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ABSTRACT

A student researcher at a nonprofit, university-based family center for learning-disabled and underachieving students designed and implemented a 7-week practicum intervention meant to improve the ability of four first and second grade level students to use reasoning skills. Piagetian theory regarding expected levels of cognitive development was researched. Students were instructed in problem solving in an effort to enable them to make inferences. Instruction in determining relationships enabled students to solve analogies. Instructional strategies included modeling, verbal rehearsal, metacognition, peer tutoring, and manipulative and discovery learning. Inservice training served to augment the researcher's knowledge of cognitive theory and its application in the classroom. Student progress was measured by Precision Teaching, a monitoring system involving charting to document growth. Evaluation data indicated that the intervention was effective. Appendices provide Precision Teaching charts, pre- and posttests, sample activity sheets, student drawings, and sample probes of students' reasoning. (RH)

INCREASING LEVELS OF ABSTRACT REASONING ABILITY IN FIRST AND SECOND GRADERS THROUGH INSTRUCTION IN INFERENTIAL THINKING AND ANALOGICAL REASONING

by

SHELLEY CINDY OBRAND

A Practicum Report
submitted to the Faculty of the Center for the Advancement of Education of Nova University in partial fulfillment of the requirements for the degree of Educational Specialist.

The abstract of this report may be placed in a National Database System for reference.

September/1989

Authorship Statement

I hereby testify that this paper and the work it reports are entirely my own. Where it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my own work, presented here, will earn similar respect.

Shelley C. Obrand

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Abstract

Increasing Levels of Abstract Reasoning Ability in First and Second Graders Through Instruction in Inferential Thinking and Analogical Reasoning.

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The ability of first and second graders to use reasoning skills was addressed by the implementation of strategies to develop inferential thinking and analogical reasoning. Piagetian theory was researched in reference to expected levels of cognitive development. The target group of students received instruction in problem-solving to enable them to make inferences. They also received instruction in determining relationships to enable them to solve analogies. Instructional strategies included: modeling, verbal rehearsal, metacognition, peer tutoring, manipulative learning, and discovery learning. The students' progress was measured by Precision Teaching (a monitoring system involving charting to document growth). Inservice training was provided by a mentor to augment the researcher's knowledge of cognitive theory and its application in the classroom. Results indicated that strategy interventions provided by a teacher, in combination with inservice training provided by a mentor, served to train the students to use higher level thinking skills. Appendices include: Precision Teaching charts, pre- and posttests, sample activity sheets, student drawings, and sample probes.

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Practicum Title Increasing Levels of Abstract Reasoning Ability in First and Second Graders Through Instruction in Inferential Thinking and Analogical Reasoning

Student's Name Shelley C. Obrand

Program Site Baudhuin School/Nova Univ. Date 8/17/89

Observer's Name Susan Weimer Susan Weimer
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Observer's position Elem Program Dir. Phone # 475-7324

Observer's comment on impact of the project (handwritten):

The practicum was implemented at the Baudhuin Oral School during the summer of 1989. The final report demonstrates the strategies and interventions utilized.

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CHAPTER I

Purpose

This practicum was designed to serve elementary students functioning at the first and second grade levels. The focus of the practicum dealt with providing instruction to enhance the students' ability to utilize reasoning skills. The researcher was also to gain theoretical and practical information provided by a mentor through inservice training.

The setting for the practicum implementation was a private, educational institution serving students from preschool to graduate level. The on-campus program, housed in the university's family center, was designed to meet the academic needs of learning disabled students and underachievers ranging in ability levels from kindergarten through eighth grade.

Demographically, children enrolled in the remedial program are seen from two counties. The families have mixed socio-economic backgrounds; lower middle class, middle class, and upper middle class constitute the majority of clients seen. Racially, it is predominantly White with a minority of Black and

Hispanic children. The political and economic forces behind the program, and the center in which it is housed, stem from the university. The faculty operates under the auspices of the university, but it is a private, non-profit center. Financial support is provided by government grants, tuition fees, and personal donations offered by the private sector. Scholarship monies are available for socio-economically disadvantaged families.

During the course of the school year, September through June, the program operates on four eight-week sessions meeting with students two hours a week after school. The summer session that this researcher was involved in ran for an eight-week period of time. During week number one, the writer reviewed psychological test data, administered criterion-referenced tests to the children, analyzed the results, and planned individualized programs for four students. This was followed by six, intensive weeks of instruction. The eighth week was scheduled for formal parent conferences to discuss the students' progress.

Children enrolled in the summer program attended local, private, or public schools. Students were recommended to the program by psychologists, exceptional student education (ESE) specialists, classroom teachers, or the parents themselves. It is the goal of the program to work on deficient skill areas and enhance the children's self-concepts by providing immediate positive feedback through charting daily performances.

Population

The four students targeted for this study functioned at above average level in literal comprehension, but lacked the ability to think or reason abstractly, as determined by the following information which provides a profile of each child.

Student one, a second-grade female student, attended a public elementary school. She had two older siblings and resided in an intact family. According to the results of the Wechsler Intelligence Scale for Children - Revised (WISC-R), she was placed in the average range with a full-scale intelligence quotient (IQ) score of 106. The student was referred for testing by the classroom teacher due to her poor classroom performance. She received a scaled score of 10 in Information, a 6 in Similarities (which assesses logical relationships and abstract thinking), and an 8 in Comprehension (which assesses social judgement and reasoning). The writer administered the Multilevel Academic Skills Inventory (MASI) to the student and she received the following comprehension scores at the primary level: complex questions - 1 correct/1 error, sequence questions - 2 correct/0 errors, factual questions and inferential questions - 1 correct/3 errors.

Student two, a second-grade female student, attended a private accelerated school. She resided with both parents and was the second of three children. She was referred to the program because she had difficulty attending to task and completing her classwork. The regular classroom teacher perceived her as a bright child. The student had not been evaluated by a school psychologist. Pertinent California Achievement Test (CAT) scores revealed weaknesses in word analysis (19) and using information (23). Results of the MASI comprehension component revealed the following test scores at the primary level: complex questions - 2 correct/0 errors, sequential questions - 1 correct/1 error, factual questions - 2 correct/0 errors, and inferential questions - 2 correct/2 errors.

Student three, a second-grade male student who attended a public elementary school, was experiencing academic difficulties. He was a motivated learner and according to his classroom teacher, he was a meticulously detailed worker which presented difficulty with task completion. The student was administered a WISC-R by the school psychologist to seek eligibility for an exceptional student program. Results revealed a full-scale IQ of 116 with no significant discrepancies. He scored a 13 in Digit Span and Picture Completion and a 12 in Picture Arrangement confirming his strength of visual detail and attention to task. He scored an 8 on Similarities (associating abstract ideas) and a 9 in Comprehension (reasoning and providing logical solutions). The student received the following MASI comprehension scores at the primary level: complex questions - 1 correct/1 error, sequential questions - 2 correct/0 errors, factual questions - 2 correct/0 errors, and inferential questions - 2 correct/2 errors.

Student four attended a private school for learning disabilities where he was functioning on a first-grade level. His mother had been recently remarried and he had one older brother. The student was highly distractible and had poor word attack skills. He required constant feedback to enable him to perform at levels commensurate with his abilities. Results of the Iowa test scores revealed deficits in the areas of language (1.1) and reading (1.5). The MASI comprehension subskills were read aloud to him by the examiner due to his difficulty in decoding at the primary level. He scored 0 correct/2 errors in complex questions, 1 correct/1 error in sequential questions, 2 correct/0 errors in factual questions, and 0 correct/4 errors in inferential thinking.

Based on the preceding information, it was determined by this writer that instructional strategies to improve inferential thinking would be of benefit to the targeted group. Baseline data scores of abstract reasoning skills were also collected to further document the need for instruction in this area, as indicated by Tables I-IV (Appendix A:74).

Mentor inservice training was provided to augment the researcher's knowledge of cognitive theory. Cognitive theory and its application was discussed for the purpose of implementation. A pretest measured prior knowledge of the subject matter (Appendix B:78).

Based upon documented need, the following objectives were identified for instructional purposes:

1. The four students will read a group of words and circle the correct analogy from a choice of three at a rate of 12-15 words per minute as measured by Precision Teaching.

2. Three of the four students will read a group of words, determine the relationship, and supply (write) a word to complete the analogy at a rate of 10-14 words per minute as measured by Precision Teaching.

3. Given five short paragraphs to read, all of the students will correctly identify five inferential statements per minute by circling a response from a choice of three as measured by Precision Teaching.

4. After listening to a short story, the four students will respond verbally to inferential questions

at a rate of 5-7 responses within three minutes as measured by Precision Teaching.

5. The writer will increase her knowledge of cognitive theory and practical application by 50 percent as measured by a pre and posttest.

CHAPTER II

Research and Solution Strategy

Based on the analysis of previous test scores and the researcher's own baseline data collection, it was determined that the targeted population of first and second graders was deficient in reasoning skills. The focus of this practicum was to provide instruction to increase the students' abilities to utilize higher level thinking skills. Instructional strategies were designed to encourage the use of inferential thinking and analogical reasoning.

The ultimate goal of the educator is to provide teaching experiences resulting in optimum learning. To accomplish this, teachers must understand the nature and needs of young children. The process can be enhanced by investigating the theoretical basis of cognitive development. Once this is done, the educator can apply the theory to classroom teaching and develop the learner's potential by providing relevant, meaningful instruction.

Piaget's Learning Theory

Jean Piaget, a leading cognitive theorist, studied how children develop cognitive abilities. He brought many insights into the way children learn. According to Piaget, as cited by Lerner, Czudhowski, and Goldenberg (1987), children pass through stages of development characterized by particular types of thinking.

Piaget's theoretical assumptions, as cited by Webb (1987), state that there are four factors of mental development: the maturation of nervous and endocrine systems; the experience of discovering on the part of the learner; the social interactions offering observation, instruction, and feedback; and the internal self-regulation mechanisms that respond to environmental stimulation by assimilation and accommodation. Within this theoretical base, Piaget has identified a series of stages of cognitive development. "The stages must occur in a particular sequence, since each stage incorporates and restructures the previous one and refines the individual's ability to perceive and understand" (Webb, 1987:93). The stages are as follows: the sensori-motor stage (birth to about two years), the preoperational stage (two to seven years), the concrete operational stage (seven to eleven years), and the formal operations stage (adolescence).

In keeping with Piaget's theoretical assumptions, progress through the stages should not be accelerated. Piaget, as quoted by Webb (1987:94) states, "better comprehension at a given stage may be a more appropriate goal than forced acceleration to the next cognitive level." According to Webb, Piaget feels that such piecemeal acceleration often results in distorted or incomplete conceptional development that may hamper future thinking. A child must be developmentally ready to learn and internalize newly acquired information. Direct experience involving the child's actions facilitates cognitive development. When a child makes an incorrect response and the teacher simply tells the student the right answer, the student may ignore all reasoning connected to that wrong answer. Instead, the teacher can promote thinking and cognitive growth by helping the child analyze the problem again by directly involving the student in the experience (i.e., deciding whether an object will sink or float). Furth and

Wachs, as cited by Wadsworth (1978), suggested the following rationale when selecting activities that experientially involve students: (a) let each child's success be measured in terms of bettering his/her performance; (b) avoid activities that are so structured that there is only one correct way to respond; (c) provide challenging, but not overwhelming activities, (d) arrange for most of the students' time to be focused on activities, not on the teacher; and (e) provide activities to be completed with peers since this interaction can provide encouragement and assistance. The importance of social interactions can be seen in peer interactions for several reasons. Students attach special significance to activities that are considered important by their peers. Peers can serve as models for skills to be acquired. Since peers are at about the same cognitive level as the learner, their explanations may be more understandable than those of the teacher (Webb, 1987).

Since the researcher's target population was seven and eight year olds, the emphasis of research is within the stage of concrete operations. As children move into the concrete operational stage, they are able to use logic to analyze relationships and structure the environment into categories that are meaningful (Webb, 1987). A child must have many interactions with concrete materials within this period, since the ability to think abstractly is built on understanding these interactions. In all areas of learning, much concrete experience must precede abstract verbalizations.

