82	12	201

-- Verbalizations were not recorded for this stage of this experimental session.

** A stimulated recall was not included in experimental session IV.

Table 14. Summary table of the frequencies of the major variables cited for Barbara by each diagnostician in each experimental session (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	1-Bon.	1	0	--	0	0	0	0	17	2	20
	2-Pat	14	0	3	0	0	0	0	11	0	28
	3-Sar.	4	0	--	0	0	0	0	15	1	20
	4-Amy	10	0	9	0	0	0	1	**	2	22
	Total	29	0	12	0	0	0	1	43	5	90
Hypotheses	1-Bon.	7	0	--	0	0	0	0	2	0	9
	2-Pat	8	0	3	0	0	0	0	1	0	12
	3-Sar.	11	0	--	0	0	0	3	0	0	14
	4-Amy	10	0	1	0	0	0	0	**	0	11
	Total	36	0	4	0	0	0	3	3	0	46

-- Verbalizations were not recorded for this stage of this experimental session.

** A stimulated recall was not included in experimental session IV.

Table 15. Summary table of the frequencies of the major variables cited for Stephanie by each diagnostician in each experimental session.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	1-Pat	24	*	--	42	24	*	0	42	0	190
	2-Sar.	155	3	2	48	1	0	0	2	0	211
	3-Amy	163	1	--	43	27	29	2	99	1	367
	4-Bon.	77	1	85	16	23	0	3	**	0	205
	Total	477	5	87	149	75	29	5	143	1	973
Multiple cues	1-Pat	22	*	--	0	0	*	12	27	1	62
	2-Sar.	56	3	1	1	0	0	20	38	0	119
	3-Amy	38	6	--	0	0	0	4	20	4	72
	4-Bon.	51	0	20	0	9	0	9	**	4	93
	Total	167	9	21	1	9	0	45	85	9	346
Missing cues	1-Pat	4	*	--	0	0	0	0	11	0	15
	2-Sar.	13	0	2	0	0	0	0	30	0	46
	3-Amy	13	0	--	0	9	0	0	0	0	22
	4-Bon.	54	0	27	0	12	0	2	**	0	95
	Total	97	0	29	0	21	0	2	41	0	178

* Pat's personal notes were not available from this session.

-- Verbalizations were not recorded for this stage.

** The stimulated recall stage was not part of this experimental session procedure.

Table 15. Summary table of the frequencies of the major variables cited for Stephanie by each diagnostician in each experimental session (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	1-Pat	1	*	--	0	0	*	0	6	0	7
	2-Sar.	3	0	0	0	0	0	0	16	0	19
	3-Amy	8	0	--	0	3	0	0	0	0	11
	4-Bon.	15	0	18	0	2	0	0	**	0	35
	Total	27	0	18	0	5	0	0	22	0	72
Hypotheses	1-Pat	4	*	--	0	0	*	0	2	0	6
	2-Sar.	7	0	0	0	0	0	0	1	0	8
	3-Amy	4	0	--	0	5	0	0	1	0	12
	4-Bon.	8	0	0	0	0	0	0	**	0	8
	Total	23	0	0	0	5	0	0	4	0	34

* Pat's personal notes from this session were not available.

-- Verbalizations were not recorded for this stage.

** The stimulated recall stage was not part of this experimental session procedure.

Table 16. Summary table of the frequencies of the major variables cited for Tonita by each diagnostician in each experimental session.

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Single cues	1-Sar.	73	1	--	113	0	0	13	85	1	286
	2-Amy	285	1	57	61	0	0	25	2	0	431
	3-Judy	91	1	--	49	0	0	0	73	0	214
	4-Pat	262	0	53	28	0	0	0	**	0	343
	Total	711	3	110	251	0	0	38	160	1	1,274
Multiple cues	1-Sar.	38	0	--	6	0	0	7	55	3	109
	2-Amy	34	1	13	0	0	0	5	19	3	75
	3-Judy	67	0	--	0	0	0	13	18	7	105
	4-Pat	78	0	20	0	0	0	4	**	2	109
	Total	217	1	38	6	0	0	29	92	15	398
Missing cues	1-Sar.	33	2	--	0	0	0	0	33	1	69
	2-Amy	22	0	8	0	0	0	2	9	1	42
	3-Judy	9	0	--	0	0	0	0	16	2	27
	4-Pat	51	0	15	0	0	0	1	**	2	69
	Total	115	2	23	0	0	0	3	58	6	207

-- Verbalizations were not recorded for this stage.

** The stimulated recall stage was not part of this experimental session procedure.

Table 16. Summary table of the frequencies of the major variables cited for Tonita by each diagnostician in each experimental session (continued).

Variable/ session		Stage									TOTALS
		Prep.	N./Prep.	Inter.	N./Int.	Add.Cues	Notes/AC	Wr.Diag.	Stim.Rec.	Wrap	
Inferences	1-Sar.	10	1	--	0	0	0	0	16	1	28
	2-Amy	8	0	9	0	0	0	0	3	0	20
	3-Judy	4	0	--	0	0	0	0	12	0	16
	4-Pat	20	0	11	0	0	0	0	**	0	31
	Total	42	1	20	0	0	0	0	31	1	95
Hypotheses	1-Sar.	7	0	--	3	0	0	0	0	0	10
	2-Amy	11	0	4	0	0	0	0	3	3	21
	3-Judy	8	0	--	0	0	0	5	0	0	13
	4-Pat	12	1	1	0	0	0	0	**	0	14
	Total	38	1	5	3	0	0	5	3	3	58

-- Verbalizations were not recorded for this stage.

** The stimulated recall stage was not part of this experimental session procedure.

Table 17. Please refer to Table 11 for the summary table of the frequencies of the major variables cited for Peter, the client diagnosed in the control condition (experimental session Y).

Appendix L

Frequencies of Major Variables Analyzed by Experimental Session and Diagnostician

(Tables 18 - 22)

Table 18. Number of different cues and hypotheses cited by each diagnostician at each stage in session I.

	AMY									TOTAL CITED
	Prep.	N./Prep.	N. Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	65	32	113	0	12	8	29	0	259	421
Multiple Cues	23	7	0	0	0	31	23	5	89	105
Missing Cues	15	0	0	0	0	1	3	2	21	23
Inferences	2	0	0	0	0	0	0	0	2	2
Hypotheses	7	1	0	0	0	3	9	3	23	43
	PAT									
	Prep.	N./Prep.	N. Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	82	*	42	24	*	0	42	0	190	255
Multiple Cues	22	*	*	0	*	12	27	1	62	74
Missing Cues	4	*	*	0	*	0	11	0	15	16
Inferences	1	*	*	0	*	0	6	0	7	7
Hypotheses	4	*	*	0	*	0	2	0	6	52
	JUDY									
	Prep.	N./Prep.	N. Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	69	5	82	7	0	10	56	0	229	421
Multiple Cues	47	0	0	0	0	11	54	0	112	152
Missing Cues	10	0	0	0	0	0	24	1	35	51
Inferences	2	0	0	0	0	0	17	0	19	19
Hypotheses	8	0	0	0	0	0	5	0	13	123

* Personal notes for Pat in experimental session 1 are missing.

