22

Mediated Learning Experience, Instrumental Enrichment, and the Learning Propensity Assessment Device[1]

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(with an Introduction by Serena Wieder)

INTRODUCTION

During the past 50 years, Reuven Feuerstein and his colleagues have pioneered a variety of approaches to enhance the cognitive abilities of children. Children with special needs have challenges to learning for many different reasons, but their learning difficulties have often been used to set limits on their potential, just as symptoms and other signs have often been used to limit expectations. As a result, many believe that little can be done to modify the course of life for children with autistic spectrum disorders or difficulties in relating and communicating, as well as those with Down, fragile X, and other syndromes. Feuerstein has long refuted this notion that signs, symptoms, and diagnostic labels lead to a condition of immutability. Instead, he believes that with appropriate mediation (i.e., interactive learning experiences) many children can learn to greater degrees than usually expected. Feuerstein has not only pioneered understanding of the basic conditions underlying learning disorders and defined the specific cognitive capacities necessary for learning, but also *how* to develop these capacities to allow each child to move forward through mediated learning experience.

The following chapter presents a brief overview of Feuerstein's theory and practice of enhancing cognitive functioning. The main part of the chapter focuses on specific techniques developed to enhance abstract thinking and problem-solving skills in children with cognitive challenges, including children with the syndromes mentioned previously. Because so much has been written about Mediated Learning Experience, Feuerstein's Instrumental Enrichment, and the Learning Propensity Assessment Device, this chapter will—by necessity—present the highlights in an outline and schematic fashion. More detailed descriptions, including a large number of research studies, are available on the website for The International Center for the Enhancement of Learning Potential at http://icelp.org.

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[1] With the exception of the "Introduction" and the "Conclusions" section, this chapter has been adapted, with permission, from information available from the website for The International Center for the Enhancement of Learning Potential at http://icelp.org.

MEDIATED LEARING EXPERIENCE

Mediated Learning Experience (MLE) describes a special type of interaction between a learner and a person, whom we shall call a "mediator." A mediator is different from a teacher, as illustrated by Figures 1 and 2.

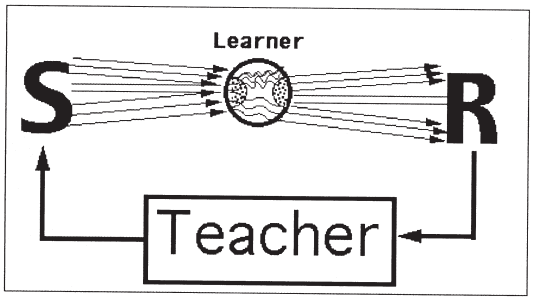


Figure 1. Schematic of Teacher-Learner Model

In this model, the teacher provides a suitable stimulus (e.g., homework, test, or assignment) and then observes the response of the learner to the stimulus. Based on the response, the teacher interacts with the learner (e.g., praise, criticism, encouragement, grade, new assignment) and the process is continued until either the teacher or the learner is satisfied or time runs out. Teachers develop their own repertoire of methods depending upon the size of the class, the apparent ability of the learner(s), and the subject matter.

In Feuerstein's method, the above figure is replaced by one in which a warm human being, indicated by the "H" in the diagram, intervenes in the process by placing himself or herself between the learner and the stimulus and between the learner and the response.

The "intentionality" of the mediator is different from that of a teacher. The mediator is not concerned with solving the problem at hand. Rather, the mediator is concerned with how the learner approaches solving the problem. The problem at hand is only an excuse to involve the mediator with the learner's thinking process.

Figure 2. Schematic of Mediator-Learner Model

For the learner's thinking process to be successful, at least three important features must characterize the interaction: intentionality and reciprocity, mediation of meaning, and transcendence.

1. Intentionality and Reciprocity

Intentionality has been explained previously. The mediator concentrates on understanding and helping the learner understand how the learner is using his or her brain. Reciprocity refers to the need for the learner and the mediator to see each other at the "same level." That is, the teacher does not pretend to know the answer as to how the learner should be thinking.

2. Mediation of Meaning

The mediator interprets for the learner the significance of what the learner has accomplished. The mediator also mediates feelings of accomplishment. "Now that you have figured that out, you can probably use the same method on this harder problem." "Now I'll bet you see the advantage of having developed a strategy for solving the problem." "Did you notice how you went faster when you decided you could be flexible in your approach?" In various ways, the mediator causes the learner to reflect not just on the solution to the problem but also on how the solution was obtained and the generalizations that flow from it.

3. Transcendence

Human beings differ from the other species in the way they can transfer lessons learned from one experience to rules and methods to use in another situation. Indeed, this is what learning should be about, for if a person does

not generalize from experience that person does not gain 30 years of experience, that person simply repeats one year 30 times. Transcendence means "bridging" between the experience and lessons learned in the current situation and new situations. "Where else in your life to you suppose it is important to have a strategy?" "How often has 'impulsivity' gotten you into difficulty in your family life?" "Where else do you find that you are imposing structure on what would otherwise be a confusing set of input information?" "When and where do you find it useful to categorize information?"

The above three criteria are essential in defining MLE. However, the mediator also pays close attention to other aspects of learning from experience, and mediates for other (affective) components of learning, including:

- Regulation and control of behavior
- Feelings of competency
- Sharing behavior
- Individuation/psychological differentiation
- Goal seeking/setting/achieving/monitoring
- Challenge: The search for novelty and complexity
- Awareness of the potential for change
- The search of optimistic alternatives
- Feeling of belonging

Cognitive Dysfunctions at the Three Problem-Solving Stages

In examining the approach of the learner in a problem-solving situation, it is helpful to the mediator to develop a mental image of the steps learners take in successful problem solving and in what can go wrong. Feuerstein and his associates have developed the following examples of cognitive dysfunctions at the three stages of problem solving.