Piaget's research established that the development of concrete operational thinking was central to the early development and future development of intelligence. According to Freyberg, cited by Pasnak (1978), reasoning ability, as measured by Piagetian tasks of logical thinking, is basic to school achievement in kindergarten and the primary grades. Silliphant, cited by Pasnak (1978), points out that children in a typical kindergarten are reasoning at different levels, in Piagetian terms. Many of these children have mastered the concepts of seriation and classification, marking the transition from preoperational to concrete operational thinking. "Some, however, are unable to order objects consistently along a dimension, or to abstract differences and similarities along a multitude of dimensions" (Pasnak, 1987:358).

Piaget has focused many of his studies around several aspects of relations. His early research on the child from about five to ten years investigated reasoning about differences given a verbal problem to solve. For example: A has fairer hair than B; A has darker hair than C. Which is the darkest? Results showed that these children were unable to deal with these problems at a verbal level. "Apparently, the child's classification is concrete; he understands the inclusion relations of real objects, but fails to comprehend the same relations when imaginary classes are involved" (Ginsburg and Opper, 1978:123). Piaget returned to the problem of relations in his later work. Using a revised clinical method, he performed studies on ordinal relations (greater than/less than and serial ordering of sticks). Results indicated that the concrete operational child can understand and manipulate ordinal relations, but as in the case of classification, there is a limitation.

> He can deal with relations on a concrete level only when real objects are involved. As in the case of classification, the

> processes underlying the child's ability to manipulate relations form integrated and comprehensive structures. (Ginsburg and Opper, 1978:138)

Even at the concrete operational level, children can perceive relations and begin to think abstractly. Piaget, as cited by Wadsworth (1978) describes two aspects of thinking that are different but related: the figurative aspect and the operative aspect, or figurative and operational thinking. "The person looking at a tree 'sees' it figuratively, but in his mind it is also conceived as alive, having roots, branches, leaves, as a potential piece of furniture, etc." (Wadsworth, 1978:40). These operative perceptions go beyond the limitations of figurative knowledge. Intellectual growth is categorized by the growth of operative knowledge. "Figurative knowledge 'feeds' the development of operative knowledge and is its source" (Wadsworth, 1978:41). Children must be able to think figuratively and operatively as they develop higher level thinking skills. Comparing/ contrasting, inferring information, and determining relationships are several of the skills that require the ability to think in operational terms.

The concrete operational child acquires logical thought processes to apply to concrete problems.

> He/she developed the ability to think through relationships, to perceive consequences of acts, and to group entities in a logical fashion. Children are now better able to systemize and organize their thoughts . . . and deal with aspects of logic, classes, and relations (Lavatelli, 1977:221).

Silliphant, as cited by Pasnak (1987), documented evidence that many studies have shown that concrete operational thinking is related to reading skills in grades one to three, and that the relationship is especially strong for seriation and classification. With this information in mind, a curriculum modification was designed to increase the general reasoning ability of kindergarten children who were lagging in cognitive development. An instructional program was designed for experimental children given "learning set instruction" on unidimensional classification and seriation. The learning set instruction consisted of teaching students to manipulate objects according to four primary dimensions: texture, size, form, orientation. They were also taught to discover the class of an object and relate it to another of similar function. A teacher-led discussion of classification and seriation prompted the students to rationalize their decisions of placement of objects. The children in the control group were taught these concepts through the regular math and reading curriculum (lecture instruction). Results revealed that the experimental students made twice the gains of the control children on reading and math achievement according to the Metropolitan Achievement Test. The intervention demonstrated that the understanding of these concepts is crucial to the transition from preoperational to concrete operational thought. "The study suggests that learning sets focused on cognitive operations, especially relevant stages of thinking, may have an impact on kindergarten students' reasoning abilities" (Pasnak, 1987:362).

Bloom's Learning Theory

The learning process, according to Benjamin Bloom, occurs in a hierarchical manner beginning with simple thinking processes and proceeding step-by-step through more complex processes. Hamblen, as quoted by Zachman (Making Language Bloom, 1988:9), states:

> A taxonomy was formulated on principles that learning proceeds from concrete knowledge to

> abstract values, from dependent to independent thinking, from taking-for-granted facts to increased consciousness, and from the denotative to the connotative.

Bloom's taxonomy contains six major classes: knowledge, comprehension, application, analysis, synthesis, and evaluation.

Based on verbal interactions with the targeted population of seven and eight-year-old learners, this researcher determined that they had obtained mastery of the knowledge level of the taxonomy. Therefore, reasoning skills were focused on at the levels of both comprehension and application of the taxonomy. The comprehension level refers to the ability to grasp the meaning of material by translating material, interpreting material (explaining or summarizing), or by estimating (predicting). This learning is one step beyond the simple remembering of material and is the lowest level of understanding (Dembo, 1982). The application level refers to the ability to use newly acquired information in other situations. This includes the application of rules, principles, and theories.

"Probably the largest general class of intellectual abilities and skills emphasized in schools are those which involve comprehension" (Bloom, 1968:89). Here, according to Krathwohl, as cited by Costa (1985), comprehension represents an understanding of a literal message of a communication. Three types of comprehension are considered: translation (putting meaning into another form), interpretation (making inferences and generalizations based on relationships), and extrapolation (making estimates and predictions). Key question words to elicit comprehension level responses include: describe, explain, use your own words, compare and contrast (Making Language Bloom, 1988).

"The fact that most of what we learn is intended for application to problem situations in real life is indicative of the importance of application objectives in the general curriculum" (Bloom, 1968:122). Part of the effectiveness of a school program is dependent upon how well the students apply what was obtained in the learning process. The application of information requires "comprehension." Key question words to elicit application level responses include: solve, what else, instead of, choose, apply and sort (Making Language Bloom, 1988).

> We need more than ever to help students develop problem solving methods which will yield more complete and adequate solutions to a wide range of problem situations. It is hoped that the taxonomy . . . will facilitate the exploration of new methods of teaching for high-level problem solving and assist in evaluating these methods (Bloom, 1968:43).

Even though the taxonomy was first designed to work with the gifted population, special educators working with learning disabled students are beginning to apply Bloom's research in their special education classes. By using the six progressive thinking levels of the taxonomy to teach, question, and evaluate, educators have discovered that children with special needs can think critically. Zachman, as quoted in Making Language Bloom (1988:3), states "Educators have uncovered these students' and young students' abilities to predict, decide, select, infer, and analyze all that they learn in school and experience in life." Critical thinking or reasoning are no longer terms thought of in only gifted classrooms; these skills can and must be used in regular and special education classrooms, too.

Thinking Skills

The goal of having students become more effective thinkers is fundamental to education. While many teachers value thinking and use methods that encourage its development, a number of studies indicate that these teachers are not the norm. John Goodlad conducted an extensive study involving more than 1,000 classrooms throughout the country. Results showed an average of 75 percent of class time was spent on instruction and approximately 70 percent of this time involved verbal interactions with teachers "out-talking" students by a ratio of three to one. Less than one percent of teacher talk encourages students to be involved with more than just recall of information (McTighe and Schollenberger, 1978). Other studies have reached similar conclusions. "Most teachers do not regularly employ methods that encourage and develop thinking in their students" (Costa, 1985:7)

Arthur Costa believes that teachers should create classroom conditions that are conducive to children's thinking. This can be accomplished by teaching for, of, and about thinking. Costa recommends that teachers pose problems, raise questions to students, value thinking and make time for it in the school day, and respond to students' ideas in a way that creates trust and allows risk-taking (Costa and Marzano, 1987). Others agree that the teaching of thinking requires teachers to instruct students in the process of thinking. This does not mean that a specialized curriculum is required, rather that thinking skills should be taught through subject areas in the regular curriculum. For example; reading requires analysis, comparisons, making analogies, inferring, and evaluating (Costa, 1985).

Costa and Marzano (1987) have identified several starting points for developing students' thinking skills. Teachers should use specific cognitive terminology to show students how to perform particular skills. For example, instead of saying "Let's <u>look</u> at these two pictures," say, "Let's <u>compare</u> these two pictures." Then the teacher must demonstrate how to find similarities and differences in them. "As children hear these terms daily and develop the cognitive processes that these labels signify, they will internalize the words and use them as part of their own vocabularies" (Costa and Marzano, 1987:30). Another suggestion concerns giving directions. Teachers often provide so much information that students are not required to infer meaning. Instead, teachers should ask questions that require students to analyze the task and identify what is needed to complete the task. According to Laborde, as cited by Costa and Marzano (1987), to encourage careful thinking, teachers should probe students' specificity: be specific about actions, make precise comparisons, and use accurate descriptors. Training students to use metacognitive thought processes is a further recommendation made by the authors. "When teachers ask children to describe the thought processes they are using, and the plans they are formulating, students learn to think about their own thinking--to metacogitate" (Costa and Marzano, 1987:32). Whimbey, as cited by Costa (1985), refers to this as "talk about problem solving." As teachers ask students to describe what's going on inside their heads, the students become aware of their thinking processes. Teachers can share their own thinking by verbally rehearsing the ways to solve problems aloud. The teachers can model their metacognitive processes to students.

Costa also recommends ways in which to develop thinking skills along Bloom's Taxonomy. He suggests modeling, comparing, discussing, and interacting at the comprehension level. Extending use across subject areas, demonstrating, and analyzing is encouraged at the application level.

Inferential Thinking

This writer focused her research on the cognitive development of young learners based on the work of Piaget (at the concrete operational stage), Bloom (at comprehension and application levels), and Costa (levels of thinking). Utilizing this framework, or theoretical base, the young learners' capabilities were investigated within the above-mentioned levels. Research has shown that the students were cognitively ready to receive instruction in the skill areas of inferential thinking and analogical reasoning.

According to Pearson and Hanson, as cited by Holmes (1985), readers have more difficulty answering inferential questions than literal questions. One explanation is that students are not given enough practice in using inferential skills. Guszak, as cited by Holmes (1985), found that teachers tend to ask more literal than inferential questions. This was found to be true of basal readers, also. Sadker, as cited by Holmes (1985), found that studies of classrooms suggest that lower achieving students or poorer readers are asked fewer inferential questions than better readers. A second explanation is that poor readers do not use their prior knowledge to answer inferential questions. Torgeson, as cited by Holmes (1985), suggests that logical reasoning may truly be lost when students do not have successful strategies for solving problems.

Holmes (1985) conducted a study to determine whether teaching disabled readers a structured inferencing strategy using materials sequenced from easy to more difficult would improve their ability to answer inferential questions. The subjects were third and fourth-grade students who were randomly placed in an experimental group (strategy training plus materials) and a control group. Results indicated that the strategy group scored significantly higher on experimenter-designed inference questions (Holmes, 1985).

Strategy training consisted of a number of techniques. The task of answering inferential questions was simplified when information required to answer the question was given in one or several sentences rather than lengthy paragraphs. Another way the task was simplified was by the type of response required. Yes/no or multiple choice questions require recognition, while short answer questions require producing a response. Begelski, as cited by Holmes (1985), considers recognition to be an easier task than production. Sequencing the difficulty level of inferential activities was also an effective strategy. First, the students were given a pre-question, followed by one sentence, and a multiple-choice response. Second, the students were given a pre-question, several sentences, and a multiple-choice response. Third, students were given a pre-question, a paragraph, and a multiple-choice response, followed by a pre-question, a paragraph, and no response. Last, the students were given a post-question, a paragraph, and no response. Students progressed well through each level. Two additional strategies included teaching the children to use key words from the passages and self-questioning.

For example, if trying to determine the identity of an animal after selecting key words to describe the animal, the students would name various animals and self-question to see if the characteristics matched the animal.

According to Graesser, as cited by Thompson and Myers (1985), states that the role of inferences in comprehension has been studied at length with adults and children, but little research has been done with children under five years of age. Thompson and Myers (1985) conducted a study of four and seven-year-olds to compare the effects of several variables of inferential processes in young children. The three variables were inferential types, causal connections, and asking inferential questions. Inference types included constrained inferences (which is determined by and relevant to the information in a story, but the child must have background knowledge about the object or events), and unconstrained elaborative inferences (which is adding extra story knowledge to irrelevant information) (Thompson and Myers, 1985). It was found that seven-year-olds were most responsive to logical questions and least responsive to unconstrained questions, while four-year-olds responded most frequently to unconstrained questions and least to constrained questions. Data suggested that by the age of seven, children restrict their range of inferences to those of a story. Only when questioned for elaboration might they take the time to look for clues to respond. The seven-year-olds responded more to logical inferences because their memories were better. The four-year-olds responded least to constrained inferences as Wimmer, cited by Thompson and Myers (1985), suggests that they may not have sufficient world knowledge in order to connect story events.