Table 18. Number of different cues and hypotheses cited by each diagnostician at each stage in session I (continued).

	SARAH									TOTAL CITED
	Prep.	N./Prep.	N. Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	73	1	113	0	0	13	85	1	286	507
Multiple Cues	38	0	6	0	0	7	55	3	109	151
Missing Cues	33	2	0	0	0	0	33	1	69	86
Inferences	10	1	0	0	0	0	16	1	28	28
Hypotheses	7	0	3	0	0	0	0	0	10	158
	BONNIE									
	Prep.	N./Prep.	N. Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	24	2	102	4	0	9	61	2	204	263
Multiple Cues	16	2	8	0	0	10	47	1	84	120
Missing Cues	4	2	0	0	0	0	24	2	32	40
Inferences	1	0	0	0	0	0	17	2	20	20
Hypotheses	7	0	0	0	0	0	2	0	9	79

Table 19. Number of different cues and hypotheses cited by each diagnostician at each stage in session II.

	Prep.	N./Prep.	Int.	N. Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	TOTAL CITED
AMY											
Single Cues	285	1	57	61	0	0	25	2	0	431	831
Multiple Cues	34	1	13	0	0	0	5	19	3	75	85
Missing Cues	22	0	8	0	0	0	2	9	1	42	65
Inferences	8	0	9	0	0	0	0	3	0	20	20
Hypotheses	11	0	4	0	0	0	0	3	3	21	39
PAT											
Single Cues	194	12	5	71	6	1	0	14	0	303	673
Multiple Cues	67	1	0	2	0	0	6	9	0	85	137
Missing Cues	38	0	5	0	0	0	0	19	2	64	78
Inferences	14	0	3	0	0	0	0	11	0	28	28
Hypotheses	8	0	3	0	0	0	0	1	0	12	83
JUDY											
Single Cues	43	0	1	0	0	0	2	5	0	51	79
Multiple Cues	39	0	1	0	0	0	8	20	0	68	99
Missing Cues	10	0	4	1	0	0	0	23	9	46	63
Inferences	1	0	1	0	0	0	0	9	1	12	12
Hypotheses	7	0	0	0	0	0	0	0	0	7	69

Table 19. Number of different cues and hypotheses cited by each diagnostician at each stage in session II (continued).

	SARAH										TOTAL CITED
	Prep.	N./Prep.	Int.	N. Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	155	3	2	48	1	0	0	2	0	211	308
Multiple Cues	56	3	1	1	0	0	20	38	0	119	156
Missing Cues	13	0	2	0	0	0	1	30	0	46	59
Inferences	3	0	0	0	0	0	0	16	0	19	19
Hypotheses	7	0	0	0	0	0	0	1	0	8	62
	BONNIE										
	Prep.	N./Prep.	Int.	N. Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	53	0	37	17	54	0	2	5	0	168	273
Multiple Cues	17	2	18	1	14	0	12	30	1	95	132
Missing Cues	13	0	12	0	11	0	1	24	3	64	78
Inferences	4	0	10	0	5	0	1	17	0	37	37
Hypotheses	6	0	3	0	1	0	0	0	0	10	128

Table 20. Number of different cues and hypotheses cited by each diagnostician at each stage in session III.

	Prep.	N./Prep.	N. Int.	Add. Cues	Notes/AC	Stim. Recall	Diag.	Wrap	Total	TOTAL CITED
AMY										
Single Cues	163	1	43	27	29	99	2	1	367	538
Multiple Cues	38	6	0	0	0	20	4	4	72	97
Missing Cues	13	0	0	0	0	9	0	0	22	33
Inferences	8	0	0	0	0	3	0	0	11	11
Hypotheses	4	0	0	0	0	5	1	2	12	32
PAT										
Single Cues	164	1	49	5	0	89	2	3	313	545
Multiple Cues	33	3	0	0	0	51	8	1	96	134
Missing Cues	18	0	0	0	0	30	2	0	50	64
Inferences	8	0	0	0	0	17	0	0	25	25
Hypotheses	10	0	0	0	0	2	0	0	12	102
JUDY										
Single Cues	91	1	49	0	0	73	0	0	214	305
Multiple Cues	67	0	0	0	0	18	13	7	105	135
Missing Cues	9	0	0	0	0	16	0	2	27	29
Inferences	4	0	0	0	0	12	0	0	16	16
Hypotheses	8	0	0	0	0	5	0	0	13	92

Table 20. Number of different cues and hypotheses cited by each diagnostician at each stage in session III (continued)

	SARAH									TOTAL CITED
	Prep.	N./Prep.	N. Int.	Add. Cues	Notes/AC	Stim. Recall	Diag.	Wrap	Total	
Single Cues	161	0	71	0	0	66	0	0	298	423
Multiple Cues	76	0	3	0	0	38	5	5	127	199
Missing Cues	14	0	0	0	0	39	0	4	57	72
Inferences	4	0	0	0	0	15	0	1	20	20
Hypotheses	11	0	0	0	0	3	0	0	14	126
	BONNIE									
	Prep.	N./Prep.	N. Int.	Add. Cues	Notes/AC	Stim. Recall	Diag.	Wrap	Total	
Single Cues	81	5	79	0	0	20	5	3	193	265
Multiple Cues	28	5	0	0	0	38	16	2	89	134
Missing Cues	18	0	0	0	0	24	0	2	44	53
Inferences	6	0	0	0	0	16	0	1	23	23
Hypotheses	5	2	0	0	0	0	3	0	10	80

Table 21. Number of different cues and hypotheses cited by each diagnostician at each stage in session IV.

	Prep.	N./Prep.	Inter.	N./Int.	Add. Cues	Notes/AC	Diag.	Wrap	Total	TOTAL CITED
AMY										
Single Cues	187	0	105	57	0	0	15	2	366	629
Multiple Cues	44	3	14	0	11	0	9	4	85	103
Missing Cues	22	0	23	0	9	0	0	1	55	77
Inferences	13	0	10	0	1	0	0	1	25	25
Hypotheses	12	0	4	0	0	0	0	0	16	71
PAT										
	Prep.	N./Prep.	Inter.	N./Int.	Add. Cues	Notes/AC	Diag.	Wrap	Total	
Single Cues	262	0	53	28	0	0	0	0	343	482
Multiple Cues	78	0	25	0	0	0	4	2	109	174
Missing Cues	51	0	15	0	0	0	1	2	69	102
Inferences	20	0	11	0	0	0	0	0	31	31
Hypotheses	12	1	1	0	0	0	0	0	14	116
JUDY										
	Prep.	N./Prep.	Inter.	N./Int.	Add. Cues	Notes/AC	Diag.	Wrap	Total	
Single Cues	83	1	57	25	0	0	6	0	172	243
Multiple Cues	43	0	18	0	0	0	16	1	78	105
Missing Cues	21	0	17	0	0	0	6	4	48	81
Inferences	10	1	9	0	0	0	1	2	22	22
Hypotheses	10	0	1	0	0	0	0	0	11	111

Table 21. Number of different cues and hypotheses cited by each diagnostician at each stage in session IV(continued).