Stage 1: Difficulties of the Learner During the Input Stage of Problem Solving

- Blurred and sweeping perception.
- Unplanned, impulsive, and unsystematic exploratory behavior.
- Lack of or impaired receptive verbal tools that affect discrimination, (e.g., objects, events, and relationships are not appropriately labeled).
- Lack of or impaired spatial orientation and lack of stable system of reference by which to establish topological and Euclidian organization of space.
- Lack of or impaired temporal concepts.
- Lack of or impaired conservation of constancy.
- Lack of or a deficient need for precision and accuracy in data gathering.
- Lack of capacity for considering two or more sources of information at once. (This is reflected in dealing with data in a piecemeal fashion rather than as a unit of facts that are organized.)

Stage 2: Difficulties of the Learner During the Elaboration Phase

- Inadequacy in the perception of the existence of a problem and its definition.
- Inability to select relevant as opposed to irrelevant cues in defining a problem.
- Lack of spontaneous comparative behavior or the limitation of its application by an inhibited need system.
- Narrowness of the mental field.
- Episodic grasp of reality.
- Lack of need for the establishment of relationships.
- Lack of need for and/or exercise of summative behavior.
- Lack of or impaired need for pursuing logical evidence.
- Lack of or impaired ability to use inferential or hypothetical (if) thinking.

- Lack of or impaired ability to use planning behavior.
- Non-elaboration of certain categories because the verbal concepts are not part of the individual verbal inventory on a receptive level, or because they are not mobilized at the expressive level.

Stage 3: Difficulties of the Learner During The Output Phase

- Egocentric communication modality.
- Blocking.
- Trial and error responses.
- Lack of or impaired verbal or other tools for adequately communicating elaborated responses.
- Lack of or impaired need for precision and accuracy in the communication of one's responses.
- Deficiency of visual transport.
- Impulsive, random, unplanned behavior.

Although MLE may be used with any situation in which the learner is challenged by a problem, there are some situations which are much easier to deal with than others. For example, in Feuerstein's Instrumental Enrichment, the problems have been designed to be attractive and fun to solve. They have also been designed to emphasize one or another of the potential dysfunctions listed earlier. Another example is in the Learning Propensity Assessment Device, in which the problems posed to the learner are aimed specifically at one or another of the above potential difficulties.

FEUERSTEIN'S INSTRUMENTAL ENRICHMENT

Feuerstein's Instrumental Enrichment Program (FIE) is a cognitive education program that was begun in the 1950s. The program has been successfully used in 70 countries as a tool for the enhancement of learning potential in specially challenged individuals and those in high-risk environments.

FIE is a classroom curriculum designed to enhance the cognitive functions necessary for academic learning and achievement. The fundamental assumption of the program, based on the theory and research pioneered by the author is that intelligence is dynamic and modifiable, not static or fixed. Thus the program seeks to correct deficiencies in fundamental thinking skills: provide students with the concepts, skills, strategies, operations and techniques necessary to function as independent learners; to diagnose; and to help students learn how to learn.

FIE materials are organized into instruments that comprise paper-and-pencil tasks aimed at such specific cognitive domains as analytic perception, orientation in space and time, comparative behavior, classification, and more. The FIE program is mediated by a certified FIE trainer and can be implemented in the classroom setting or as an individual tutoring and remedial teaching device. This program has received worldwide recognition and has been translated into 16 languages.

Mastery of the tasks in FIE is never a matter of rote learning or mere reproduction of a learned skill. It always involves the application of rules, principles, or strategies in a variety of tasks. Thus, FIE systematically reinforces the cognitive functions that enable learners to define problems, make connections and see relationships, motivate themselves, and improve their work habits.

FIE consists of fourteen instruments that focus on specific cognitive functions. Learning how to learn takes place through repetitionænot repetition of the FIE tasks themselves, but of the cognitive functions that enable individuals to think effectively. Tasks become increasingly complex and abstract, and the instruments reinforce cognitive functions

in a cyclical manner. Deliberately free of specific subject matter, the FIE tasks are intended to be more readily transferable to all life situations. Through FIE, students develop the ability to apply their cognitive functions to any problem or thinking situation.

Samples from each of the 14 instruments in the FIE program follow. Each sample describes an instrument, provides a summary of the cognitive processes the instrument addresses, and presents a task from the instrument. The sample tasks have been chosen randomly from the sequence of tasks in each instrument and do not necessarily reflect the development of the program.

Instruments of FIE

Organization of Dots

Organization of Dots provides practice in projecting virtual relationships through tasks that require an individual to identify and outline given figures within a cloud of dots. The projection of a potential relationship requires that the learner search for meaning among otherwise separate phenomena. Through repeated practice and successful completion of progressively more difficult exercises, the instrument encourages task-intrinsic motivation and activates a variety of cognitive functions.

Cognitive Functions Developed

- Definition of the problem
- Selection of dots that are relevant to the figure that is sought
- Planning behavior
- Hypothetical thinking and use of logical evidence
- Summative behavior

Mediation of Sample Task

Mediation of challenge is indicated in the sample task shown in Figure 3, in which there are no given cues and the dots are numerous and close together. Mediation of a feeling of competence is important as the students compare strategies of solution. As in all tasks in Organization of Dots, there must be regulation and control of behavior.

Sample Task

Spontaneous comparison of projected figure to the model.

Instructions: Connect the dots so that the geometric figures in the first frame appear in each of the following frames. The orientations of the figures may be different from the first frame. Some of the figures overlap.

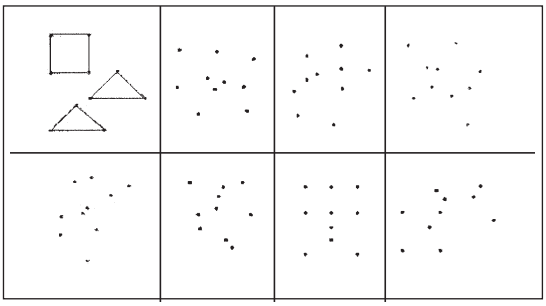


Figure 3. Sample Task in the Organization of Dots Instrument

Comparisons

The Comparisons instrument increases an individual's ability to differentiate between parameters of comparison and to develop the cognitive functions involved in comparative behavior. The instrument provides concepts, labels, and operations with which to describe similarities and differences. From Comparisons individuals learn to organize and integrate separate and distinct bits of information into coordinated and meaningful systems. The instrument helps build learners' feelings of competence and independence by enriching the repertoire of attributes by which they compare objects and events.