Causal connections within stories that affect inferences referred to physical causes (when a mechanical cause is responsible for an event), or psychological causes (when a character's thoughts or feelings relate to events). Results indicated that four-year-olds performed better when physical causes connected events. Seven-year-olds responded equally as well to either type. The study revealed that four and seven-year-olds do differ in their logical constrained and unconstrained inference production, and their ability to use causal connections between story events (Thompson and Myers, 1985).

Torrance (1978) recommends that teachers ask interpretive questions to begin the process of inferential thinking on the part of the learner. After reading short passages, the teacher may ask students to interpret individual words or sentences. "The interpretation question is a useful technique in helping children comprehend written materials. It can be used to help young people see relationships and implications in any kind of idea" (Torrance, 1978:174).

Effective questioning strategies are vital to the quality and accuracy of student responses. "Questioning is often called the 'hub' of the teaching process" (Bowen, 1986:2). Meaningful and creative questions are often much more important and revealing than the answers given. A good questioning technique is one of the most important tools of the teacher (Bowen, 1986).

In order for teachers to ask effective questions, they must be aware of the difficulty level of the questions. There are four levels of questioning. Students must recall or locate facts and details at the concrete level. Students begin to develop thinking skills and go beyond the comprehension of facts at the abstract level. Students must be able to judge information against a criteria at the critical level. The creative level consisted of open-ended thought-provoking questions (Bowen, 1986).

The abstract level of questioning relates to the interpretation level of thinking skills. These skills include drawing inferences, predicting outcomes, seeing cause and effect, and seeing relationships and analogies. An effective means for developing reasoning skills that demands the ability to determine relationships is the study of analogies.

Analogical Reasoning

Analogies are comparisons expressing logical relationships between words or concepts. "Understanding analogies requires the ability to discern relationships between words, and the knowledge that the first word pair in an analogy must have the same relationship as the second" (Goldberg and Rothstein, p. 167). The formula, A is to B as C is to D, presents words with no context. Interpreting analogies is a higher level thinking skill involving abstract reasoning. There are a variety of analogy constructions. They include:

synonyms, antonyms, concepts in the same class, members of a class, causal relations, size relations, time/sequence relations, part to whole, and concepts that perform functions for other concepts (Talpins, 1989). At the comprehension level, the focus is on identifying relationships between words. At the applications level, the focus is on incomplete analogies where choices are not provided.

Geck and Holyoak, as quoted by Neppold, Erskine, and Freed (1988:440), state that "analogical reasoning occurs when familiar concepts are related to new experiences, and similarities between relatively different situations are discovered." Analogies are often used by teachers from preschool through college levels as they attempt to clarify difficult concepts for students. For example, for a first grade nutrition lesson, a teacher might make the analogy that children need food just as cars need gasoline.

In a study conducted by Neppold, Erskine, and Freed (1988), the researchers examined children ages 5 and 11 as to their ability to reason by analogy. Verbal and perceptual analogy problems, in the form of A is to B as C is to D, were studied. According to

Lorge, as cited by Neppold, Erskine, and Freed (1988), research has shown that competence in verbal analogical reasoning is related to competence in perceptual analogical reasoning and competence in both areas is related to intelligence and academic achievement. Feuerstein, as cited by Neppold, Erskine, and Freed (1988), added that the ability to solve analogy problems continued to develop throughout childhood and adolescence as speed and accuracy improve and systematic strategies develop.

This study consisted of listening to a story involving the transfer of objects from one location to another. In the story, a genie wanted to move his jewels from one bottle to another quite a distance apart. To accomplish this, he rolled his magic carpet into a tube and used it as a tunnel to transfer the jewels from one bottle to the other. The students were to solve an analogous task of moving gumballs from one bowl to another bowl that was out of reach. Results revealed that when cognitive and linguistic demands are lowered, children as young as five can perform analogous tasks successfully (Neppold, Erskine, and Freed, 1988).

Gentner, as cited by Neppold, Erskine, and Freed (1988), also demonstrated that children ages four to seven were able to reason by analogy when age appropriate activities were employed. In Gentner's study, a task was presented that required the child to determine what parts of a tree would be analogous to parts of the body. Results indicated that even four-year-olds performed the task as well as a control group of adults.

In similar studies conducted by Crisafi and Brown (1986), the learning and transfer abilities of two- to four-year-old children were examined on tasks that required them to combine two separately learned solutions to reach a goal. The children were taught to find a penny in a piggy bank and insert the coin in a gumball machine to receive a gumball. They were then shown a milk container filled with coins and a specially designed truck that dumped candy when a coin was inserted. The children were asked to produce a piece of candy without any instruction of how to accomplish the task. A similar experiment was then conducted as the children were to obtain candy from a three panel plastic box by opening an opaque drawer with a key located under the middle panel.

Results revealed that young children are capable of combining two separately learned pieces of information to reach a goal when the task is familiar (Crisafi and Brown, 1986). According to Campione, as cited by Crisafi and Brown (1986), in order to transfer a learned solution from one task to another that has different surface features but underlying similarities the students must apply the relations between the two analogous situations. It was found that these children did notice the similarity of analogous tasks that differed on the surface but shared the same strategies and, thus, were able to solve the problem.

Peer Tutoring

Another strategy to encourage students to work at an optimal level is the use of peer tutors. Tutoring programs, offered in many schools today, differ in an important way from yesterday's tutorial programs. In most modern programs, children are tutored by peers or paraprofessionals rather than by regular school teachers (Cohen, Kulik, and Kulik, 1982). Research investigations, conducted by the authors, measured the ef' .s of tutoring programs on the students who received tutoring and on the students who served as tutors. In analyzing, 45 of 52 student achievement studies, results revealed higher examination performance of students tutored by peers as compared to students in a conventional class. Tutored students also developed positive attitudes toward the subject matter taught. In 33 of 38 studies investigating the effects on tutors, it was found that students who served as tutors performed better than control students on examinations in the subject being taught. The attitudes toward subject matter was also more positive among those serving as tutors (Cohen, Kulik, and Kulik, 1982).

According to Cohen, Kulik, and Kulik (1982); Ellson, Rosenshine, and Furst, concluded that tutoring programs can co. ribute to the academic growth of students who receive the tutoring and students who provide the tutoring as well. The most effective tutoring includes the following features: (a) a highly structured program; (b) instruction in basic content and skills (grades 1-3); and (c) a program of short duration (a few weeks) (Bennett, 1986). "The message from the educational literature on tutoring seems clear enough; these programs have definite and positive effects on academic performance and attitudes of the tutors and tutees" (Cohen, Kulik, and Kulik, 1982:244).

Precision Teaching

As imperative as it is for educators to continuously seek innovative strategy interventions to teach young students, it is equally essential that they have a way to monitor student progression and evaluate the effectiveness of their instructional endeavors. Precision Teaching is such a monitoring system that measures student progress. It is a direct, continuous measure of performance in specific skill areas. Precision Teaching uses rate or frequency as a unit of measure. The number of correct and incorrect responses for a specific time period is measured. The proficient or fluent student does tasks not only correctly but within set time limits (Hefferin, 1983).

According to Patrick McGreevy, cited by Hefferin (1983), a behavior that is either academic or social is selected by a teacher as a target of change. In order to change a behavior, the teacher must be able to count it. The behavior must be observable, repeatable, and have a beginning and end (Hefferin, 1983). For example, "writing subtraction facts" can be observed, repeated, and has a start and an end.

After a behavior has been chosen, the counting period is decided upon. The unit of measure used in Precision Teaching is frequency per minute (the number of behaviors occurring during a specified time period) (Hefferin, 1983). One-minute samples are usually the counting period for most academic behaviors.

Each day, the classroom teacher takes a one-minute timed sample of each student's performance in particular skill areas. The data is then plotted on a logarithmic chart. The number of responses that are to be accelerated (often the number correct) are represented as dots on the chart. The responses that are to be decelerated (often the number of errors) are represented as X's. Charting serves several important functions. It provides the student with a visual picture of his/her performance, encourages competition with oneself (is self-motivating), and allows the teacher to make instructional decisions based on data collected. These daily decisions involve changes in methods, materials, schedules of reinforcement and/or consequences (Appendix C:83).

"Practices, fluency building, and instructional decisions based on direct, continuous data form the foundation of Precision Teaching" (Hefferin, 1983:7). Precision Teaching provides useful information which can help teachers and students get the most benefit out of the school day.

This researcher conducted an extensive review of the literature on cognitive theory and development. This review led to strategy interventions targeted to improve young learners' abilities to think abstractly. Instructional strategies designed to facilitate thinking skills, questioning techniques, inferential thought, and analogical reasoning were investigated. Student achievement was documented by the use of Precision Teaching.

CHAPTER III

Method

Whimbey, as cited by Worsham in Developing Minds (Costa, 1985), claimed that studies indicate that a student's ability to think more effectively can be improved through direct instruction. Whimbey's research indicated that if students are taught basic thinking skills and given practice in using them, then overall ability to think and solve problems will improve (Costa, 1985). This practicum involved instructional emphasis on developing thinking skills.

General Interventions

This instructor met with the four targeted students in first and second grades for a period of seven weeks. The students received instruction five days a week. Class periods were comprised of teacher instruction using demonstrations and modeling, class discussion, games, manipulative learning, and skills practice activity sheets. One of the above-mentioned formats was used on a daily basis.

Various strategies were utilized during the implementation period. These techniques facilitated student understanding of inferential and analogical thinking. Teaching methods included peer tutoring, modeling and verbal rehearsal, metacognition, prompting, using appropriate cognitive language, and directly involving students in the learning process.

Peer Tutors

Peer tutors were used to further clarify instruction, to demonstrate procedure, and/or to check other student's work. At times, the language of children communicates intent more effectively than that of the teacher. Peers also served as models to show how to follow procedure. The teacher encouraged students to work out sample problems for each other serving as a guide for further independent seat work. Peers were also asked to check each other's work using answer keys and to provide feedback regarding correct and incorrect responses. If responses were incorrect, students were encouraged to state why a different response would have been more appropriate.

Metacognition

Along the same lines as verbal rehearsal and modeling, the students were encouraged to describe their own thought processes. They were told to "think about thinking." Students learned to "talk their way through" problem solving to realize which strategies they used. For example, given the problem of transferring marbles from one bowl to another, without the use of fingers, students were to think through a strategy to solve the problem, and then compare their solutions.

Prompting

It was often necessary to prompt student responses for either clarification or expansion of ideas. At the beginning of the implementation period, the "I don't know" syndrome was rampant. Prompting questions such as, "What else might have happened?" or "What if . . ." increased student response time. Peers often prompted each other by providing clues to solve problems. For example, a student might say, "You do this when you are hungry," when seeking the word "eat."

Appropriate Cognitive Language

The students were trained to use reasoning skills by learning the correct cognitive language to solve problems. For example; if a task demanded that the students compare objects, the teacher would say, "Let's compare these objects," not "Let's look at these objects." The students learned to internalize the labels given to concepts such as compare, contrast, analyze, describe, and relate. Providing appropriate labels for cognitive concepts enabled the students to respond more specifically and accurately.

Direct Student Involvement

The students were involved in manipulative learning whenever possible by physically experimenting with objects and discovering solution strategies. For example, when deciding whether words were tangible or intangible, the students were instructed to physically place items such as a "pencil," "toy car," and "fun" into boxes. Students were not just told the right answer; instead, they were to analyze the problem by direct involvement.

Strategies That Developed Inferential Thinking

The following strategies were used during implementation of this practicum to develop the targeted students' inferential thinking skills:

1. The students learned the key words that elicited inferential thinking. The teacher and students brainstormed descriptors at the chalkboard that dealt with higher level thinking skills. The following words were selected: solve, what else, apply, choose, describe, explain, compare, contrast, use your own words, and what if. The teacher modeled example sentences containing each one of the descriptors. The students then thought of additional sentences as they participated in a group discussion. The same procedure was followed to identify literal thinking descriptors, such as who, what, where, when, define, state, tell, etc. The students then wrote each descriptor on a separate index card. The words were color-coded for inferential and literal terms. The colors were arbitrary; the students chose their own colors. They made a "key card" for the two types of terms that matched the color of the descriptor words (Appendix D:86). The students then manipulated the

cards by matching the words to the correct key card type using the color-coded prompts. Eventually, this prompt was removed, the students matched words to the key cards, and self-checked their responses on the back of the key card where all the descriptors were listed.