	SARAH									TOTAL
	Prep.	N./Prep.	Inter.	N./Int.	Add. Cues.	Notes/AC	Diag.	Wrap	Total	CITED
Single Cues	83	0	47	13	0	0	0	1	144	176
Multiple Cues	29	0	21	0	2	0	7	1	59	82
Missing Cues	19	0	24	0	0	0	0	4	47	65
Inferences	7	0	11	0	0	0	0	1	19	19
Hypotheses	10	0	3	0	0	0	0	0	13	82
	BONNIE									
	Prep.	N./Prep.	Inter.	N./Int.	Add. Cues.	Notes/AC	Diag.	Wrap	Total	
Single Cues	77	1	85	16	23	0	3	0	205	308
Multiple Cues	51	0	20	0	9	0	9	4	93	117
Missing Cues	54	0	27	0	12	0	2	0	95	142
Inferences	15	0	18	0	2	0	0	0	35	35
Hypotheses	8	0	0	0	0	0	0	0	8	138

Table 22. Number of different cues and hypotheses cited by each diagnostician at each stage in session V.

	Prep.	N./Prep.	Inter.	N./Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	TOTAL CITED
AMY											
Single Cues	115	0	45	134	1	28	1	24	0	348	516
Multiple Cues	34	0	8	6	0	0	2	22	2	74	103
Missing Cues	19	0	8	1	0	0	0	14	1	43	54
Inferences	8	0	7	0	0	0	0	6	1	22	22
Hypotheses	7	0	3	1	0	0	0	3	0	14	45
PAT											
Single Cues	187	4	37	33	7	0	3	21	0	292	467
Multiple Cues	63	4	15	0	0	0	7	25	1	115	175
Missing Cues	26	0	7	0	0	0	0	11	2	46	63
Inferences	12	0	5	0	0	0	0	10	2	29	29
Hypotheses	10	0	1	0	0	0	0	1	0	12	114
JUDY											
Single Cues	82	2	79	20	0	0	4	10	0	197	270
Multiple Cues	51	0	27	3	0	0	2	17	0	100	158
Missing Cues	13	0	28	2	0	0	1	0	0	44	67
Inferences	5	0	23	0	0	0	0	0	0	28	28
Hypotheses	5	0	6	0	0	0	0	0	0	11	42

Table 22. Number of different cues and hypotheses cited by each diagnostician at each stage in session V (continued).

	SARAH										TOTAL CITED
	Prep.	N./Prep.	Inter.	N./Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	87	2	94	0	0	0	10	16	4	213	427
Multiple Cues	35	29	1	0	0	0	4	30	3	102	147
Missing Cues	10	0	26	2	0	0	4	9	0	51	67
Inferences	4	0	16	0	0	0	4	5	0	29	29
Hypotheses	13	0	3	0	0	0	0	0	0	16	167
	BONNIE										
	Prep.	N./Prep.	Inter.	N./Int.	Add. Cues	Notes/AC	Diag.	Stim. Recall	Wrap	Total	
Single Cues	78	2	63	62	3	0	7	8	0	223	345
Multiple Cues	33	1	22	0	0	0	6	24	0	86	104
Missing Cues	14	0	10	0	0	0	2	16	4	46	51
Inferences	4	0	10	0	0	0	2	15	2	33	33
Hypotheses	6	0	4	0	0	0	0	0	0	10	103

Appendix M

Cues Selected and Assessments Administered by Each Diagnostician for Each Client

(Figures 15 - 19)

AMY

EXPERIMENTAL SESSION #1 - Brett

Cues selected during Preparation stage:
(Selective search in order cues appeared on case inventory) clinic referral; family background; health (diseases, vision, hearing, speech); attendance; kindergarten report card; kindergarten checklist; 1st grade report card; selected SRA scores; clinic informal reading inventory; entire folder of information submitted by independent reading diagnostician

Assessments used in interaction stage:
Informal conversation; basal reading series informal reading inventory; teacher-made assessments of phonics and structural analysis skills; closing conversation

Additional file cues requested:
Examined the SRA test results not viewed earlier

EXPERIMENTAL SESSION #2 - Tonita:

Cues selected during Preparation stage:
Examined entire contents of entire file in order appearing on the case inventory

Assessments that would have been used:
Need to do comprehensive assessment of all reading skills to assess which skills were missed when Tonita skipped two book levels when she went from second to third grade; specific assessments would include phonics assessments, a basal series placement test, a pencil and paper/ classroom test, a listening test

Additional file cues requested:
None, all were seen during Preparation stage

EXPERIMENTAL SESSION #3 - Stephanie:

Cues selected during Preparation stage:
(Selective search) clinic and school referrals; Metropolitan Readiness Tests (K and K-repeat); all report cards; family background; health (vision, hearing, speech)

Assessments used in interaction stage:
Informal conversation; basal reading series informal reading inventory; prereading (reading readiness) assessments on sequence, opposites; informal language activities; closing conversation

Additional cues requested:
(Requested all cues not yet examined) All standardized tests in folder; entire contents of file from reading clinic; remainder of cues in health and medical file; attendance

Figure 15. Amy's cue selection and assessment procedures.

EXPERIMENTAL SESSION #4 - Matt:

Cues selected during Preparation stage:

(Selective search) clinic and school referrals; attendance; report cards; health (diseases, hearing, throat speech); Metropolitan Readiness Tests (K and K-repeat); Criterion-referenced Tests of Mastery

Assessments that would have been used:

Dolch sight words; assessment with cloze format; further assessments on blends, digraphs, ending consonants; more oral reading

Additional cues requested:

(Requested all cues not yet examined) All standardized tests in folder; entire contents of file from reading clinic; general/family background file; remainder of health file

EXPERIMENTAL SESSION #5 - Peter:

Cues selected during Preparation stage:

(Selective search) clinic referral; kindergarten screening; Metropolitan Readiness Test; Criterion-referenced Tests of Mastery; attendance; report cards; family background

Assessments that would have been used:

Classroom observation; basal reading series placement test; conversation with his teachers and the psychologists

Additional cues requested:

(Requested all cues not yet examined) All standardized tests in folders; entire contests of reading clinic file; remainder of medical/health file

---

Figure 15. Amy's cue selection and assessment procedures (continued).