Cognitive Functions Developed

- Ability to keep in mind a great number of parameters during the process of elaboration.
- Making a plan that will take into account the complexity of the tasks.
- Use of hypothetical thinking and hypothesis testing to evaluate the alternative response.
- Selection of relevant cues and reference points.

Mediation of Sample Task

An opportunity for mediated regulation and control of impulsive behavior is provided in the sample tasks shown in Figure 4, in which an individual must discriminate among a number of given parameters. A feeling of competence is mediated to the students as strategies for the solution of the tasks are discussed. Goal-setting and goal-achieving behavior must also be mediated.

Sample Task

Instructions: Circle the word or words that describe what is common between the sample picture on the left and each of the pictures in the same row.

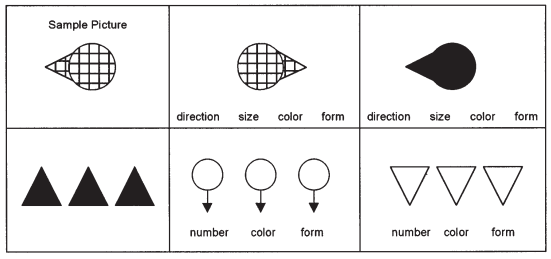


Figure 4. A Sample Task in the Comparisons Instrument

Orientation in Space-I

Orientation in Space-I addresses the poor articulation, differentiation, and representation of space that may result from an inability to detach oneself from one's own body position as a reference. It deals with a relative system of reference for localizing objects in space and in relation to one another. As a result of their experience with these tasks, learners discover why there are differing points of view in the perception of an object or an experience and how to give consideration to an opinion that is different from their own.

Cognitive Functions Developed

- Definition of problem when no instructions are given or when tasks vary from frame to frame.
- Hypothetical thinking: "If...then."
- Use of logic to solve tasks for which the information is not directly provided.
- Comparison as a strategy for checking one's work.
- Internalization of the relationship between the elements of the system of reference.

Mediation of Sample Task

Mediation of goal-seeking, goal-setting, goal-planning, and goal-achieving behavior is indicated in the sample task shown in Figure 5, which varies from frame to frame. Mediation of challenge is also indicated.

Sample Task

Instructions: Fill in what is missing so that each frame will contain an arrow, a dot, and an indication on which side of the arrow the dot is located.

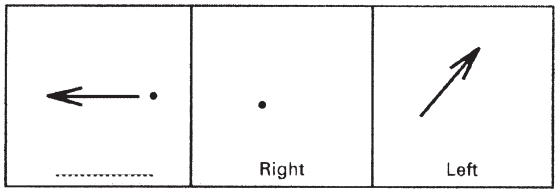


Figure 5. A Sample Task in Orientation in Space -I Instrument

Analytic Perception

Analytic Perception enhances one's ability to differentiate (divide a whole into its parts) and integrate (join parts into a whole). Adaptation to the world depends upon the flexibility to alternate between these two perceptual processes. As a result of their experiences with the tasks in this instrument, learners begin to differentiate between inner and outer sources of reference. They are then able to form and discriminately use internal referents to process information and to structure and restructure their varied life experiences.

Cognitive Functions Developed

- Spontaneous comparison to model.
- Establishment of relationship between parts, and between the parts and the model.
- Categorization of parts according to their shapes and colors.
- Visual transport of parts to the model.

Mediation of Sample Task

Mediation for intentionality, reciprocity, transcendence, and meaning are necessary in confronting the sample task in Figure 6. Sharing behavior is encouraged in comparing strategies and expression.

Sample Task

Instructions: In each of the exercises below you are given a model. Choose the box that contains all the parts that make up the design, and write its number in the circle provided.

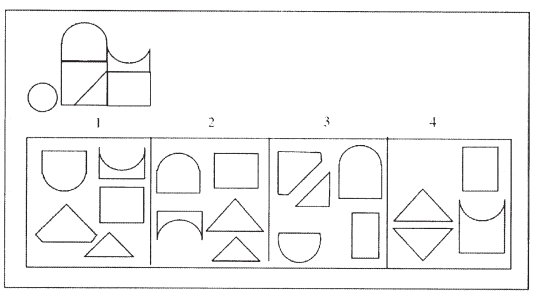


Figure 6. A Sample Task in the Analytic Perception Instrument

Illustrations

Illustrations presents a collection of situations in which a problem can be perceived and recognized. Learners attempt to offer an appropriate solution to the identified problem. This instrument mediates learner's ability to perceive details, use several sources of information, and exercise comparative behavior. Illustrations lends itself to the development of vocabulary and oral and written language; it is also highly useful for generating task-intrinsic motivation.

Cognitive Functions Developed

- Definition of the inferred problem.
- Use of relevant cues as a basis for inference.
- Use of comparative behavior.
- Use of summative behavior.
- Hypothetical thinking and use of logical evidence to support conclusions.
- Establishment of relationships between the individuals, objects, and events shown in the illustrations.

Mediation of Sample Task

Goal-seeking, goal-setting, goal-planning, and goal-achieving behavior must be mediated in the discussion of the plight of the piano movers in the sample task shown in Figure 7. Regulation and control of behavior should be mediated as playing a major role in ensuring time for planning and reflection. The meaning of the pictured event should be mediated and projected into various life situations.

Sample Task

Instructions: Examine the picture carefully. Is there a problem?

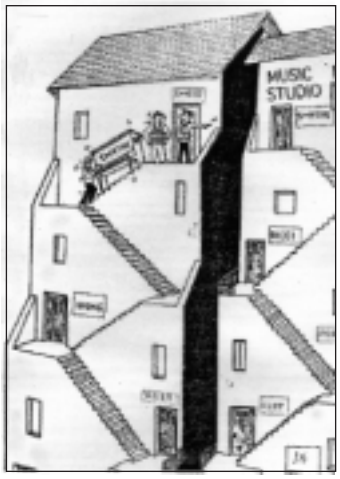


Figure 7. Sample Task in the Illustrations Instrument

Family Relations

The Family Relations instrument uses a system of relationships to link separate beings and categories and emphasizes the necessary and sufficient conditions for inclusion in and exclusion from categories. The exercises in Family Relations demand precise use of language in encoding and decoding relationships and require inferential thinking, analytic thinking, and deductive reasoning to justify conclusions based on logical evidence.