2. When reading short stories where information was inferred, the students identified key (clue) words that facilitated solving the problem. The students circled the key words that were relevant to responding to the question. For example, to identify a specific animal, the students circled all the descriptors that might help to name that animal. The students were asked to hypothesize possible answers. A story might tell about an animal with spots. It may state that the animal eats leaves, has a large tongue, long legs, small ears, a long neck, and can run fast. By using self-questioning strategies (formulating yes/no questions; i.e., Is a giraffe an animal? Does a giraffe have a long neck? Does it eat leaves? Can it reach the top of a tree?), the students concluded that the animal must be a "giraffe." The students were provided with little magnifying glasses (found in

cereal boxes) as they were encouraged to "play detective" and look for clue words.

3. The teacher sequenced the difficulty level of material read by students. First, activities were presented so that the students were able to preview a question prior to reading the passage. The students then responded to a multiple-choice question format. Second, material was presented but the students were not allowed to preview the question before reading the selection; however, they still responded to a multiple-choice format. Third, the students were again given permission to peruse the question before reading the story, but at this level, they responded to a short answer question (without the benefit of the multi-choice prompt). Last, at the most difficult level, the students read the selection and responded to a short answer question seen only after reading the selection.

4. The students were involved in logical and analytical thinking as they worked on activities dealing with absurdities. Absurdities included phrases (i.e., hot ice) and sentences (i.e., Mom swept the floor with a spoon). The students explained why the phrase or sentence was absurd. This was a daily

motivational activity that the students engaged in at the onset of each session. The students began to "think" as group discussions led them to decide why the sentences were absurd. The students drew pictures of the absurd scenes, followed by sensible versions of the same scenarios (Appendix E:88).

5. A similar strategy to number four, involved the use of activity sheets to infer whether information was real or make-believe. The level of difficulty was sequenced from easy to hard by practicing with pictures, then phrases, followed by sentences (Appendix F:91). The students drew pictures of only the make-believe statements. Participating in a group discussion, students explained why the make-believe sentences were not realistic.

The students were also engaged in manipulative learning to improve inferential thinking by using the following strategies:

6. The students were presented with brightly covered gift boxes. They were given index cards with words printed on them. The following scenario was then described. "You are going to your best friend's birthday party. You are to "wrap" the presents you

would be able to physically give a friend. If the gift cannot be wrapped, you are to explain why." For example, words such as stuffed animal, drum, love, necklace, friendship, laughter, cars, fun, books, pencils, and happiness were provided. The students deposited the word card in the gift box if the descriptor could be "wrapped."

7. Each of the four students was given a pattern of a large hand. They cut out a hand of their own from construction paper. The group brainstormed words and wrote them on index cards. They exchanged word piles with each other and sorted the word card to the hand if it was a descriptor of something that could be touched. All of the students had the opportunity to play with each other's words. Each student who made his/her own set of words checked to see if the peers had placed them in the appropriate category. If a response was incorrect, the student had to re-think the strategy, aloud.

8. Students drew pictures of concepts that were difficult to describe, visually. The students closed their eyes and defined the concept by visualizing it in the context of a situation. This situation had to be

relevant to them to give the concept meaning. The students were then able to draw the difficult concept from their own frame of reference. For example, student IV depicted the concept of love by drawing his mother hugging him (Appendix F:91).

9. Solving riddles required the students to infer meaning The teacher asked the riddles and the students responded. They provided a rationale for the selection of their response. Some riddles contained irrelevant information, or information that was too general. The students indicated which information served as clues, which did not, and why. As the students became more proficient in solving riddles, they made up their own and tried them out on each other (Appendix G:99). At the end of the seven-week experience, the student-generated riddles were compiled into a book entitled, Our Riddle Book.

10. Games were designed by this writer to reinforce inferential thinking. They were played in teams and encouraged problem solving. One such game was entitled "Emergencies." An example scenario is as follows: "You are home alone. You see smoke coming from your neighbor's kitchen. What do you think is

happening? What can you do about the situation?" The students on one team decided on a solution strategy and shared it with the group. The other team either accepted the solution strategy or challenged their response. If the response was challenged by a team, they provided their own solution strategy.

The ten strategy interventions described above facilitated the students' abilities to use reasoning skills. By providing instruction through modeling, demonstrations, metacognitive strategies, and practice through group interaction, manipulatives, drawing and game playing, the students learned how to reason. Inferential thought was developing.

Strategies That Developed Analogical Reasoning

To develop analogical reasoning, the students progressed from activities dealing with classification, to comparisons, to determining relationship types. Strategies included working with manipulatives, peer groups, discussion, and teacher prompting and demonstration. Discovery learning was critical to the development of this type of reasoning. The following activities were used to develop analogical reasoning:

1. The students were given manipulative cut-outs to represent noun concepts. Each student was given a child (with the word "person" written on it), a house (with the word "place" written on it), and a ball (with the word "thing" written on it). The students took turns matching words or phrases to the correct stimulus picture. The explained why the word or phrase belonged with the noun concept they selected. The students were then asked for a one-sentence definition that specified how all the common nouns (under one concept) were alike and how they were different. Each student then added several words of their own for each noun concept (Appendix H:101).

2. The students learned to categorize objects according to texture, size, and function. They were given a bag filled with objects, such as a paper clip, rubber heart, stapler, an eraser shaped as a heart, a rubber band, a hair clip, a comb, a book, paper, a glass, a pencil grip, a box, peanuts, a rock, a feather, crayons, a stuffed animal, etc. The students decided in which class the item belonged. They also determined whether or not the object could belong in more than one class. To add to this

exercise, each student had to find one other object in the classroom that belonged in two of the three classes.

3. In keeping with the above strategy, the group of students was given four objects. They had to classify the objects, determine which item did not belong, and reclassify it. For example, sandpaper, an emery board, a scouring pad, and a feather.

4. Another strategy to encourage the students to practice categorization and class inclusion involved manipulations. The children went "fishing" for words. Ten "Mama" fish were set out on a table. These fish represented different categories, such as loud things, red things, round things, crunchy things, rubber things, hot things, soft things, etc. The "baby" fish (50 in all) each had a word written on it which placed it in particular categories. (Each fish could be placed in several classes.) For example, fire engine could be placed under loud things or red things. The 50 fish were laid out on the floor with a paper clip on each one. The fishing pole was made from a piece of wood, with a string hanging from it, and a magnet at the end serving as bait (Appendix I:103).

5. The teacher read the students a story with a problem that had to be solved. After hearing the story, the students were provided with a comparable situation to see if they could apply an analogous strategy to a similar set of circumstances. The students were read a story about a genie who had to transfer jewels from a treasure chest to his magic bottle without anyone knowing he possessed the jewels. He decided to use his magic carpet and roll it up as a tube shooting his jewels through from the chest to his bottle. The students were given a bowl filled with gumballs. They were told that the gumballs had to be moved to a second bowl across the table, but they could not use their hands to carry the gumballs. They were given the following materials: paper, scissors, and rubber bands. At a more advanced level, they were told a story about Snoopy and Woodstock. Woodstock had built a nest on top of Snoopy's doghouse where Snoopy enjoyed sleeping. He was angry because he could no longer sleep on his doghouse. So, Woodstock, being a loyal friend, decided to build another nest in a tree. There was a problem. How could Woodstock transfer the eggs from one nest to another? The students were

divided into teams. Each team was given two paper nests. In one nest, there were six marbles. The teams had to find a strategy solution to transfer the delicate eggs (marbles) from one nest to the other, without the use of fingers. They were given the following materials: a spoon, paper, tape, scissors, paper clips, rubber bands, and string. Once the marbles had been transferred, the teams explained their own strategy interventions to each other.

6. The students drew a tree and a body. They were instructed to draw tree parts that were analogous to body parts. The students then analyzed each other's trees to account for its parts. They labeled the tree parts with the analogous body parts (Appendix J:105).

7. The students learned to chart items of similar features, function, or attributes. The teacher provided stimulus words that the students were to chart according to the above criteria. For example, buildings - school, house, office; and food - fruit, meat, and desserts. As the students became more proficient at this task, they were able to think of their own words to chart, followed by thinking of words for their peers to chart (Appendix F:91).

8. In a similar lesson, presented as a group activity, the teacher set up a situation where the students brainstormed as many appropriate responses as they could. For example, Jerry's job is to collect garden tools. Name some tools. Barbara wants to buy a soft toy for her baby sister. What are several toys she could buy? Another similar activity explored relationships in terms of both likeness and difference. Students told how similar items were alike, yet different (i.e., jacket/shirt, apple/carrot). After being presented with several of these relationships, the students were to generate their own analogous relations and determine the differences (Appendix F:91).

9. The students were given a grocery bag of various boxes and bags of food items of assorted weight, shapes, and sizes. The students grouped the items homogeneously and stacked the grocery items on shelves in a way that made sense. The students had to give reasons why they sorted the groceries as they did (i.e., cold items, paper products, dairy products, etc.).

10. The teacher designed a game of basic analogies. The gameboard consisted of 20 incomplete

analogies in boxes. Game cards contained clue words. The students selected a word card and placed it in the box that completed the analogy. Each word card had a part of a panda bear drawn on it. If the word cards were placed on the correct analogy box, the panda bear picture was complete.

The ten strategies previously discussed heightened the learners' awareness of analogical reasoning. Many of the activities presented to the students served as prerequisites to solving analogies. Manipulative training enabled the students to apply their newly acquired reasoning skills.

Precision Teaching

Just as content is tested, thinking skills should be tested. Students must demonstrate the ability to apply skills taught. Precision Teaching, as a measurement tool, enables the students to do so.

Each day, after instruction or practice exercises, the four students were administered probes (skill sheets) to measure their progress (Appendix K:107). A one-minute, daily, timed sample of their performance was measured. This is called a timing. The students' probes were individualized so that they were able to work at their own cognitive levels. For example, the inferencing probe was on an A level for Student IV, a B level for Students I and III, and a C level for Student II. The students were aware of the criteria for mastery (number correct needed to pass the skill), and each day they attempted to reach successive approximations of their goals. This was accomplished by the teacher marking a red star on each of the student's probes so they could visualize their goal (aim) for the day. The placement of the aim star was determined by projecting 30 percent improvement in skill development each week. This enabled the students to work at their own pace.

After the timings of analogies and inferences, the students checked their responses using answer keys. They counted the total number of correct responses and total number of errors and plotted this data on their logarithmic charts (Appendix C:83). Every student had two charts - one for the results of their efforts with analogies and one for inferences. Each day the students connected their dots (correct responses) and x's (errors) to reveal a visual display of their efforts. A successful learning picture depicted dots accelerating on the graph, and errors decelerating on the graph. Raw data scores were placed in the data boxes to the right of the graph.

The students' charts and probes were kept in their individual assigned folders. They were responsible for preparing themselves for their timings after the practice activities were completed. Preparing themselves included: having a sharpened pencil, charts placed on the right-hand corner of their desks, and probes out in front of them with their aim star located.

Mentor Inservice Training

The writer presented the students various learning opportunities to increase the ability to use reasoning skills. Instructional strategies were selected based on research investigation and through mentor inservice training. The inservice training sessions were developed by a mentor to facilitate this writer's knowledge of strategy interventions at the cognitive level.

The writer and mentor met to discuss the needs of the implementation phase. The writer shared her study topic with the mentor, indicated strategies she wanted to learn, and a master plan of action was formulated by both participants. The mentor and this researcher met weekly, for six consecutive, 30-45 minute sessions. Inservice training sessions included the following topics: (a) Jean Piaget's Cognitive Stages of Growth, (b) Benjamin Bloom's Taxonomy of Cognitive Development, (c) levels of thinking skills, (d) questioning techniques, (e) abstract reasoning, (f) analogical reasoning, (g) the Wechsler Intelligence Scale for Children - Revised (WISC-R), and (h) manipulative training with the young learner. The sessions were designed as lecture followed by discussion. The writer's participation was mandatory. For example, following a lecture on Bloom's Taxonomy of Cognitive Development, the writer was to cite an example of a skill taught at various levels. The results of each week's strategy interventions with the target population were shared with the mentor.

The writer's increase in knowledge of theory and application was measured by pre and posttest scores (Appendix B:78). The posttest was administered at the culmination of the practicum implementation. The inservice sessions, along with review of the literature, provided a valuable framework of theoretical knowledge and innovative strategy interventions.

Strategy interventions provided by the teacher, in combination with inservice training provided by a mentor, served to help the students to use higher-level thinking skills. Precision Teaching measured the targeted students' skill development in inferential thinking and analogical reasoning.