PAT

EXPERIMENTAL SESSION #1 - Stephanie:

Cues selected during Preparation stage:
(Selective search) attendance; report cards; Criterion-referenced Tests of Mastery; entire contents of standardized test file

Assessments used in Interaction stage:
Informal conversation; John's informal reading inventory; closing conversation

Additional file cues requested:
Metropolitan Readiness Tests (K and K-repeat); childhood diseases; general/family background file; reading clinic's informal reading inventory and Woodcock Reading Mastery -- Word Identification Test results

EXPERIMENTAL SESSION #2 - Barbara:

Cues selected during Preparation stage:
(Selective search) reading clinic and school referrals; family background; entire health folder; attendance; grades; entire standardized test folder; reading clinic's Peabody Picture Vocabulary Test and final report; *inferred information from twin*

Assessments that would have been used:
Classroom observation; language assessments; teacher consultation

Additional file cues requested:
Kaufman adaptive behavior assessment

EXPERIMENTAL SESSION #3 - Matt:

Cues selected during Preparation stage:
(Selective search -- "I started at the back and worked forward because I kind of ran out of time last time.") All standardized tests in folder; reading clinic tutor's report; reading clinic and school referrals; general/family background; health file; report cards; kindergarten screening

Assessments used in Interaction stage:
Informal conversation; John's informal reading inventory; informal reading in trade books; closing conversation

Additional cues requested:
None

Figure 16. Pat's cue selection and assessment procedures.

EXPERIMENTAL SESSION #4 - Tonita:

Cues selected during Preparation stage:
Examined entire contents of entire file in order appearing on case inventory
Assessments that would have been used:
Teacher consultation; needs a comprehensive evaluation by psychologist for ability and possible emotional problem
Additional cues requested:
None

EXPERIMENTAL SESSION #5 - Peter:

Cues selected during Preparation stage:
(Examined cues in order of case inventory) Referrals; general/family information; health; attendance; school grades; all standardized test results
Assessments that would have been used:
Informal reading assessment with trade books; classroom activities; requested a neurological work-up
Additional cues requested:
(Requested all cues not yet examined) Criterion-referenced Tests of Mastery; entire contents of reading clinic folder

---

Figure 16. Pat's cue selection and assessment procedures (continued).

JUDY

EXPERIMENTAL SESSION #1 - Matt:

Cues selected during Preparation stage:
(Selective search) Entire folder of standardized test results; health (vision, hearing, speech); report cards; Metropolitan Readiness Test (K only); family background; reading clinic's informal reading inventory

Assessments used in Interaction stage:
Informal conversation; informal assessment of written language; informal reading in trade books; Peabody Picture Vocabulary Test; closing conversation

Additional file cues requested:
None

EXPERIMENTAL SESSION #2 - Brett:

Cues selected during Preparation stage:
(Selective search) Reading clinic and school referrals; family background; health (vision, hearing, speech); attendance; report cards; SRA test results; reading clinic tutor's report; entire folder of information submitted by independent reading diagnostician

Assessments that would have been used:
Classroom observation; parent consultation; Woodcock-Johnson Psychoeducational Battery of Tests; ability test

Additional file cues requested:
None

EXPERIMENTAL SESSION #3 - Tonita:

Cues selected during Preparation stage:
(Selective search) Reading clinic and school referrals; health file (vision, hearing, speech); attendance; report cards; Criterion-referenced Tests of Mastery

Assessments used in Interaction stage:
Informal conversation; Peabody Individual Achievement Test; informal reading in trade books; closing conversation

Additional cues requested:
None

Figure 17. Judy's cue selection and assessment procedures.

EXPERIMENTAL SESSION #4 - Barbara:

Cues selected during Preparation stage:
(Selective search) Entire contents of standardized test folder; health (vision, hearing); attendance; reading clinic tutor's report and informal reading inventory

Assessments that would have been used:
Diagnostic teaching; phonics assessment; diagnostic spelling potential test; teacher consultation

Additional cues requested:
Speech report in health folder

EXPERIMENTAL SESSION #5 - Peter:

Cues selected during Preparation stage:
(Selective search) Clinic referral; health (vision, hearing speech); attendance; report cards; kindergarten screening test; WISC-R; Woodcock-Johnson Psychoeducational Battery of Tests; school referral; family background; remainder of standardized test folder

Assessments that would have been used:
Language assessment; Slingerland Test for Specific Language Disabilities

Additional cues requested:
None

Figure 17. Judy's cue selection and assessment procedures (continued).

SARAH

EXPERIMENTAL SESSION #1 - Tonita:

Cues selected during Preparation stage:
(Selective search) Family background; clinic referral; health (vision, hearing); attendance; report cards (selected content areas and all teacher comments); Criterion-referenced Tests of Mastery; entire contents of folder from the reading clinic

Assessments used in Interaction stage:
Informal conversation; informal reading in trade books; Ekwall informal reading inventory; closing conversation

Additional file cues requested:
None

EXPERIMENTAL SESSION #2 - Stephanie:

Cues selected during Preparation stage:
(Selective search) reading clinic and school referrals; family background; health (vision, hearing); attendance; report cards (grades 2-3, selected content areas and all teacher comments); Criterion-referenced Tests of Mastery; WISC-R; Peabody Picture Vocabulary Test; entire reading clinic folder; Woodcock Johnson Psychoeducational Battery of Tests; Metropolitan Readiness Test (K-repeat only); kindergarten report cards; birthdate; 1st grade report card

Assessments that would have been used:
Word recognition test; Dolch word list; grade level assessments; more oral reading; vocabulary games

Additional file cues requested:
None

EXPERIMENTAL SESSION #3 - Barbara:

Cues selected during Preparation stage:
(Selective search) Clinic and school referrals; family background; health (vision, hearing); attendance; report cards; Metropolitan Readiness Test (K-repeat only); WISC-R; Criterion-referenced Tests of Mastery; Woodcock-Johnson Psychoeducational Battery of Tests; Peabody Picture Vocabulary Test; entire file from the reading clinic

Assessments used in Interaction stage:
Informal conversation; informal reading in trade books; Ekwall informal reading inventory; closing conversation

Additional cues requested:
None

Figure 18. Sarah's cue selection and assessment procedures.

EXPERIMENTAL SESSION #4 - Brett:

Cues selected during Preparation stage:

("Not pulling in order of importance") Clinic and school referrals; family background; health (vision, hearing); attendance; report cards; SRA test results; reading clinic tutor's report; kindergarten screening; entire folder of information submitted by independent reading diagnostician

Assessments that would have been used:

Basal reading series placement test; cloze assessment; listening assessment; more oral reading; teacher consultation

Additional cues requested:

None

EXPERIMENTAL SESSION #5 - Peter:

Cues selected during Preparation stage:

(Examined cues in order of case inventory) Referrals; general/family information; health (vision, hearing); attendance; school grades (selected content areas and all teacher comments); all standardized test results; entire contents of reading clinic folder

Assessments that would have been used:

Assessment of inferential comprehension skills; more oral reading of trade books; games

Additional cues requested:

None

Figure 18. Sarah's cue selection and assessment procedures (continued).