Cognitive Functions Developed

- Definition of problem in order to determine what one is being asked to do.
- Using only information that is relevant.
- Comparison between elements and relationships to determine similarities and differences.
- Enlarging the mental field by bearing in mind a number of discrete elements and the relationships among them.
- Hypothetical thinking and the use of logical evidence to justify one's conclusions.
- Overcoming an episodic grasp of reality by seeking the links and bonds that unite separate entities.

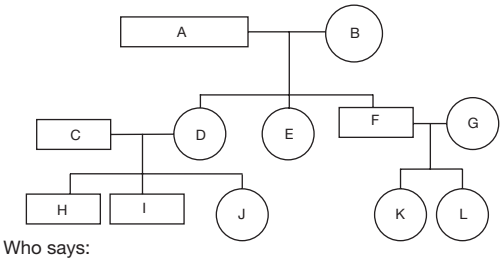
Mediation of Sample Task

Individuation and psychological differentiation, as well as sharing behavior, should be mediated in the sample tasks shown in Figure 8, which require taking a point of view other than one's own. Mediation of goal-planning and goal-achieving behavior is necessary in discussing the process by which the tasks are solved.

Sample Task

Instructions: Using the information in the genealogical map, answer the questions listed on the page.

Use the information in the geneological map to complete the page.



Who says:
1. "B is my wife" _____
2. "D is my daughter but I am not her father"_____
3. "E is my sister but I am not her sister" _____
4. "J is my granddaughter as well as A's granddaughter" _____
5. "H is my cousin. He is also K's cousin" _____
6. "H,I,J,K, and L are my nephews and nieces" _____

What are the relationships?

1. G → F
2. F → A
3. A → H
4. H → G
5. E → I

Figure 8. A Sample Task in the Family Relations Instrument

Categorization

Categorization is based on successful comparison, differentiation, and discrimination. This instrument helps individuals develop the flexibility and divergent thinking necessary for categorizing and recategorizing

the same objects into different sets as the principles and parameters of categorization change with new needs and objectives. In categorizing, an individual moves from establishing relationships among concrete items to projecting relationships among concepts. This ability is essential to and basic for logical and verbal operations.

Cognitive Functions Developed

- Comparative behavior to ascertain similarities and differences
- Selection of relevant attributes
- Summative behavior
- Projection of relationships
- Determination of cognitive categories

Mediation of Sample Task

Mediation of goal-seeking, goal-planning, and goal-achieving behavior is indicated for the sample tasks shown in Figure 9. Mediation of challenge is elicited in the complex task at the bottom of Figure 9. Individuation is mediated in comparing two alternative solutions to the same task.

Sample Task

Instructions: Classify the cubes according to size and color. Fill in the headings and write the correct letter in each empty square.

Numerical Progressions

The Numerical Progressions instrument helps learners search for, deduce, and induce relationships between separate objects or events. Learners draw accurate conclusions regarding the cause of progressions as the instrument increases their ability to compare, infer, and reason deductively and inductively. This instrument mediates precision, discrimination, and a willingness to defer judgment until all of the elements have been worked out in determining a common rule for a progression.

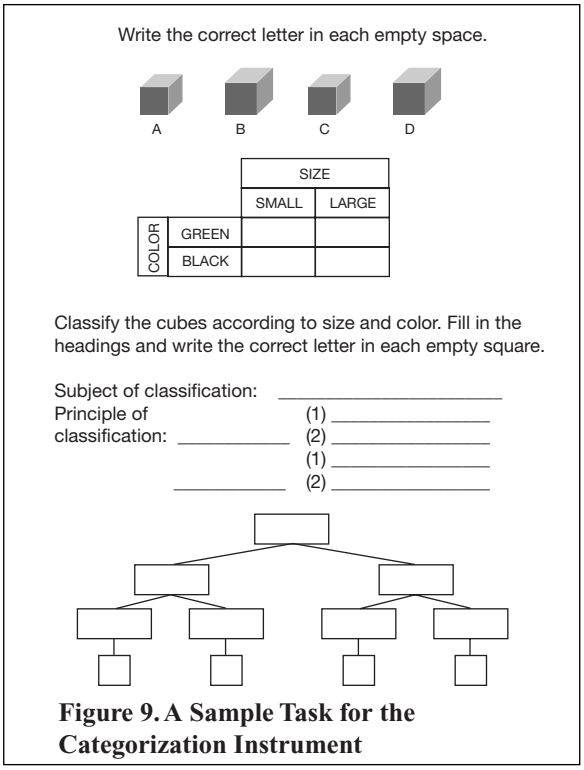


Figure 9. A Sample Task for the Categorization Instrument

Cognitive Functions Developed

- Use of relevant tacit cues like index (the place of a number in the progression).
- Projection of relationships between the elements of the progression.

Mediation of Sample Task

Mediation of challenge is essential for the very difficult, very complex, and novel sample tasks shown in Figure 10 (see next page). Mediation of intentionality, transcendence, and meaning is indicated in fostering an understanding of higher-order relationships.

Sample Task

Instructions: Fill in the progressions, the relationships between the numbers, and the relationship between the relationships.

Temporal Relations

The Temporal Relations instrument develops learner's ability to use temporal concepts to describe and order their experiences. An

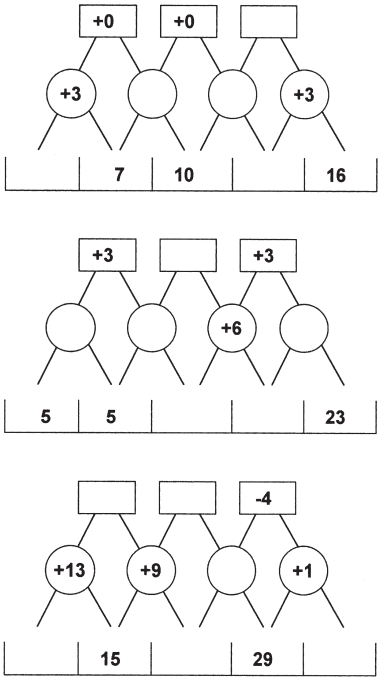


Figure 10. Sample Task for the Numerical Progressions Instrument

adequate orientation to time is important to relational thinking and is acquired through mediated learning experiences. Without an awareness of the continuity of time, its ordered succession, and of the rhythm of events, individuals make no use of their past to predict, anticipate, plan, and prioritize future events. The Temporal Relations instrument helps mediate temporal relationships and appropriate and precise use of temporal concepts and relationships.