CHAPTER IV

Results

The practicum implementation proved to be very effective. The objectives were successfully met. The students all reached their mastery level criteria as indicated by Tables V-VIII (Appendix A:74). The four targeted students mastered reading groups of words and circling the correct analogy from a choice of three at a rate of 12-15 per minute. Three of the four students mastered the next level of reading groups of words and supplying words to complete analogies at a rate of 10-14 per minute. All of the students were able to correctly identify five inferential statements per minute after reading five paragraphs. The four targeted students were also able to respond, verbally, to 5-7 inferential questions after listening to a short story.

Student I

Student I, a second grader, was able to master three separate lists of marking words from a multiple-choice format to complete analogies. She was able to progress to the next level of writing her own analogies, mastering one list. Student I moved through four units of inferential thinking at the B level. She was also able to respond accurately to inferential questions from five different stories.

<u>Student II</u>

Student II, a second grader, reached a mastery level of three separate lists of marking multiple-choice answers to complete analogies. She mastered one additional list as she progressed to the next level of writing her own analogies. Student II moved through three units of inferential thinking at a C level. She accurately answered inferential questions from seven different stories.

<u>Student III</u>

Student III, a second grader, responded to two separate lists of circling multiple-choice answers to complete analogies at a mastery level. He was able to progress to the next level of writing his own analogies, mastering one list. Student III passed four units of inferential thinking at the B level. He also responded accurately to inferential questions from five stories.

Student IV

Student IV, a first grader, was able to master two separate lists of circling words from a multiple-choice format to complete analogies. He moved through six units of inferential thinking at the A level. He was able to accurately respond to inferential questions from four different stories.

Discussion

Strategy Interventions - There were many effective strategy interventions that increased the students' reasoning abilities. They were initiated by teachers, peers, and the students themselves. One of the positive aspects of the training was observing the students utilizing learned strategies on their own.

Peer Tutors - Students who assisted other students aided in further clarification of instruction and served to demonstrate procedure. Peers contributed by checking each other's work and providing one another with feedback. Peers served as models demonstrating "how" to perform specific tasks.

Verbal Rehearsal and Metacognition - These strategies enabled the learners to "see" and understand the thinking process required to solve problems. They were taught to "think about thinking," and to verbally rehearse their strategies of choice to decide if they were reasonable.

Using Cognitive Language - The students learned to internalize the labels given to cognitive concepts. They were more accurate and specific in their responses when they were trained with correct cognitive languag'. It was just as simple (and less complicated) to teach the children the proper cognitive language, than to teach t em alternate definitions.

Direct Student Involvement - The primary level student benefited from direct experimentation using manipulatives. As t.ey experimented physically with objects, they were able to discover solution strategies. Students were able to analyze problems through direct involvement which indicated that this approach was developmentally appropriate.

Effective Strategies for Inferential Thinking

Key word training enabled the student to select relevant information pertaining to inferential questions. Looking for clue words facilitated the reader's understanding of pertinent material. Activities dealing with absurdities focused the students' attention on utilizing analytical thinking. They were responsible for providing proof for logical reasoning. Explaining "why" sentences were absurd served to heighten the students' awareness of critical thinking. Manipulative learning enabled them to experiment with reason through trial-and-error. Drawing pictures helped the students to make sense of abstract concepts by visualizing them in the context of a familiar situation. Solving riddles was a fun, challenging method for students to infer meaning. Games served to motivate students to perform at maximum levels.

Effective Strategies for Analogical Reasoning

Manipulative learning used with classification helped the students to visualize likeness and difference of objects. They learned to categorize items according to size, function, orientation, etc. Discovery learning within this framework set the stage for analogous reasoning. Hearing stories of situational dilemmas involving solution strategies enabled the students to apply the strategies to analogous problem tasks of their own. Group activities enabled the students to brainstorm appropriate responses to solve problems. The giving and sharing of ideas led to productive solutions. Once again, games motivated students to succeed. Team playing instilled a healthy sense of competition on the part of the learners.

Precision Teaching was an effective tool to measure students' growth in inferential thinking and analogical reasoning. Charting daily performances was of benefit to the teacher for the following reasons: (a) the graphs provided a visual presentation of progress so instructional decisions could be made: (b) since student performance was monitored daily, it provided immediate feedback of responses; and (c) charting aided in record-keeping. Graphing was of benefit to the students, as well, for the following reasons: (a) it provided the students with a learning picture of growth; (b) charting served as a motivator - students were excited to plot results; (c) it programmed the students for success and limited frustration, since immediate changes were made by observing the charts; and (d) students developed a sense of responsibility for their own learning and independence as they self-charted.

Mentor Inservice Training

The effectiveness of the inservice training was documented by the results of a pre and posttest. A 50 percent increase in pre/posttest scores was expected. The writer scored a 58 on the pretest and 100 on the posttest noting a 72 percent increase in scores. The cognitive theory and application presented was useful in developing strategy interventions with the students.

The targeted population of first and second graders was deficient in reasoning skills. Based on review of the literature in conjunction with strategy training and inservice lectures, the students improved their basic thinking skills. Documented by Precision Teaching, it was evident that inferential and analogical reasoning skills were augmented.

CHAPTER V

Recommendations

Although the program objectives were successfully met, the following recommendations are made to further enhance the students' abilities to use reasoning skills:

The students should spend more time learning about nine relationship types that comprise analogies. It would have been less difficult for the students to figure out the relationships to complete analogies if they were first aware of the various types. The students should also be encouraged to invent their own analogies. They would have done so had the implementation period been longer, enabling the learners to reach this advanced thinking level of cognitive development.

The students should also continue to focus on reasoning skills in their regular classroom settings. This instruction may be provided through the regular educational curriculum. The ability to reason is an essential part of any reading or math curriculum. Reading comprehension and math problem solving require students to think critically, analytically, and to reason. The instruction may also be provided through a specific thinking skills program. Local counties are currently field testing pilot programs to become a part of the elementary school curricula.

The following recommendations are made for individual students: Student I must be provided with activities to improve her short-term memory. It was often difficult for her to remember story details to enable her to draw conclusions and make inferences. Student III must practice following multi-step directions to facilitate his efforts to seek strategy solutions to problems. Student IV must continue to build basic word attack skills. He had the cognitive ability to respond to inferential questions at more advanced levels, but his reading skills were not proficient enough for him to function independently at these levels. Material was often read aloud to this student.

Mentor Inservice Training

The inservice training enabled the writer to apply newly acquired information with the students. It is recommended that the mentor observe strategy interventions implemented in the classroom. Feedback regarding the effectiveness of these interventions may then be provided. Discussions can be directly related to the relevancy of instruction in the classroom.

This writer holds a supervisory position training graduate degree education students (teachers) to utilize instructional methods in the classroom. The newly acquired strategy interventions to improve abstract reasoning ability will be shared with these teachers as part of their inservice training. In so doing, these methods will permeate a wider population of regular classroom instruction.

Based on the analysis of previous test scores and the researcher's baseline data collection, it was determined that the targeted population of first and second graders was deficient in reasoning skills. Instructional strategies designed to facilitate inferential thinking and analogical reasoning were successfully implemented. Student objectives were mastered as measured by Precision Teaching. Inservice training served to augment the writer's knowledge of cognitive theory and its application in the classroom.

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Practicum Cover Sheet

SEP 1 8 1989

NAME OF SITE

- ___ Bradenton
- ___ Daytona
- _✓_ Ft. Lauderdale
- ___ Ft. Myers
- ___ Ft. Pierce
- ___ Gainesville
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- ___ Las Vegas
- ___ Melbourne
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- ___ Orlando
- ___ Phoenix
- ___ Tallahassee
- ___ Tampa
- ___ West Palm Beach

TYPE OF DOCUMENT

- ___ Proposal
- _✓_ Final Report
- ___ Revision
- ___ Addendum

DEGREE

- ___ M.S.
- _✓_ Ed.S.

DEGREE MAJOR

Early Childhood

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HOME PHONE (305) 961-5344 **WORK PHONE** (305) 475-7324

NAME OF BUILDING WHERE PRACTICUM WAS CONDUCTED

Ralph J. Baudhuin School of Nova University

ADDRESS 3375 S.W. 75 Avenue

Fort Lauderdale, Florida 33314

NAME OF PRACTICUM OBSERVER Susan Weimer

ADDRESS 3207 N.W. 104 Terrace

POSITION Elementary Coordinator **PHONE** (305) 742-9583

PRACTICUM TITLE Increasing Levels of Abstract Reasoning Ability in First and Second Graders Through Instruction in Inferential Thinking and Analogical Reasoning

TIMING INFORMATION

June 6, 1989	Date of initiating practicum
September, 1989	Date of mailing this document
July 3, 1989	Practicum implementation start-up date
August 4, 1989	Practicum implementation ending date

MAILING ADDRESS

Director of Practicums
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NAME OF ADVISOR Dr. Yvetta George

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Dade 940-6447 ext. 7457
Palm Beach 732-6600 ext.7457
Florida WATS 1-800-432-5021 ext. 7457

FOR OFFICE USE

Advisor's Signature ____________

Date ____________

Director Approval ____________

Date ____________ Course designation ____________

Grade ____________

Appendix A

Baseline Data Scores (Tables I-IV)
Data Scores: Results (Tables V-VIII)

Appendix A

Baseline Data Scores

TABLE I

Skill: See words - think relationship - circle analogy

Student	Criteria for Mastery	Baseline Data Corrects	Baseline Data Errors
I	12-15	3	2
II	12-15	0	5
III	12-15	5	5
IV	12-15	1	4

TABLE II

Skill: See words - think relationship - write analogy

Student	Criteria for Mastery	Baseline Data Corrects	Baseline Data Errors
I	10-14	5	3
II	10-14	6	1
III	10-14	3	2

TABLE III

Skill: See paragraph - circle inferential statement

Student	Level	Criteria for Mastery	Baseline Data Corrects	Baseline Data Errors
I	B	4	0	1
II	C	5	3	3
III	B	4	1	2
IV	A	4	0	0

Appendix A

TABLE IV

Skill: Hear story - answer inferential questions

Student	Criteria for Mastery	Baseline Data Corrects	Baseline Data Errors
I	5-7	1	1
II	5-7	2	2
III	5-7	1	2
IV	5-7	0	2

Data Scores: Results of Interventions

TABLE V

Skill: See words - think relationship - circle analogy

Student	Criteria for Mastery	Performance Beginning Corrects/Errors	Performance Ending Corrects/Errors
I	12-15	3/2	12/0
II	12-15	0/5	15/0
III	12-15	5/5	15/0
IV	12-15	1/4	12/0

TABLE VI

Skill: See words - think relationship - write analogy

Student	Criteria for Mastery	Performance Beginning Corrects/Errors	Performance Ending Corrects/Errors
I	10-14	5/3	11/2
II	10-14	6/1	14/0
III	10-14	3/2	13/1

Appendix A

TABLE VII

Skill: See paragraph - circle inferential statement

Student	Level	Criteria for Mastery	Performance: Beginning Corrects/Errors	Performance: Ending Corrects/Errors
I	B	4	0/1	4/0
II	C	5	3/3	5/0
III	B	4	1/2	4/0
IV	A	4	0/0	4/0

TABLE VIII

Skill: Hear story - answer inferential questions

Student	Criteria for Mastery	Performance: Beginning Corrects/Errors	Performance: Ending Corrects/Errors
I	5-7	1/1	8/1
II	5-7	2/2	9/0
III	5-7	1/2	[illegible]/0
IV	5-7	0/2	5/0

Pretest and Posttest

NAME: Shelley C. Alvand 6/31/89 RAW SCORE: 58

PERCENTAGE: 58%

(PRE) POSTTEST

COGNITIVE THEORY AND STRATEGIES

5 /10 1. What is Bloom's Taxonomy? For what purpose is it used?

a hierarchy of cognitive development.
Purpose. to provide a sequential, step-by-step way to teach cognitive skills and evaluate this learning according to levels of a hierarchy.

9 /15 2. Name the stages of cognitive development of Bloom's Taxonomy. Provide an example of a skill taught at each level.

Knowledge - skill: facts (basic math)
Comprehension - skill: main ideas
Application - skill: go to store and make change
analysis - skill: plot development in a story
Synthesis - skill: take principles of addition to learn multiplication

6 /10 3. Describe the four levels of thinking skills and provide a sample question related to each level.

Literal - What is the name of . . .
Inferential - Why do you think that . . .
Critical - Evaluate the author's intent . . .