BONNIE

EXPERIMENTAL SESSION #1 - Barbara:

Cues selected during Preparation stage:
(Selective search) Entire folder of standardized test results; report cards (selected content areas and teacher comments); health (vision, childhood diseases); family background

Assessments used in Interaction stage:
Informal conversation; basal reading series placement test; Woodcock Reading Mastery Test; informal phonics assessment; informal spelling test; Barnell-Loft Specific Skills reading comprehension tasks; closing conversation

Additional file cues requested:
Criterion-referenced Tests of Mastery; report cards (additional content areas); reading clinic tutor's report

EXPERIMENTAL SESSION #2 - Matt:

Cues selected during Preparation stage:
(Selective search) Family background; age; WISC-R; Criterion-referenced Tests of Mastery; Woodcock-Johnson Psychoeducational Battery of Tests; clinic and school referrals; Slingerland Test for Specific Language Disabilities; entire contents of folder from reading clinic

Assessments that would have been used:
Classroom observation; consultation with parents and teachers; auditory discrimination assessment; additional language assessments

Additional file cues requested:
Report cards (teacher comments first, then grades); health (speech, hearing)

EXPERIMENTAL SESSION #3 - Brett:

Cues selected during Preparation stage:
(Selective search) Family background; SRA test results; entire folder of information submitted by independent reading diagnostician; first grade report card (selected content areas); clinic referral; health (vision, hearing, speech); clinic informal reading inventory results

Assessments used in Interaction stage:
Informal conversation; basal reading series placement test; Woodcock Reading Mastery Test; Barnell Loft Specific Skills reading comprehension tasks; closing conversation

Additional cues requested:
None

Figure 19. Bonnie's cue selection and assessment procedures.

EXPERIMENTAL SESSION #4 - Stephanie:

Cues selected during Preparation stage:
(Selective search) Clinic referral; WISC-R; Woodcock-Psychoeducational Battery of Tests; Peabody Picture Vocabulary Test; school referral; third grade report card (selected content areas); family background; Metropolitan Readiness Test; entire contents of folder from reading clinic

Assessments that would have been used:
Teacher consultation; informal language/speech assessment; comprehensive assessment of reading problem (no specific comments from school)

Additional cues requested:
Criterion-referenced Tests of Mastery (third grade only)

EXPERIMENTAL SESSION #5 - Peter:

Cues selected during Preparation stage:
(Selective search) WISC-R; Woodcock-Johnson Psychoeducational Battery of Tests; clinic referral; second grade report card and teacher comments; Criterion-referenced Test of Mastery; school referral; reading clinic informal reading inventory; general/family information; health (hearing); kindergarten screening; Visual-Auditory Discrimination Screening test; Bender-Gestalt Test; Metropolitan Readiness Test; attendance

Assessments that would have been used:
Teacher and parent consultation; classroom activities; another listening assessment; cloze assessment; spelling test

Additional cues requested:
None

Figure 19. Bonnie's cue selection and assessment procedures (continued).

Appendix N

Hypotheses Generated for Each Client Across the Experimental Session

(Tables 23 - 28)

Table 23. Summary table of generated hypotheses for Brett's reading problem by each diagnostician across the stages and experimental sessions.

BRETT						
Hypothesis	**Prep.**	**Int./TA**	**Notes**	**Diag.**	**St.Rec.**	**Wrap**
Average ability	AJB		AJ	J	JB	JB
Weak in phonics	AJSB	JS	J		B	AJSB
Oral comprehension is okay	A	J	J	S		
Conflict w/ reading series	AJ		J	J	AJ	AJ
Parents' high expectations					AB	AB
Listening comprehension is okay	A		A			
When working w/ tutor, phonics skills are okay	AJSB	JS	J	AS	B	B
Weakness is pre-reading					A	
SRA is not valid				A	A	
Health is okay				A		
Tired during testing				A		
Auditory phonics is weak area			A		A	A
Poor w/ nonsense syllables	A					
Good memory for sight words		S		S	A	AS
Possible LD	JSB	S			AB	
Accurate scores					A	
Thinks things through					A	
Good reading comprehension					A	
Nervous/ active	S	S			A	
Good verbal ability	S			B	PJB	B
Disfluent in oral reading		S		S		AS
Parent problem w/ no testing allowed	JS	JS			J	J
Visual problem/pattern changes	JS		J	J	J	
Attendance	J		J		J	
Immaturity	S					S
Doesn't use context cues	SJB	SJ		SJ	B	SJB
Needs to be motivated	S	S		S		SB
Neurological problem		S		S	P	
Disfluency is a learned response		S				
Many different problems						S

Key: A = Amy, experimental session #1
J = Judy, experimental session #2
B = Bonnie, experimental session #3
S = Sarah, experimental session #4

Table 24. Summary table of generated hypotheses for Matt's reading problem by each diagnostician across the stages and experimental sessions.

MATT						
Hypothesis	**Prep.**	**Int./TA**	**Notes**	**Diag.**	**St.Rec.**	**Wrap**
Learning disabled	APJB	AB	A	AJB	APJB	AJBP
Immaturity	A					
Repeated due to inability to understand opposite/rhume	A			P	P	P
Birth order	A					
Can relax, tune out noises	A					
Finishes slowly, mind elsewhere	A					
Behavior problem	AJ			JB	JB	B
Distractible	APB		P	PB	PB	PB
Low average>avg. IQ	A	AB	AB	AB	B	AP
Poor comprehension, working too hard just to read	AB	AB	AB	B	B	B
Memory deficits	A		A			A
Visual learner	A			A		A
Poor word attack	P	A		A		
Poor word knowledge	PJ	A		P	PJ	PJ
Active, "little boy" syndrome					A	AB
Poor self-concept/frustrated	P		P	P	PJ	PJ
Visual problem	PJ		P	P	PJ	P
Auditory problem	PJ		J	B	PJB	B
Written language problem	J			J	J	PJ
Listening problem	PJ				J	
Teacher/student conflict					J	
Gets lost in cracks						
OK academically	B	B		B	B	B
Decoding okay	B	B		B	B	
Seizure	B					
Disfluent speech		B	B	B	B	
Autistic					P	

Key: J = Judy, experimental session #1
B = Bonnie, experimental session #2
P = Pat, experimental session #3
A = Amy, experimental session #4

Table 25. Summary table of generated hypotheses for Barbara's reading problem by each diagnostician across the stages and experimental sessions.