Cognitive Functions Developed

- Comparison of the temporal characteristics of events
- Use of relevant cues
- Formulation of hypotheses

Mediation of Sample Task

Mediation of a feeling of competence is necessary in order to define the nature of the sample tasks that follow and the relevance of the given information to its solution. Projection and control of behavior is mediated in restraining impulsivity in gathering and processing information.

Sample Task

Riddles:

1. Lucy has been in the United States for 2 years. Steve has been in the United States for 1 year. Is it possible to know which of the two is older? Why?
2. Terry runs 117 yards (107 meters) per minute. Harry runs 223 yards (214 meters) per minute. Is it possible to know who will win if they have a race? Why?
3. Maria's mother arrived in Canada 15 years ago. Maria's grandmother arrived 6 years ago. Who is older?
4. Mark and Lisa are new immigrants. Mark is 18 years old. Lisa is 16 years old. Which one has been in the country for a longer period of time?

Instructions

The Instructions instrument focuses on encoding and decoding verbal and written information. The difficulty in the tasks is not in the meaning of the words themselves, although learners may occasionally have problems with unfamiliar terms; the difficulty is rather with the significance of the words and with what they imply in context. Through the insights gained into the reasons for their successes and failures, learners are transformed into generators of information, able and willing to interpret and transmit complex instructions.

Cognitive Functions Developed

- Definition of the problem
- Comparison of completed drawing with verbal instructions
- Use of relevant cues to clarify ambiguities
- Hypothetical thinking and use of logical evidence to support hypotheses

Mediation of Sample Task

Mediated regulation and control of behavior is indicated until the instructions and picture have been completed and errors identified.

Sample Task

Instructions: Matching/not matching: On the left side of the page there is a description.

Beside the description there is a corresponding drawing. Look at the drawing and read the description. Check whether the description matches the drawing. If it does, circle the word MATCHING and go on to the next exercise. If it does not, circle the words NOT MATCHING, and write on the lines the correct description that will match the drawing. Figure 11 shows a sample task.

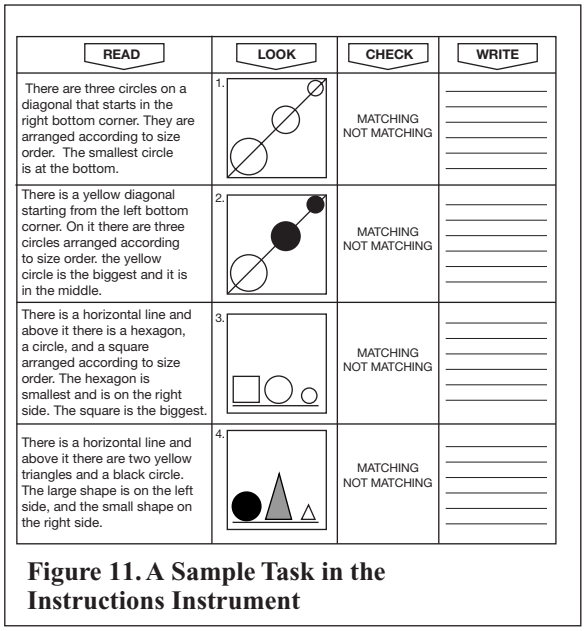


Figure 11. A Sample Task in the Instructions Instrument

Orientation in Space-II

Orientation in Space-II introduces and provides practice in the use of external, stable, and absolute systems of reference. Geographical concepts such as compass points, coordinates, and graphs are used to describe relationships and an object's orientation in space. Learners have to simultaneously apply the relative (internal) system of reference and the absolute (external) system of reference to describe and understand spatial relationships.

Cognitive Functions Developed

- Definition of the problem.
- Comparison of alternative solutions.
- Summing right and left turns and finding their equivalents in fractions of a circle.
- Projection and description of spatial relationships in terms of relative and absolute systems of reference.
- Hypothetical thinking in considering alternative solutions.
- Use of logic in the integration of two systems.

Mediation of Sample Task

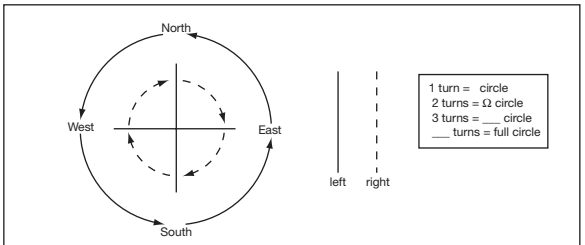
An opportunity for the mediated regulation and control of behavior is provided in the sample tasks. The willingness to defer the response until the information has been decoded, gathered, and elaborated and the strategy planned is especially necessary in the last task. Figure 12 shows a sample task.

Sample Task

Instructions: Using the picture, fill in the blanks (see Figure 12 on following page).

Syllogisms

The Syllogisms instrument presents formal, propositional logic. In syllogistic reasoning, the integration of information from two premises about the relationship between terms yields the deduction of an unknown relationship. Through the tasks of Syllogisms, learners gain the ability to discriminate between valid and invalid conclusions and between possible and inevitable outcomes. The instrument fosters inferential and abstract thinking.



LOOK AT THE ILLUSTRATION ABOVE AND FILL IN THE BLANKS BELOW

1. You are facing east.
   A. Make ____ turns to the right so that you return to where you started.
   B. Make a ____ circle, so that you return to where you started.

2. You are facing north.
   A. Make 4 turns to the right and 1 turn to the left.
   Where do you face now? _____
   B. Make a full circle to the right and circle to the left.
   Where do you face now? _____
   One turn = _____ circles. _____ turns = circle.