4 /15 4. Describe the step-by-step procedure for teaching thinking skills. Relate each step to instruction of a specific skill.

1 Look for information to substantiate facts
2 ask pertinent ~~inform~~ questions
3 analyze information
4 Evaluate information

3 /5 5. Define the term " ogy".

a relationship between words or a concept
big . small : : up : down

4 /5 6. List several types of analogies.

synonyms, antonyms, cause/effect, part to whole

3 /5 7. What are the characteristics of good questioning techniques?

Stay within capabilities of child
ask open-ended questions
ask clear questions
make students think

5 /5 8. List several do's and don'ts of questioning strategies.

Do | Don't
Make sure question is clear | ask yes/no question
Address one topic at a time | Call on student before question is asked
Give students time to respond | Ask more than one question for each

8 /10 9. Name the stages of Piaget's cognitive development and describe characteristics of each stage.

Sensorimotor - awareness through the senses; motor skills
Pre-Operational - Language develops; egocentrism
Concrete Operations - manipulations to discover and explore
Formal Operations - problem solving; moral development

3 /5 10. Why is teaching the concept of classification an important pre-requisite to abstract reasoning?

Children must learn to think in terms of likenesses/differences, class inclusion, logical relationships and exclusion in order to reason.

2 /5 11. According to the Wechsler Intelligence Scale for Children - Revised, which subtests can be correlated to reasoning ability? Why?

Similarities - abstract reasoning; discover likeness/differences
Comprehension - analyzing, make comparisons, judgements

3 /5 12. List six key "question words" that will elicit higher level thinking responses from students.

Why, how, what if, compare, relate, contrast, predict

3 /5 13. What are the advantages of teaching skills to young children using manipulatives?

They can "see" what they are learning; discovery, experimentation; concrete learning

NAME: Shelley C Alrand 8/14/89

RAW SCORE: 100

PERCENTAGE: 100%

PRE/POSTTEST

COGNITIVE THEORY AND STRATEGIES

10/10 1. What is Bloom's Taxonomy? For what purpose is it used?

a classification system that describes students' cognitive behaviors at 6 hierarchial levels. Purpose: to give educators a way to focus on how students' behaviors show what they've learned. provides purpose for skills, to organize learning experiences sequentially, to organize instructional objectives, and specify levels of learning.

15/15 2. Name the stages of cognitive development of Bloom's Taxonomy. Provide an example of a skill taught at each level.

Knowledge - classification
Comprehension - compare/contrast (word meaning)
Application - inferring
Analysis - story logic
Synthesis - building hypothesis
Evaluation - developing criteria (evaluating stories)

10/10 3. Describe the four levels of thinking skills and provide a sample question related to each level.

Literal (concrete) - lowest level of thinking; recall/locate facts ex: Who wore the red dress? Where did the boy go?
Interpretation (abstract) - developing abstract thinking skills; seeing relationships, making inferences, cause/effect ex: What do you think will happen when...?
Critical - comparing information with a criterion; judging, providing evidence, reacting ex: Evaluate the strategy the boy used to solve the problem.

15/15 4. Describe the step-by-step procedure for teaching thinking skills. Relate each step to instruction of a specific skill.

Define the skill - discuss meaning of concept Skill: classify
Identify the steps - 1. identify results, 2. decide what steps are first/last, 3. arrange remaining steps in order 4. check if any steps are left out ex Skill: sequence
Demonstrate the skill - ex skill: compare/contrast students watch and listen as the teacher models how tools are same/different → (next pg)

5/5 5. Define the term "analogy".

Comparisons expressing logical relationships between words or concepts. The first word pair must have the same relationship as the second pair (and vice-versa).

5/5 6. List several types of analogies.

synonyms/antonyms, class inclusion, concept in the same class, causal relations, class exclusion, time/sequence relations, part to whole, size relationship, and one concept performing a function for another.

5/5 7. What are the characteristics of good questioning techniques?

Questions are clearly stated, they guide the discussion toward objectives, they are thought-provoking, within the ability and experience range of students, and they are not overused.

5/5 8. List several do's and don'ts of questioning strategies.

Do - address the question to the whole class and then call on an individual, allow the student time to respond, encourage students to ask questions (of teacher & peers), ask specific questions to ensure clear concise answers

Don't - ask yes/no questions, ask ambiguous questions, repeat question (unless not heard)

10/10 9. Name the stages of Piaget's cognitive development and describe characteristics of each stage.

Sensorimotor - (birth to 2) uses senses and motor abilities to understand the world; coordination of sensory/motor skills

Preoperational - (2-6) symbolic thinking (language) develops; imagination flourishes; child is egocentric

Concrete Operations (7-11) understands and applies logical operations to interpret experiences; conservation classification important concepts

Formal Operations (12+) thinks abstractly, moral issues are important

5/5 10. Why is teaching the concept of classification an important pre-requisite to abstract reasoning?

Classification provides the basis for storing and retrieving information that is connected. Words can be related to each other because they share a membership in the same semantic class. Classifying allows for building a vocabulary base that is organized, flexible, and elaborated. With this system for information, a foundation for reasoning skills can be built

5/5 11. According to the Wechsler Intelligence Scale for Children - Revised, which subtests can be correlated to reasoning ability? Why?

Similarities - deals with relationships, logical and abstract reasoning, associating abstract ideas

Comprehension - reasoning, social judgements, logical solutions

Arithmetic - reasoning, concentration, sequencing

5/5 12. List six key "question words" that will elicit higher level thinking responses from students.

Solve, choose, predict, analyze, describe, why, think of, what if, what else, how, give reasons

5/5 13. What are the advantages of teaching skills to young children using manipulatives?

Children learn by exploring, doing and seeing. Concepts can be more easily understood by having the child manipulate the learning material. Students can experiment and reason by using manipulatives.

3) Creative - open-ended questions; elaborating, applying to what is already known ex: what would happen if ?

4) Practice the skill ex. finding main ideas

Provide Feedback - ex skill interpreting pictures

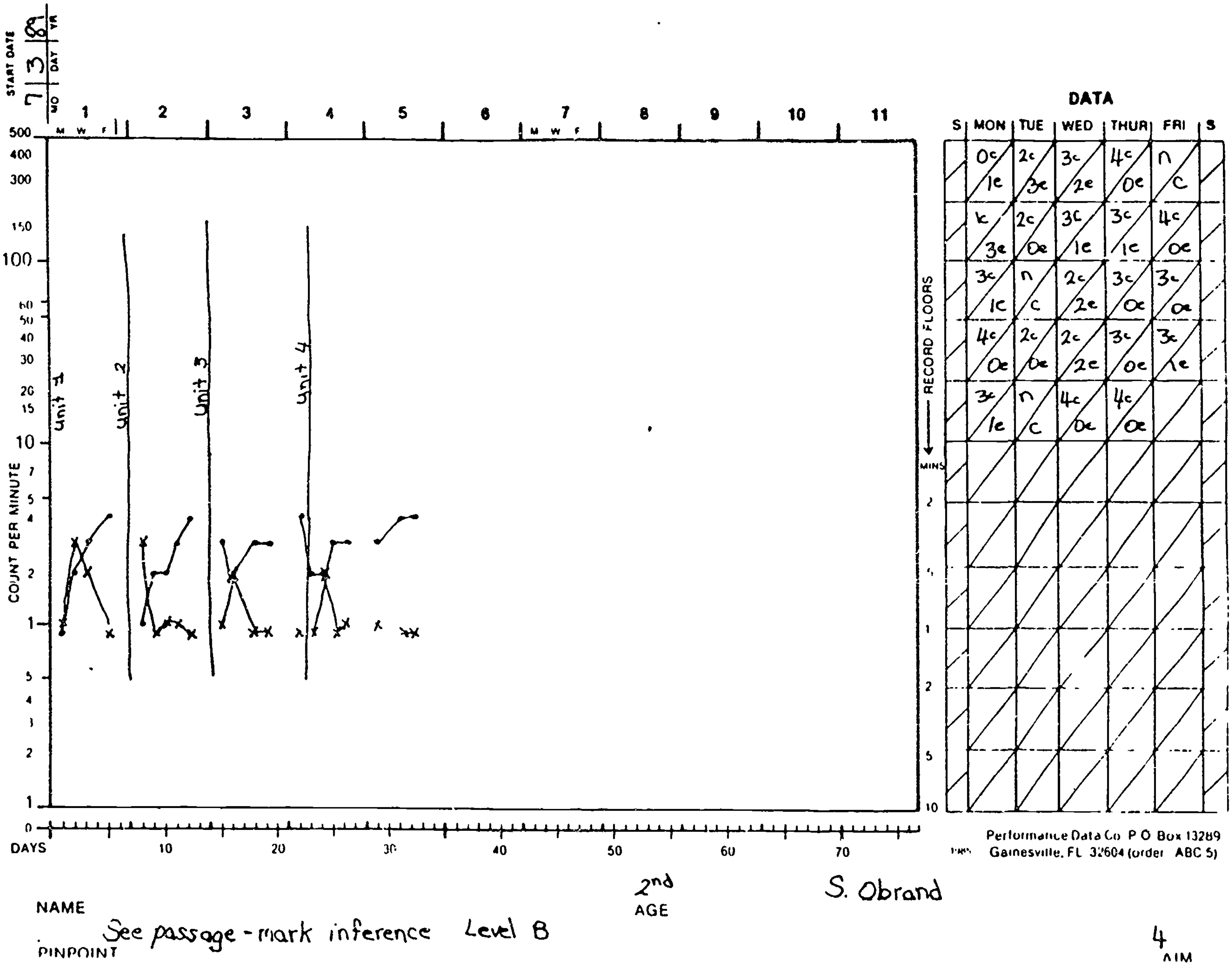
discuss student responses, ask students to describe what they did, metacognition - how did you decide what the picture was telling you

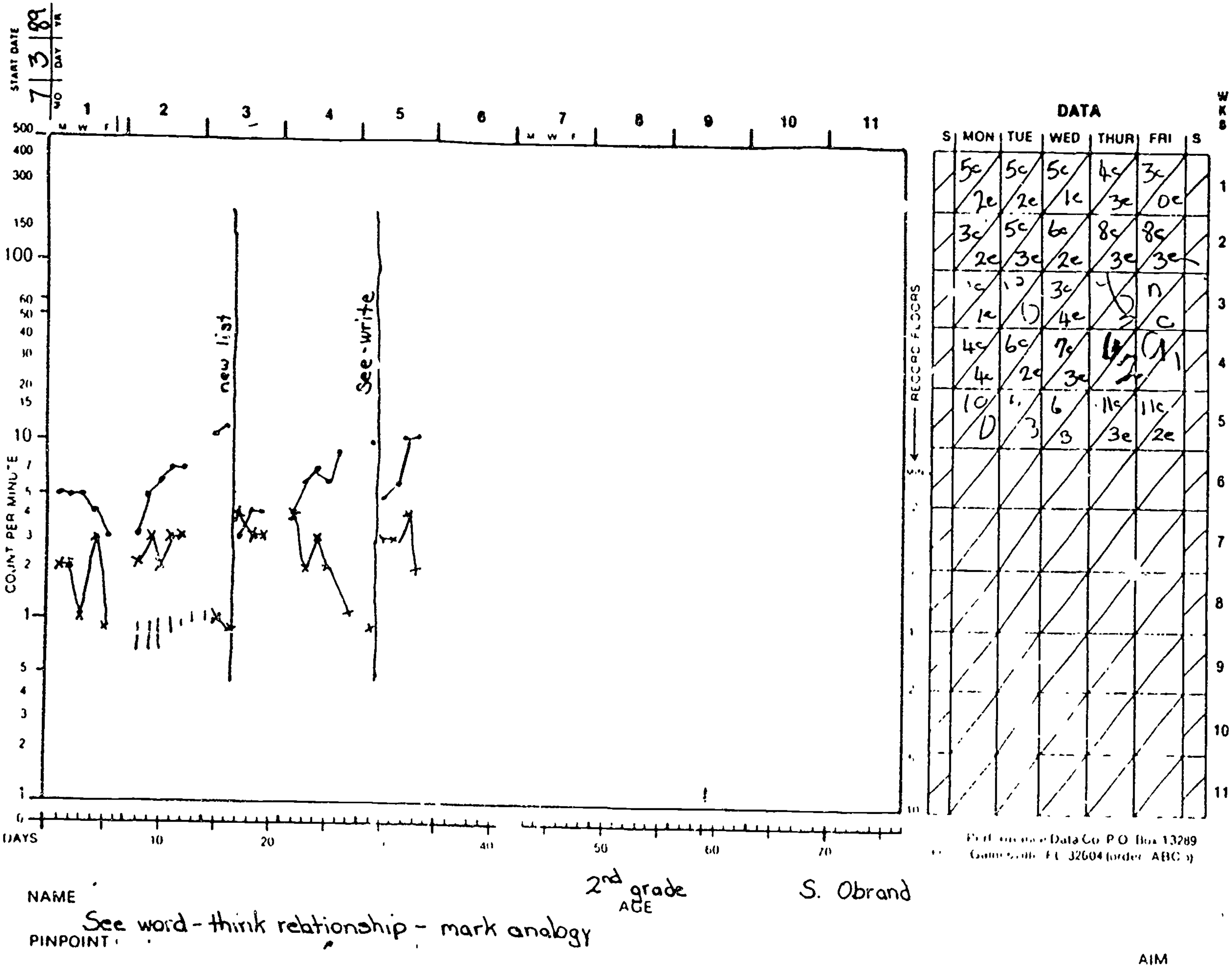
Transfer the skill - ex skill identify relationships

writing the names of all the people in your family and discuss how you are related to them