BARBARA						
Hypothesis	**Prep.**	**Int./TA**	**Notes**	**Diag.**	**St.Rec.**	**Wrap**
Serious academic problems	PS			S	JB	JB
Auditory problems	P	P	J		B	AJSB
Good attendance	PS	J	J	S		
Visual learner/sight reader	P	P	P	P	PS	PS
Limited ability	PSB	P	P	PS	PSB	PS
LD	JSB	PJ	J	PJ	PSB	PJB
Contextual reader		P		P	P	P
Poor kinesthetically, doesn't like written language	JB	PJ		J		JB
Visual + auditory learner	P	P		P	P	P
Home environment	PB			P	PB	PB
Reading problem					P	
Visual problem/ uses fingers	J					
Auditory memory is good	J					
Language disability	JB	J	J	J	JB	JP
Teacher-pupil interaction	J				S	J
Rote memory is good	J	J		J		
Can't blend sounds		J		J		J
Poor reading comprehension	JSB	J		J	SB	
Should be doing better	S			S	S	S
Immature in kindergarten	S			S	S	
Shy/ doesn't do well in groups	S				SB	AS
Attention problems/ active	S			S	S	S
Not motivated	S			S	S	S
Works hard	B				B	B
Late implementation of remedial services by the school					B	B

Key: B = Bonnie, experimental session #1
P = Pat, experimental session #2
S = Sarah, experimental session #3
J = Judy, experimental session #4

Table 26. Summary table of generated hypotheses for Stephanie's reading problem by each diagnostician across the stages and experimental sessions.

STEPHANIE						
Hypothesis	**Prep.**	**Int./TA**	**Notes**	**Diag.**	**St.Rec.**	**Wrap**
Slow learner	APSB	B		ASB	APS	APSB
Immature	AS				B	
Home environment	ASB	B		SB	S	SB
Visual area is a strength	A				P	
Language development problems	P				AP	AP
Not thinking during reading, poor comprehension	S			S	AS	S
Focuses on details; oral reading is good	S				AS	S
Concrete learner						A
Phonics is poor, coincides with reading level	SB	B		ASB	S	S
Not working up to potential; motivation problem	PSB	B	SB	B	PS	S
Short attention span		A			P	A
Parent concern; but no school help	B	B		B		B
Twin effects	BP	BPS	BPS		BPS	BP
Below grade level	B	B	B	B		B

Key: P = Pat, experimental session #1
S = Sarah, experimental session #2
A = Amy, experimental session #3
B = Bonnie, experimental session #4

Table 27. Summary table of generated hypotheses for Tonita's reading problem by each diagnostician across the stages and experimental sessions.

TONITA						
Hypothesis	**Prep.**	**Int./TA**	**Notes**	**Diag.**	**St.Rec.**	**Wrap**
Slight weakness in language	AJP		P	AJP	J	J
Immaturity/should have repeated	AP					
Effort goes w/ grades	A					
Frustrated in 1st grade/first sign of a weaker student	APS				AS	
Teacher effects; bad 3rd grade year	AP	P		P	J	
Culturally related grammar/ due to background	AP					
Problem due to skipping books from 2nd to 3rd grade	AJ				J	
Reading problem is not that bad	A	A				A
Comprehends while reads	S	A			S	
Low-average learner	P	P			A	A
Phonics needs some review	PS	P	PS	PS	SA	APS
Likes to please adults	P			P		P
Coordination problem, shows up in handwriting	PJ	P		J		
Learning disabled	P					
Divorce/poor home life are keys	PJS	P		P	JS	PS
Self-image is poor; poor attitude	PS	P	P	S	S	S
Sight learner, uses configuration	S	P	J		S	PS
Auditory problems	J	P	P	PJ	J	PJ
Vision may be a problem, wears glasses	S				S	S
Misses details when reading, due to being such a fast reader	S			S	S	S

Key: S = Sarah, experimental session #1
A = Amy, experimental session #2
J = Judy, experimental session #3
P = Pat, experimental session #4

Table 28. Summary table of generated hypotheses for Peter's reading problem as cited by each diagnostician across the stages and experimental sessions.

PETER						
Hypothesis	**Prep.**	**Int./TA**	**Notes**	**Diag.**	**St.Rec.**	**Wrap**
Average ability	APSB	PSB	SB	PSB	APSB	APSB
Learning disabled	APJSB	B		PJ	APJB	J
Perceptive/good sense of humor	PSB	BJ	B	B	PSB	BPJS
Contextual reader		APJSB		AJS	APJSB	ASB
Poor phonics	PJS	PJSB	A	APJSB	APJSB	APJS
Reading level should be on grade level		A		A	A	A
Visual learner	S	AB			ASB	B
Clinic is making a difference					A	
Should be doing better/ not performing to potential	S	S			AS	S
Attention problem in groups					A	
Good home background	PSB	BJ			PSB	BP
Reading problem	PSB	S	S	PS	PS	
Good memory	P				P	
Motor problem	P				PJ	J
Language/vocabulary problem	PAJ		J	J	PAJ	J
Visual problem	P	P			P	P
Brain damage; auditory recall of details is the problem	P			P	P	
Problem in curricular areas	J				J	
Demeanor/motivation/attitude are problematic	SBP	JSB		SBP	JSBP	SBP
Doesn't know when he's correct		J			J	
Knows what he can and can't do		J			J	
Comprehension is good	S	S		S	S	S
Jokes when frustrated	S	S		S	S	
Structural analysis = problem	S	S				
Oral reading fluency is off		S		S		
Hates questioning		S				
Immature		S				
Strong reasoning skills	B			B		

Key: A = Amy, P = Pat, J = Judy, S = Sarah, B = Bonnie — All diagnosed Peter via experimental session V

Appendix O

Formulation of Hypotheses, Diagnoses and Prescriptions by Diagnosticians for Each Client

(Figures 21 - 26)

BRETT

AMY - experimental session #1:

Hypotheses:

Average ability; weak in phonics; oral comprehension is okay; parents have high expectations; phonics okay with tutor; weak in prereading; SRA is not valid; health is okay; tired during testing; auditory phonics is weak area; poor memory for sight words; her scores are accurate; Brett thinks work through -- takes long; good reading comprehension; nervous and active during session; good verbal ability; hesitate during oral reading

Diagnosis:

Instructional level approximately 2.1; not severely disabled; oral reading fluency most evident problem

Prescription:

Lots of easy reading in high interest books; work on phrasing with phrase cards

JUDY - experimental session #2:

Hypotheses:

Average ability; weak in phonics; oral comprehension okay; conflict with reading series; phonics is okay with the tutor; possible LD; parental problem - no testing; visual problem with pattern of changes; attendance; doesn't use context cues

Diagnosis:

"He's average."; just needs instruction; skills don't seem to transfer

Prescription:

Needs a model to overtly compare; needs training to use the skills he has

BONNIE -- experimental session #3:

Hypotheses:

Average ability; weak in phonics; parents have high expectations; phonics okay with tutor; possible LD; good verbal ability; doesn't use context cues; possible motivation problem

Diagnosis:

Instructional level = 2.1; good visual memory; poor in vocabulary; has not internalized decoding strategies; average student; needs to be challenged

Prescription:

Continue with Chapter I -- stress vowel sounds, blending, word families, Dolch words; continue with the reading clinic -- focus on high interest, easy reading books; read with parents

Figure 21. A comparison of the hypotheses, diagnoses, and prescriptions stated for Brett across all diagnosticians.