3. You are facing north.
   Make 3 turns to the right and 1 to the left.
   Where do you face now? _____
   To face east, one can move ____ circle to the right or ____ circle to the left.

4. You are to turn south to east in two steps. (There is more than one solution.)

	Alternative 1 (turns)	Alternative 2 (turns)	Alternative 3 (turns)
FIRST STEP SECOND STEP	2 left 1 right	2 right _____	circle right __ circle left

Figure 12. A Sample Task in the Orientation in Space-II Instrument

Cognitive Functions Developed

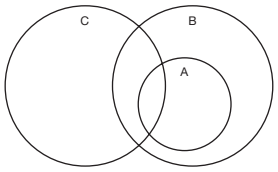
- Appropriate definition of problem.
- Spontaneous comparative behavior between attributes of a set and those of set members.
- Selection of relevant data for elaboration.
- Overcoming episodic grasp of reality by establishing relationships.
- Broadening of mental field to simultaneously elaborate information from several sources.
- Elaboration of cognitive categories on the basis of conceptual criteria.
- Use of summative behavior.
- Hypothetical thinking and search for logical evidence.

Mediation of Sample Task

Transcendence is reached through insight and generalization from the sample task into other areas of academic, vocational, and life experiences. Meaning is assigned to the logical processes that allow the mind to exceed the confines of the concrete experiences through inferential thinking. Goal-seeking, goal-setting, goal-planning, and goal-achieving behavior is mediated along with the mediation of regulated behavior and a feeling of competence. (See Figure 13).

Sample Task

Instructions: Using the drawing, answer the questions by writing the appropriate letters for each set in the parenthesis and by filling in the blanks.



All the exercises on this page are based on the above drawing. Look at the drawing above and write the appropriate letters for each set in the parentheses; then fill in the blanks.

1. All predatory animals (A) are dangerous (B).
   Some birds (C) are predatory (__).
   CONCLUSION: Some _____(C) are _____(B).

2. All redheads (__) have freckles (__).
   Some redheads (__) have blue eyes (__).
   CONCLUSION: _____(__) _____(__).

Figure 13. A Sample Task in the Syllogisms Instrument

Transitive Relations

The Transitive Relations instrument deals with relationships that exist in ordered sets, in which the differences between set members are described by the terms "greater than," "less than," and "equal to." This instrument helps learners recognize conditions that permit deductive and inductive reasoning. Through the tasks in Transitive Relations, learners demonstrate their ability to engage in inferential thinking based on logical implication and relational thinking.

Cognitive Functions Developed

- Definition of problem
- Selection of relevant information
- Comparison and categorization

- Hypothetical thinking
- Planned and systematic behavior

Mediation of Sample Task

Transcendence is reached through insight and generalization from the sample task into other areas of academic, vocational, and life experiences. Meaning is assigned to the logical processes that allow the mind to exceed the confines of the concrete experiences through inferential thinking. Goal-seeking, goal-setting, goal-planning, and goal-achieving behavior is mediated along with the mediation of regulated behavior and a feeling of competence. A feeling of optimism is mediated as students learn to induce conclusions about unknown relationships. (See Figure 14.)

Sample Task

Instructions: Complete the following problem. Four construction workers are building a building. Arthur and David together can put up two walls in one workday. Charles and Harold together can also put up two walls in one workday. Arthur does more work in one day than Charles does.

Substitute letters for the names:

Arthur _____ Charles _____
David _____ Harold _____

Using the signs (>, <), signify the relationship between the work rates:

Arthur _____ David
Charles _____ Harold
Arthur _____ Charles
Charles _____ David
David _____ Harold
Arthur _____ Harold

Figure 14. Sample Task in the Transitive Relations Instrument

Representational Stencil Design

Representational Stencil Design consists of tasks in which the student must mentally construct a design. The completion of the tasks requires a complex series of steps. The identification of the whole through its superimposed parts requires an active, mental construction with the help of inferences, and an anticipation and representation of the outcome. Answers are sought by affirmation, negation, and elimination of what is logically impossible. Learners must extrapolate from the known to the unknown and rely on logic to identify the constructions.

Cognitive Functions Developed

- Comparison
- Summative behavior
- Categorization
- Establishment of temporal and spatial relationships

Mediation of Sample Task

Challenge, competence, and optimism are mediated as students realize their ability and teachers expect them to perform this very difficult task. Regulation of impulsive behavior and representational goal-oriented cognitive behavior are key to the mediation offered by the teacher in the context of this instrument. (See Figure 15.)

Sample Task

Instructions: List the stencil numbers that make up the completed design in the right order.

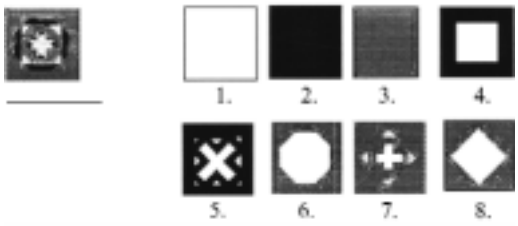


Figure 15. A Sample Task in the Representational Stencil Design Instrument

A DESCRIPTION OF THE LEARNING PROPENSITY ASSESSMENT DEVICE (LPAD)[2]

Process and Instruments

The Learning Propensity Assessment Devise (LPAD) is a series of tests or activities that (1) evaluate the way an individual learns, and (2) identify the development of cognitive functions. That is, the LPAD enables us to observe and record how a person learns, what kinds of teaching are required to respond more successfully, and how much of the observed learning is retained as new and more challenging tasks are presented. Through this approach, we can gain a picture of the way a person thinks, learns, and the possibilities for the development of their thinking and learning potential. The LPAD differs from traditional educational and psychological evaluation in that we gain information not from scores or single responses, but from observations of repeated responses to the tasks, and from teaching the subject how to solve problems and respond correctly (mediation).

Used in conjunction with standardized assessment, the LPAD adds a perspective on what kinds of interventions are needed and the individual's learning abilities and potential for growth. Another important feature of the LPAD instruments is their inclusion of all of the various important ways of processing and responding to informationæverbal, pictorial, numerical, figural, symbolic, graphicæand the ways in which the subject combines them to respond cognitively.