Appendix C

Precision Teaching Charts




START DATE 7 3 89
MO DAY YR
DATA
S MON TUE WED THUR FRI S
WKS
COUNT PER MINUTE
new list
See-write
RECORD FLOORS
DAYS
NAME
2nd grade
AGE
S. Obrand
PINPOINT
See word - think relationship - mark analogy
AIM

Appendix D

Key Word Match
Inferential/Literal Words

Match to Sample : Keycards
Keyword questions

Literal details found in story	Inferential meaning understood but not clearly said in story
(keycard) - green	(keycard) - blue

Literal keywords	Inferential keywords
who	use your own words
state	what else
when	what if
tell	instead of
when	why do you think
define	
(keywords) - green	(key words) - blue

Appendix E

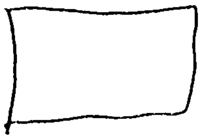
Absurd Pictures

Absurd Pictures

Pretty monster

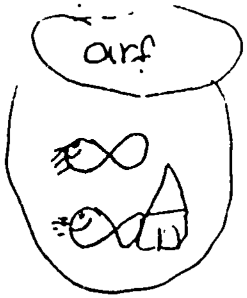
ugly monster

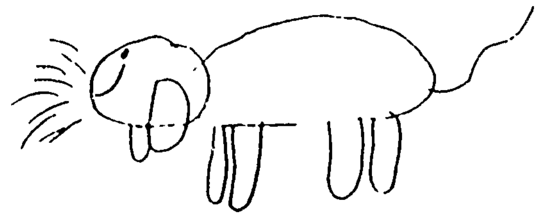
Hot ice



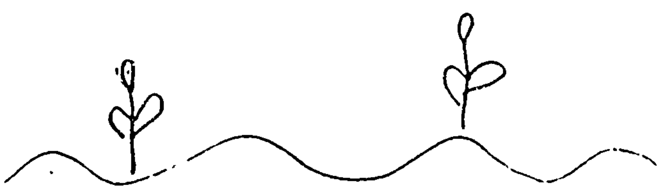
ice

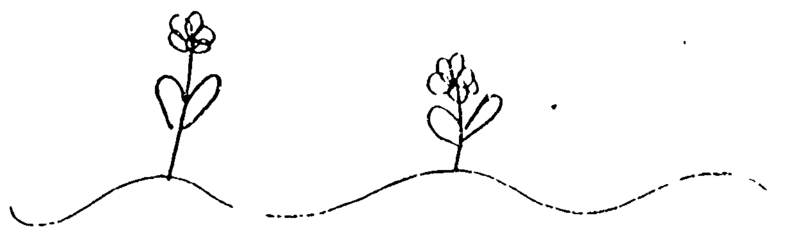
Absurd Pictures





The fish were barking The dog was barking





I will Plant teeth I will Plant my rose

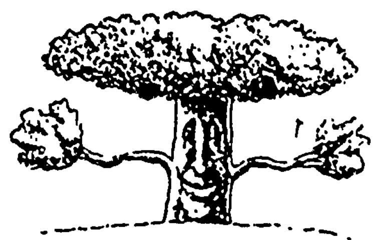
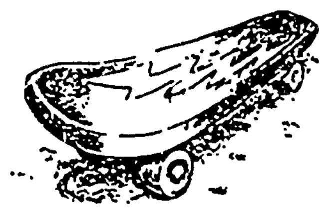
SKILL 7 REAL AND MAKE-BELIEVE

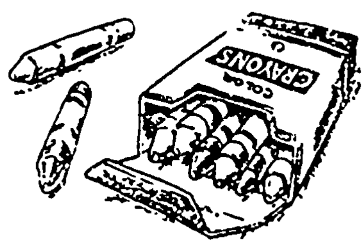
Activity Sheet

Write R if the thing is real.

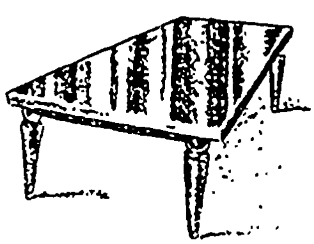
Write M if the thing is make-believe.

Great !!

M  r 

r  M 

M  M 

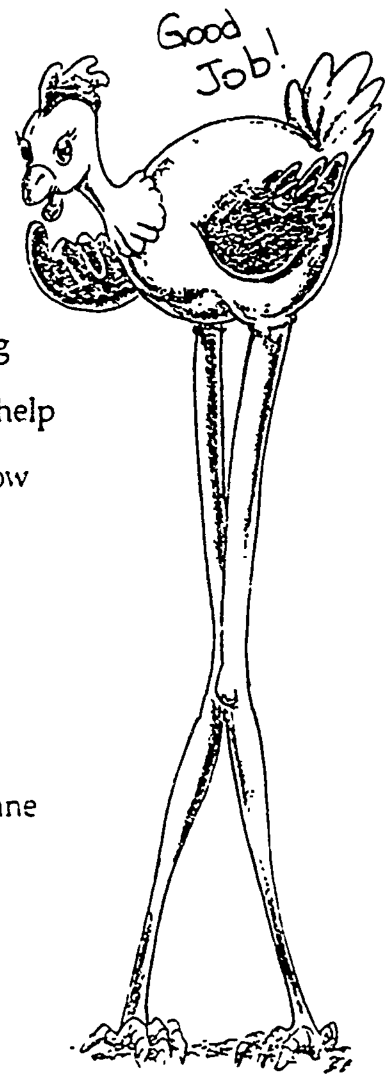
r  r 

Name

Teacher Note

Activity Sheet

Put an R before the things that are real. Put an M before the things that are make-believe.



M 1. a fairy godmother

r 2. a plant with thorns

r 3. a brown lizard

M 4. a purple leopard

M 5. a hen with legs four feet long

M 6. a pencil that writes with no help

r 7. a brown-and-white spotted cow

M 8. a dancing pig

(r) 9. a magic wand

M 10. a twenty-foot tall giant

(r) 11. orange raindrops

M 12. a cow that flies without a plane

r 13. a white rose

M 14. a three-foot-high apple

15. a chair that stays outside

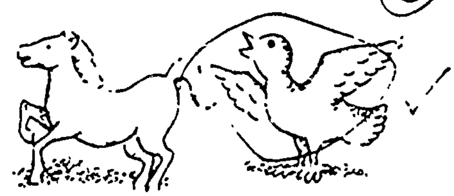
Name

SKILL 2 REAL AND MAKE-BELIEVE

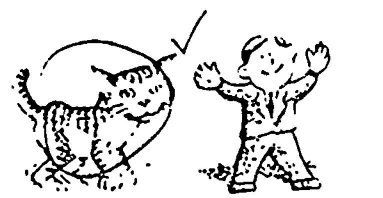
Activity Sheet

Circle the picture that makes the sentence make-believe.

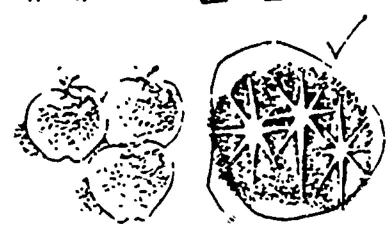
1. Sara and Jim rode on a



2. The fence was painted by a

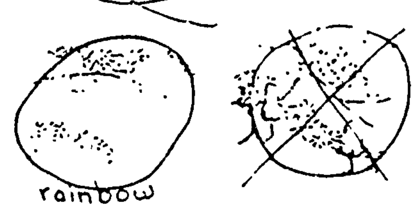


3. We climbed a tree and picked



4. In the grass, I stepped on an

5. Dan and Fran slid down the



Name

Teacher's Note

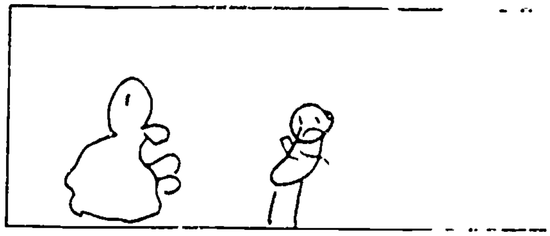
13

SKILL 20 ABSTRACT

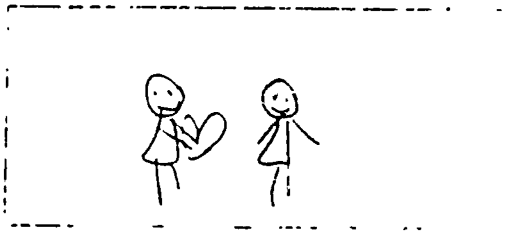
Activity Sheet

Circle the words that name something you cannot draw easily. Try to draw a picture of each word you circled.

fear fox
fence fire

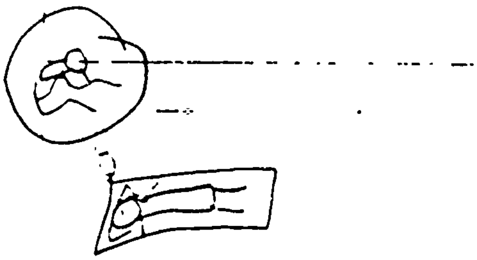


lip love
leg log



men mat
meat mind

doll dream
dog drum



Name

Name

Classification: Answering

Task 20(P): Charting Features Activity Sheet

Directions: Fill in as many answers as you can in each box. A few have been started for you. Some answers can be placed in more than one box.

ANIMALS

in the zoo	on the farm	in the house
elephant	pig	bed
lion	hors	char
zebra	chikn	mother
monky	aunt	flor

in the forest	in the water	in the jungle
tree	dolphin	lion
owl	duk	elephant
sqrl	baby duk	monky
	fish	
	shark	

in the circus	underground	in a nest
elephant	aunt	egg
pepl	snak	brid
clawn	rose	stiks

Name ______________________

Comparison: Answering

Task 4(P and I): Supplying Similarities Activity Sheet

Directions: Finish these sentences to describe how each pair of words is alike.

1. A hen is like a duck.
   They are both anmls.
   They both have Beks.
   They both can wak.

2. A jacket is like a shirt.
   They are both Put The on.
   They both have rms.
   You can wer both of them.

3. A Popsicle is like an ice cream cone.
   They are both cold.
   They can both mel-.
   You can leik both of them.

4. A bee is like a wasp.
   They are both ______________.
   They can both ______________.
   They both have ______________.

5. A desk is like a table.
   They are both ______________.
   They both have ______________.

6. An alarm clock is like a grandfather clock.
   They can both Tik.
   They both have sond.

7. An orange is like a lemon.
   They are both frut.
   They both have TACT.
   You can eit both of them

Name ____________________

Comparison: Answering

Task 5(P): Supplying Differences Activity Sheet

Directions: Read about each pair of words. Think about the ways in which they are different. Fill in the blanks to finish the sentences. The first one is started for you.

1. An apple and a carrot are different. An apple is a fruit. A carrot is a vegetable. An apple grows on a tree. A carrot grows in the grand. An apple has seeds. A carrot doesn't have seeds.

2. A hand and a foot are different. A hand is part of an arm. A foot is part of a leg. A hand has fingers. A foot has teo. You can wave with a hand. You can wak with a foot.

3. A bird and a snake are different. A bird fly. A snake crawls. A bird tweets. A snake SSSSSSS. A bird has feathers. A snake has sknin.