SARAH -- experimental session #4:

Hypotheses:

Weak in phonics; oral comprehension is okay; phonics is okay with tutor; poor memory for sight words; possible LD; nervous/active; good verbal ability; hesitates in oral reading (disfluent) -- learned response; possible vision problem with pattern of changes; immature; possible neurological problem or many problems

Diagnosis:

High attention span, very cooperative; most evident problem is disfluent oral reading (phrasing); problem with blends/vowels not that bad

Prescription:

Talk with him, see if he realized his reading is disfluent; listen to him talk on free subjects; give him time to study page before reading orally; do sight word cards with timer, use multiple word cards to practice phrasing; do a play

Figure 21. A comparison of the hypotheses, diagnoses, and prescriptions stated for Brett across all diagnosticians (continued).

MATT

JUDY - experimental session #1:

Hypotheses:
Learning disabled; behavior problems; poor knowledge of words; poor self-concept; frustrated; visual problem; auditory problem; written language problem; listening problem; teacher-student conflict

Diagnosis (no firm diagnosis offered):
His behavior is not a good indicator of his ability; has some major language problem, needs more testing (still too many questions); poor self-concept

Prescription:
Needs help in speech/language in LD setting; quit going to reading clinic to increase self-esteem

BONNIE - experimental session #2:

Hypotheses:
Learning disabled; behavior problems; distractible; low-average to average ability; comprehension poor because he works to hard to just read; auditory problems; "little boy" syndrome; okay academically; decoding is not bad; possible seizures; disfluent speech

Diagnosis:
Attention Deficit Disorder (ADD); poor comprehension of text (too involved with decoding); "little boy" syndrome

Prescription:
Consult with physician for medication on trial basis, monitor class performance; continue with Chapter I and reading clinic; lots of easy reading with frequent questioning

PAT - experimental session #3:

Hypotheses:
Learning disabled; repeated kindergarten due to language problem (opposites, rhyming); distractible; low-average to average ability; poor word attack skills; poor self-concept, frustrated; poor knowledge of words; auditory problem; written language problem; possibly autistic

Diagnosis (no firm diagnosis offered):
Attention span needs to be brought under control before a diagnosis can be made; severe language disability; written language problem (needs Visual Motor Inventory); needs emotional testing -- very poor self-image

Prescription:
None

Figure 22. A comparison of the hypotheses, diagnoses, and prescriptions stated for Matt across all diagnosticians.

AMY -- experimental session #4:

Hypotheses:

Learning disabled; immaturity, possible due to birth order; repeated kindergarten due to language problem (opposites, rhyming); is making some progress; can relax and tune out noises; finishes slowly, mind is elsewhere; behavior problems; distractible; average IQ; comprehension poor because he works to hard to just read; memory problem; visual learner; poor word attack; poor knowledge of words

Diagnosis:

Average ability; impressed with physical activity, may not be able to settle down for reading; good visual memory; processing issue is vague; written language problems

Prescription:

Instruct at instructional level; lots of easy reading; continue to build sight vocabulary; have him write down own experiences; teach him to use a picture dictionary

Figure 22. A comparison of the hypotheses, diagnoses, and prescriptions stated for Matt across all diagnosticians (continued).

BARBARA

BONNIE - experimental session #1:

Hypotheses:
Limited ability; learning disabled; poor phonics; poor kinesthetically, doesn't like to write; cultural deprivation/poor home environment; language disability; poor comprehension; shy, doesn't do well in large groups; works hard; late implementation of remedial services (by the school)

Diagnosis:
Should test higher, feels has more ability; disciplined and cooperative; cultural deprivation

Prescription:
Continue with clinic program to increse exposure to new information; re-learn vowel patterns and rules for multisyllabic words; encourage writing; encourage parents to participate

PAT - experimental session #2:

Hypotheses:
Serious academic problems; auditory problems; good attendance; visual learner, sight reader; limited ability; possibly learning disabled; poor phonics; contextual reader; poor kinesthetically, doesn't like to write; visual + auditory reader; poor home environment, cultural deprivation

Diagnosis:
"Feels like looking at the same thing as last week" (twin); educable mentally handicapped; cultural deprivation

Prescription:
Placement in EMH room for language and reading, stay in regular class for math, science, and social studies; needs stimulation, new cultural experiences; use context for reading instruction (concrete cues); use sight word approach; use visual and auditory methods; have many rich language experiences

SARAH - experimental session #3:

Hypotheses:
Serious academic problems; auditory problems; good attendance; visual learner, sight reader; limited ability; poor phonics; poor comprehension; could be doing better; repeated kindergarten due to immaturity; shy, doesn't do well in large groups; attention problem, very active; not motivated

Figure 23. A comparison of the hypotheses, diagnoses, and prescriptions stated for Barbara across all diagnosticians.

Diagnosis:

Independent reading level = 2nd grade; instructional reading level = 3rd grade; oral reading fluent; sound knowledge of phonics, used context, comprehension good; behavior and low IQ work against her, hyperactive; more ability than showing; does not like to read

Prescription:

Short, controlled sessions; high interest materials; variety of reading materials and short tape-recorded stories; use manipulatives; train to watch for timer (for fidgeting); encourage to check for accuracy

AMY -- experimental session #4:

Hypotheses:

Learning disabled; immaturity, possible due to birth order; repeated kindergarten due to language problem (opposites, rhyming); is making some progress; can relax and tune out noises; finishes slowly, mind is elsewhere; behavior problems; distractible; average IQ; comprehension poor because he works to hard to just read; memory problem; visual learner; poor word attack; poor knowledge of words

Diagnosis (no firm diagnosis offered):

Average ability; impressed with physical activity, may not be able to settle down for reading; good visual memory; processing issue is vague; written language problems

Prescription:

Instruct at instructional level; lots of easy reading; continue to build sight vocabulary; have him write down own experiences; teach him to use a picture dictionary

Figure 23. A comparison of the hypotheses, diagnoses, and prescriptions stated for Barbara across all diagnosticians (continued).

STEPHANIE

PAT - experimental session #1:

Hypotheses:
Slow learner; visual area is a strength; language development problems; not thinking during reading, poor comprehension; not working up to potential, motivation problem; short attention span

Diagnosis:
Low ability; poor language ability (expressive language problem)

Prescription:
Language development program; needs a slower-paced (EMH) program; needs to go back and master basic skills

SARAH - experimental session #2:

Hypotheses:
Slow learner; immature; poor home environment; not thinking during reading, poor comprehension; poor phonics, consistent with reading level; not working up to potential, motivation problem

Diagnosis:
Independent level = primer; instructional level = 2nd grade level; no problems with phonics, structural analysis, or wild word calling; many weak areas of comprehension and vocabulary

Prescription:
Should be drawn out in conversation to improve vocabulary, try to related to personal experiences with concrete examples, must give chances to respond; use oral reading as an incentive; have guided setting for comprehension; needs more exposure to general topics; draw pictures and discuss; include parents

AMY - experimental session #3:

Hypotheses:
Slow learner; immature; poor home environment; visual area is a strength; language development problems; not thinking during reading, poor comprehension; focuses on details, oral reading is good; concrete learner; poor phonics, consistent with reading level; short attention span

Diagnosis:
Mildly retarded? ("depends upon which parts of tests are emphasized"); weakest areas are language and vocabulary; short attention span; needs further testing in phonics

Prescription:
Must have new vocabulary fully explained; use concepts in novel sentences; must have a variety of activities, emphasis on concrete; needs to work on more oral reading expression.