[2] This section on LPAD has been previously adapted from Feuerstein, Re., Falik, L. H., & Feuerstein, Ra. (1998). The Learning Propensity Assessment Device: An alternative approach to the assessment of learning potential. In R. J. Samuda, Re. Feuerstein, A. S. Kaufman, J. E. Lewis, & R. J. Sternberg (Eds.), *Advances in cross cultural assessment.* Thousand Oaks, CA: Sage.

An LPAD assessment consists of a battery of several instruments, chosen to allow the evaluator to observe as many as possible ways in which the learner responds. As the subject responds, the assessor gathers information, develops ideas about the learner's needs and functions, and uses these insights in choosing and analyzing performance in subsequent instruments. Therefore, the amount of time needed for the assessment and the number and range of instruments can vary a great deal.

The following is a brief description of each of the LPAD instruments used in this assessment.

Instruments Focusing on Perceptual-Motor Functions Organized by Cognitive Components

Organization of Dots

On this test, the subject looks at a model figure containing simple geometrical shapes, starting with squares and triangles, and increasing in complexity with subsequent task demands to include shapes composed of both regular and irregular curvilinear and rectilinear forms. The subject is then asked to "find" the model shapes in frames filled with unstructured, visually amorphous clouds of dots. The task is to draw lines to connect the dots to produce the shapes of the model, presented in many instances as overlapped, rotated, and superimposed in various ways. The subject must look for the relationships, plan and use information that must be internalized, and exercise eye-hand coordination to draw the connecting lines. As the subject completes the tasks the examiner observes and mediates the development and use of cognitive strategies such as planning, inferring, and regulating perceptual conflicts. The primary modality of the task is figural and graphomotor. Operations in this task include

differentiation, segregation of overlapping figures, conservation of the figure across changes in its position, articulation of the field, and representation (interiorization). This instrument is based upon the original contributions of Andre Rey.

Complex Figure-Drawing Test

The Complex Figure Drawing Test is adapted from Rey (1941) and Osterrieth (1945). The subject is asked to copy the Rey/Osterreith complex geometric design by looking at the model. The subject must use organizational principles to create an efficient production in the face of the complexity of the task. The great number of units of information become reduced by organization and awareness of the succession of steps needed to internalize the multitude of details. During the first reproduction phase, only minimal orienting mediation is offered. Following the first reproduction, and after a 3- to 5-minute latency period, the subject is asked to reproduce the design from memory (without looking at the model). Following the memory phase, and based on observations of the subject's performance, a mediation phase is conducted where the examiner reviews with the subject aspects of his or her performance, identifies errors and inefficiencies, and teaches organizational and design aspects. After mediation the subject is asked to copy the design again from the stimulus model, and again from memory.

Assessment is directed toward the initial performance (e.g., organizational approach, accuracy of motor skills and structural details) in reproducing the design and changes in the second copy, and memory productions, following mediation. The task requires functioning in a figural and graphic modality and measures both short-term learning and the persistence of perceptual organization difficulties. The mental operations involved in this test include discrimination, segregation of proximal elements, the articulation of a complex field, and reproduction, representation, differentiation, integration, and visual-motor coordination.

An additional phase is also available for this test, the Representational Organization of Complex Figures, in which the subject is presented with a template containing 10 designs, constructed in such a way that a central geometric figure is embedded in a set of adjacent or juxtaposed figures. The subject is asked to scan the first figure and indicate which part of the figure he or she would prefer to draw first, and the order in which all of the remaining parts would be drawn. The examiner then proceeds through the rest of the figures. No figure is actually drawnæthe subject merely indicates the parts and sequence in which they "would" be drawn. This phase is useful for those subjects who present persistent difficulties in organizational aspects of the CFD, and reveals the effects of mediation offered in earlier phases of the instrument. It removes from performance any difficulties the subject may have in the visual-motor modality.

Reversal Test

This instrument requires the subject to look at two figural designs contained in a frame and indicate whether they are the same or different. If different, the subject is asked to make a rapid mark, and move on to the next differentiation. There is no focused mediation on this instrument other than establishing a clear response expectation in the subject, which is done with several practice problems before the test is given. The subject responds rapidly, using visual tracking, without mediational intervention. The differentiations are based on reversals, part-whole relationships, and structural changes. The modality is figural with minimal motor

performance required. While this instrument does not involve mediational intervention, it gives excellent cues regarding the development of lexic functions in the subject, and orients to mediational options in other instruments (as on Raven and Set Variations), and in the content areas of reading and mathematics (as regards the decoding aspects of numerical symbols). As this instrument has recently entered the LPAD battery, there is no corresponding section in the LPAD Examiner's Manual (Feuerstein, 1995) detailing its use. This test is based on the work of Edfeldt (1954).

Diffuse Attention Test (Lahy)

This instrument was developed by Lahy from the work of Zazzo (1964). It is used in the LPAD procedure to assess the subject's adaptability and flexibility, manifested in rapidity and precision on a task that requires visual scanning. The subject must maintain attention and focus on a visual/motor and repetitive process, learning a perceptual set, and either maintaining it over time or being able to learn a new set without interference from the prior learning. Three of the eight figures are designated as model figures, and are isolated at the top of each section of the test page which the subject "learns" to differentiate. The subject must then scan lines of 40 figures, comprising the eight figures presented in a random order, and mark the three model figures when they are perceived and identified. The stimulus field is thus perceptually quite dense, and requires the subject to scan carefully and work to maintain visual tracking and cognitive attention. There are two forms of this test, one having only one such array, and 24 lines of stimuli to scan. A second form has three sections, with three different sets of three-dimensional model figures, thus enabling the assessment of retroactive inhibition—the effect of learning one set of differentiations on the subsequent performance on another set. Performance is observed in one-minute intervals, yielding scores of the proportion of correct and incorrect inclusions, and omissions, within the segments. No mediation is typically offered during the performance on the task, but the task can be practiced and mediated in a variety of ways after performance, and repeated after various practice experiences, to assess the changes with "over learning." The modality of this test is visual-motor and graphic. The operations included are limited to the identification of differentiated cues (an encoding process) and the "re-cognition" of the model.