4. Summer and winter are different. Summer can be hot. Winter can be cold. You swim in the summer. You ski in the winter. You wear shrt in the summer. You wear a coat in the winter.

5. A nest and a tank are different. A nest is in a tree. A tank is in a ____________. A ____________ lives in a nest. A fish lives in a tank. A nest is made of twigs. A tank is made of ____________.

6. A mask and boots are different. You wear a mask on your face. You wear boots on your feet. A mask can be made from papr. Boots can be made from rubber. You wear a mask when it's [illegible]. You wear boots when it's [illegible].

Riddles

1. What hops and is green?

   A frog.

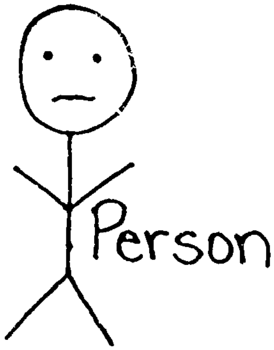
2. What has numbers, hands, and no feet?

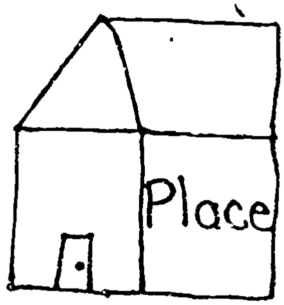
   A clock.

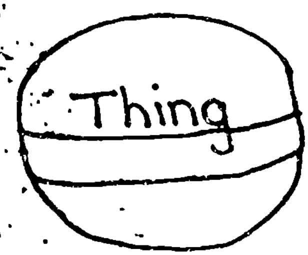
3. What has no feet but it can run?

   Water.

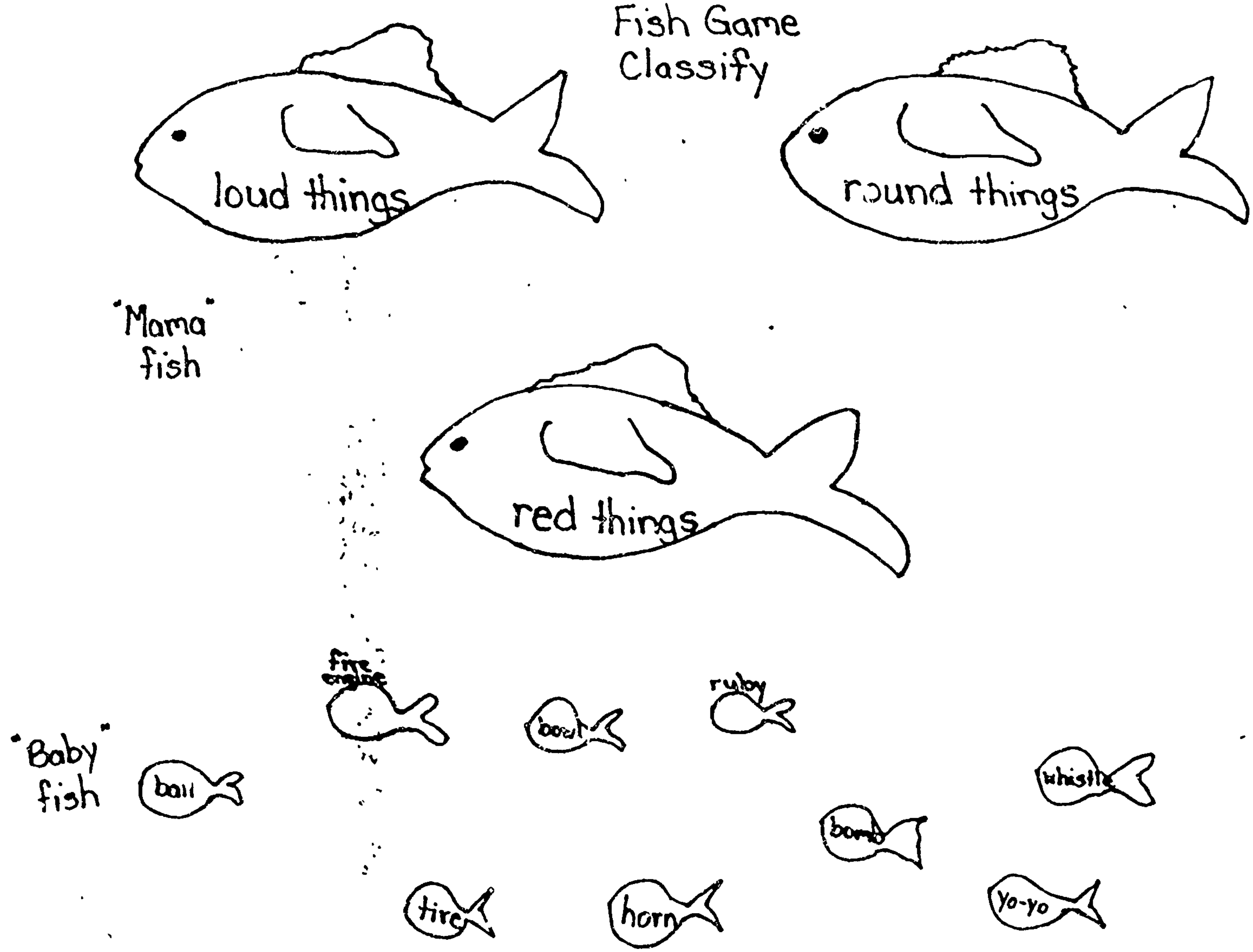
Person/Place/Thing Sort







girl	at the park	ring
teacher	under the bed	table
Mr. Jones	in a box	apple
doctor	at home	T.V.
my friend	over the rainbow	race car
police	on the beach	drum


Fish Game
Classify
loud things
round things
"Mama" fish
red things
"Baby" fish
ball
fire engine
bowl
ruby
whistle
bomb
tire
horn
yo-yo

Appendix J
Analogous Pictures

Analogous Tree & Body Parts

Appendix K

Sample Probes: Inference Levels A, B, C
Analogies Levels A, B, C

Probe: Level A: Inference

"We need more apples for the pie," said Jim. "I'll run to the store and get some."

"No," said Betty. "I'll go. I can get back sooner than you can."

Which of the following is probably true?

(A) Jim ~~doesn't like apple~~ pie.
(B) Betty can run faster than Jim.
(C) Betty has a very bad cold.

Unit 1

Probe: Inference Level 8

1. "My favorite room in the house is my bedroom," said Mary. "I like to sleep late in the morning." Father said that his favorite room is the living room, where he can watch TV.

Jim said, "My favorite room is the kitchen."

---

2. One day, Ann and her friend went camping. They went camping on a mountain. That night they slept in a tent. The next morning Ann said to her friend, "I should have brought another blanket."

---

3. "Come into my house," said Kim. "We can watch TV and play a game."

Bob said, "That sounds like fun, but I won't go into the house until you tie up your dog."

---

4. "Let's go fishing," said Bill. "There are a lot of fish in the river." Frank said that he didn't know how to fish. Bill said, "It's easy. All you have to do is wait for the fish to bite."

Unit 1

Probe: Inference Level B

1. Which of the following is probably true?

   (A) Rosa never watches TV. 4c 2e

   (B) Father likes to read.

   (C) Jim likes to eat.

---

2. Which of the following is probably true?

   (A) Ann got cold in the tent at night.

   (B) Ann's friend wanted to go home.

   (C) Ann and her friend got wet in the rain.

---

3. Which of the following is probably true?

   (A) Bob doesn't have a pet.

   (B) Bob was afraid of the dog.

   (C) Kim and Bob are in the same class.

---

4. Which of the following is probably true?

   (A) Bill doesn't have a boat.

   (B) Frank likes to eat fish.

   (C) Bill had been fishing before.

Unit 1

Probe: Inference Level C

1. Bob saw a crowd of people in the park. He went over to see what they were looking at. In the middle of the crowd was a woman. She was painting a picture of a small boy. Bob looked at the picture and said, "I wish she would paint my picture."

---

2. "Don't go near that tree," warned Harold. "There are hundreds of bees in it. I can hear them buzzing from here."
"Don't worry. I won't go near the bees," said Ron. "I learned my lesson last summer when I visited my uncle's farm."

---

3. When it stopped raining, Betty began walking home. Soon she came to a big puddle in the middle of the sidewalk. Betty ran toward the puddle and jumped high into the air. When she landed, Betty said, "I should have walked around the puddle."

---

4. Father gave Jim money to get a haircut. On the way to the barber, Jim lost the money. He didn't know what to do! Then he saw his friend, Frank. Jim asked Frank to give him a haircut. When Jim went home, his father asked, "What happened to your hair?"

---

5. The zoo was going to close at five o'clock. Lynn looked at her watch. It was almost four o'clock. "Oh, dear," said Lynn. "The zoo is going to close in about an hour, and I haven't seen half the animals. I think I'll come back again tomorrow."

Unit 1

Probe: Inference Level C

		T	F	I
1.	(A) No one was watching the woman paint.	☑	☐	☐
	(B) The woman was painting in a park.	☑	☐	☐
	(C) Bob thought the woman was a good artist.	☐	☐	☑

		T	F	I
2.	(A) There were a lot of bees in the tree.	☑	☐	☐
	(B) Harold could hear the bees buzzing.	☑	☐	☐
	(C) Ron had been stung by bees at his uncle's farm.	☐	☐	☑

		T	F	I
3.	(A) Betty landed in the puddle.	☑	☐	☐
	(B) It had not rained for two days.	☐	☑	☐
	(C) Betty was walking home.	☑	☐	☐

		T	F	I
4.	(A) Jim asked Frank for money.	☐	☑	☐
	(B) Jim didn't get a good haircut.	☑	☐	☐
	(C) Jim and Frank are friends.	☐	☐	☐

		T	F	I
5.	(A) The zoo closes at four o'clock.	☐	☑	☐
	(B) Lynn didn't have a watch.	☐	☑	☐
	(C) Lynn likes looking at the animals.	☑	☐	☐

See words - mark analogy: Probe Level A

1. Big is to little as dark is to ____.
(A) watch (B) candle (C) light (D) suit

2. Keep is to sleep as hold is to ____.
(A) whole (B) grab (C) awake (D) told

3. Help is to yelp as went is to ____.
(A) yell (B) send (C) dent (D) what

4. Grow is to raise as almost is to ____.
(A) about (B) drop (C) cry (D) win

5. Swim is to fish as hop is to ____.
(A) rabbit (B) skip (C) walk (D) cry

Probe: Analogy Level A

1. Young is to old as up is to _____.

(A) walk (B) drive (C) wall (D) down

2. Ride is to rode as hide is to _____.

(A) catch (B) about (C) hid (D) find

3. Own is to have as two is to _____.

(A) play (B) both (C) stop (D) suit

4. Lamb is to sheep as kitten is to _____.

(A) chase (B) run (C) pet (D) cat

5. Face is to lace as fold is to _____.

(A) soft (B) rope (C) cold (D) deer

Name ________

See word - think relationship - mark analogy

Probe Level B

1. dad : son :: king a) boy
b) prince
c) man

12c
0e

2. cow : rabbit :: cup a) bird
b) fork
c) napkin

3. animal : dog :: person a) boy
b) cat
c) fruit

4 pain : cry :: happy a) upset
b) hurt
c) laugh

5. large : little :: wet a) small
b) soak
c) dry

6. wheel : car :: eraser a) paper
b) pencil
c) chalk

Probe: Analogy Level B

7. pretty : beautiful :: wide
   a) nice
   b) large
   c) narrow

8. red : color :: June
   a) day
   b) blue
   c) month

9. driver : car :: teacher
   a) teaches
   b) chalkboard
   c) homework

10. tree : leaf :: book
    a) page
    b) read
    c) part

11. sun : moon :: morning
    a) light
    b) stars
    c) night

12. wings : bird :: petal
    a) flower
    b) airplane
    c) robin

See words - think - write analogy
Probe. Level C

1. Good : bad :: come : Go

12

2. Here : hear :: for : four

3. Son : father :: daughter : mother

4. Colt : horse :: cub : Bear

5. cat : animal :: cherry : fruit

6. Buzz : bee :: growl : dog

7. Apple : eat :: car : Drive

8. big : dig :: ring : cling

9. begin : end :: back : front

10. water : drink :: pie : eat

11. yesterday : today :: today : yesterday x

12. Son : sun :: right : write

13. Safety : danger :: push : pull