Figure 24. A comparison of the hypotheses, diagnoses, and prescriptions stated for Stephanie across all diagnosticians.

BONNIE - experimental session #4:

Hypotheses:

Slow learner; poor home environment, cultural deprivation; poor phonics, consistent with reading level; not working up to potential, poor motivation; parent concern but no school help; below grade level; twin effects (worked with twin last week)

Diagnosis:

No indication of special class?; can only re-cap test results; cultural deprivation, not addressed by school, may not be retarded

Prescription:

Parents should insist on special help in a small group setting; needs help in all language areas; do expressive writing; parents need to provide more experiences

Figure 24. A comparison of the hypotheses, diagnoses, and prescriptions stated for Stephanie across all diagnosticians (continued).

TONITA

SARAH - experimental session #1:

Hypotheses:

Teacher effects in 3rd grade, bad year; comprehends while reading; phonics needs review; divorce, home problems affecting school performance; poor self-image; sight learner via configuration; vision may be a problem; misses details when reading; fast reader

Diagnosis:

Doing great despite homelife; doesn't have thought patterns down yet; sounds out words by configuration

Prescription:

Have her read, tape and play back, make her aware of how she sounds; do assisted reading; work on speed, needs to hear models; focus on comprehension check of facts

AMY - experimental session #2:

Hypotheses:

Slight weakness in language; immature in kindergarten, should have repeated; effort goes with grades; frustrated in 1st grade; teacher effects in 3rd grade, bad year; culturally-related grammar and background; skipping book levels created many problems; reading problem not very bad; does comprehend while reading; low-average learner; phonics needs some review

Diagnosis (no firm diagnosis offered):

Not enough information to made diagnosis about phonics, does attempt to sound words, has trouble with vowels; instructional level = 3rd ?; attempts to make sense of test; vocabulary consistent with instructional level; appears to be a slow learner, low average ability

Prescription:

Review and re-teach vowels and patterns, evaluate further; needs further evaluation on blends and digraphs

JUDY - experimental session #3:

Hypotheses:

Slight weakness in language; culturally-related grammar, background; problem with math facts is that they were not learned originally; coordination problem, see handwriting; divorce and home situation causing severe problems; sight learner via configurations; auditory problems

Figure 25. A comparison of the hypotheses, diagnoses, and prescriptions stated for Tonita across all diagnosticians.

Diagnosis:

Severe auditory processing problem; expressive and receptive language problems

Prescription:

Would benefit from a special program/class designed to meet her needs (see above); simplify instructions

PAT - experimental session #4:

Hypotheses:

Slight weakness in language; teacher effects in 3rd grade, bad year; culturally-related grammar, background; skipping books from 2nd to 3rd caused severe problems; low-average learner; phonics needs some review; likes to please adults; coordination problem, especially with handwriting; possible LD; divorce/home situation causing stress; self-image is poor; sight learner via configuration; auditory problems

Diagnosis (no firm diagnosis offered):

Can't make accurate diagnosis, too much information is missing; needs WISC-R, Woodcock-Johnson Battery of Tests, emotional testing, information about learning styles, specific reading tests

Prescription:

None

Figure 25. A comparison of the hypotheses, diagnoses, and prescriptions stated for Tonita across all diagnosticians (continued).

PETER

AMY:

Hypotheses:

Average ability; learning disabled; contextual reader; weak in phonics; reading level should be 3.0; visual learner; 1-to-1 (special classes) making a big difference; should be doing better, not performing to potential; language problem, vocabulary;

Diagnosis:

Instructional level = 3.0; average ability; appears to think and get meaning; used context; weak in word attack and syllabication; need to test phonetic and structural analysis skills further

Prescription:

Definitely needs to work on vowels; must motivate client with high interest readings; teach vowels in real, whole words

PAT:

Hypotheses:

Average ability; learning disabled; perceptive, great sense of humor; contextual reader; poor phonics skills; good home background; reading problem; good memory; motor problems; language problems, vocabulary; visual problem; brain damage, auditory recall of details; demeanor, motivation, attitude is a problem

Diagnosis:

Severe learning disability is visual and auditory discrimination areas; needs a neurological to assess for brain damage; IQ should be higher than the test results indicate (humor indicates he is a "swift" kid)

Prescription:

Specific program tailored to disability; resource program for reading, regular class for social studies, science; use sight word approach to reading, play down phonetic analysis, teach word configuration rules.

JUDY:

Hypotheses:

Learning disabled; perceptive, good sense of humor; contextual reader; poor phonics; motor problem; language problem, vocabulary; problem in curricular areas; problem with demeanor, motivation, attitude; auditory recall of details is a problem; doesn't know when he's correct; knows what he can/can't do

Diagnosis:

Not severely disabled, but severe enough to cause problems, especially vocabulary; needs Slingerland to check other perceptual problems; good sense of humor

Figure 26. A comparison of the hypotheses, diagnoses, and prescriptions stated for Peter across all diagnosticians.

Prescription:

Give client clear introduction to words; tell client how information can be chunked with what is already known

SARAH:

Hypotheses:

Average ability; learning disabled; perceptive, good sense of humor; contextual reader; poor phonics; visual learner; should be doing better, not performing up to potential; reading problem; demeanor, motivation, attitude problem; problem with auditory recall of details; comprehension is good; jokes when frustrated; structural analysis is a problem; oral reading is disfluent; hates questioning; immature

Diagnosis:

Should be performing above what is presently doing; has a good sense of humor; is creative; body language gives him away; can't do phonics; has fallen a little behind in skills

Prescription:

Would stay away from phonics; needs high interest materials; needs to be kept busy, work intervals for short periods of time; use tape-recorded stories, multi-sensory materials; needs individual guidance on word attack

BONNIE:

Hypotheses:

Average ability; learning disabled; perceptive, good sense of humor; contextual reader; poor in phonics; visual learner; good home background; reading problem; problem with demeanor, motivation, attitude; problem with auditory recall of details; strong reasoning skills

Diagnosis:

Average ability; visual learner; will not learn to read phonetically; has no coping skills reading in isolation; depends on context when available; not being challenged, needs reason for improvement

Prescription:

Continue with Chapter I/LD help with sight word approach, later work on phonics ("back door" approach); work with challenging materials; use lots of visual stimuli; not further formal assessments

Figure 26. A comparison of the hypotheses, diagnoses, and prescriptions stated for Peter across all diagnosticians (continued).

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