Instruments Focusing on Memory, With a Learning Component

Positional Learning Test (5 x 25)

This test is adapted from the work of Andre Rey. The subject is shown a grid of 25 squares, organized in 5 rows and 5 columns, with 5 positions (corresponding to one for each row and column) designated and indicated by the examiner using an auditory verbal and motor modality (saying "here" and pointing). After a short (10-second) latency period, the subject is asked to reproduce the indicated positions by marking them on the same grid. The procedure is repeated, with minimal mediation, until the subject can reproduce the pattern correctly three times in succession. If the subject experiences difficulty, mediation is directed toward the apparent source of the errors, and to establishing strategies that the subject can use. After learning one pattern, the procedure is repeated similarly with different patterns, enabling the examiner to observe learning of new patterns in the presence of previously learned and potentially confounding patterns. The learning on this instrument reflects a visual-motor and graphic modality

and requires the subject to use the operations of encoding, sequencing, and the reproduction of a perceived set of positions.

Plateaux Test

This instrument is also adapted from the work of Andre Rey. On this test, the subject is presented with a set of four plates, superimposed upon one another in the subject's view. Each plate contains nine buttons or pegs, arranged in three parallel columns or rows (a 3 x 3 design). Each plate has one peg that cannot be removed. The fixed peg is in a different position on each of the four plates. On the exploratory phase, the subject is asked to search for the fixed peg on the first plate by taking out the pegs and replacing them until the fixed one is located, and to identify its position. The subject is asked to repeat the process for the remaining three plates successively, being encouraged to develop strategies leading to learning the positions on each plate and discovering a generalizationærule or principleærelating to the pattern of fixed positions. After the subject has learned the four positions (making three errorless repetitions), the orientation of the plate is rotated and the subject is asked to identify the position of the fixed pegs following the rotation(s). A second, representational phase is undertaken when the subject is asked to draw the pattern of fixed pegs on paper, reflecting a two-dimensional transition and interiorization. This phase assesses the transition from the concrete position to the use of a memorized or internalized representation from a three dimensional experience to a graphical two dimensional planeæa substitution of learned reality. A third phase is introduced in order to learn about the plasticity and flexibility of the memorized data. In this phase the well established positions and their successions are successively rotated by 90, 180, and 270 degrees, and the examinee is required to represent schematically (on paper) the fixed peg in the new positions produced by the respective rotations. This phase represents a higher ordered cognitive operation than the simple reproduction of the positions and their initial graphic representations, reflecting the outcome of rotations requiring shifting of learned positions.

Associative Recall

Associative Recall is assessed through two tests: The Functional Reduction and Part-Whole and the 16-Word Memory Test. Descriptions of these tests follow.

1. Functional Reduction and Part-Whole

This test consists of two versions, similar in organization and objective but differing in stimulus presentation. The subject is shown a page that contains a row of 20 simple line drawings along the top row, selected for their familiarity to the subject and the unambiguity of their figural presentations. In the first row the objects are presented in their entirety, and the subject is asked to name them (a labeling phase). In the second row, on the Functional Reduction (FR) page drawings of functional substitutes are shown. On the Part-Whole (PW) page a salient feature of the object is presented. In the third and fourth rows, there is a further stimulus reduction and changes in order of presentation. The subject is asked to recall the original labeled object on the top row from a visual inspection of the reduced stimuli under the various conditions presented in the subsequent rows that are exposed, with the preceding rows concealed. The FR page is usually used with most subjects, and the PW page may be used when the examiner feels further mediation is needed for repetition or crystallization of the functions learned on the FR page, or when the subject's level of perceptual functioning suggests that restricting the task to a focus on structural details as the link to associate

memory will yield more efficient and elaborative responses. Both pages also enable the assessment of immediate free recall and delayed free recall of the original 20 objects. The modality of this test is visual, auditory, motor and graphic. It requires the subject to use the operations of encoding, symbolization, and the discovery of functional relationships.

2. 16-Word Memory Test

This test consists to a group of 16 simple common words presented orally to the subject. The words are presented in a fixed but conceptually random order. The subject is asked to repeat as many as can be recalled following the presentation of the list and a latency period of approximately ten seconds. The subject is told that the process will be repeated several times. No mediation is offered for the first three or four repetitions. The examiner observes the subject's spontaneous recognition and inclusion in memory of the four categories into which the 16 words can be grouped. After approximately four repetitions, mediation is offered if needed to encourage the memory process, using a variety of cues, both mnemonic and cognitive, until the subject can recall all or a majority of the list using internalized memory functions and achieve accuracy and efficiency of response. The modalities of this test are auditory and verbal, and the mental operations require the reproduction of an auditory set of stimuli, internalized controls, organization, and both encoding and decoding (representationally) skills.

Instruments Involving Higher-Order Cognitive Processes and Mental Operations

Tri-Modal Analogies

This instrument is used with younger children and low-functioning individuals to establish analogical thinking, using figural, pictorial, symbolic, and verbal modalities. The stimuli require the subject to mentally manipulate and elaborate, thus moving the learner into abstract mental operations without needing to rely on concrete manipulatives. As such, the stimuli are useful as a preliminary to working on the more abstract and complex Raven's and Set Variations tasks. The instrument is administered in a format similar to the Set Variations described shortly.

The subject is shown two stimuli, asked to consider the relationship between them, and then to look at a third stimulus. The subject is then asked to select from a number of alternatives a fourth choice that is consistent with the relationship existing in the first two.

The learner is required to use concepts of size, shape, number, and positional orientation to establish relationships and complete the analogy. The mediational opportunities in this instrument enable the teaching of orienting and superordinate concepts, and the analysis of errors can indicate areas of deficiency or fragility in concept formation or acquisition. The general progression of tasks is at a lower level (as regards necessary mental operations), but assesses similar processes as in the Raven's and Set Variations instruments described shortly.

This instrument has just entered the LPAD battery, but at the present time is not addressed in the Revised Examiner's Manual (Feuerstein, 1995). However, the reader is advised to study the sections on the Raven's and Set Variations instruments to develop a deeper understanding of, for example, the mediational suggestions, general goals and objectives, because there is a close consonance.

LPAD Matrices

The instruments used in the LPAD procedures are those of the published Ravens Colored (CPM) and Standard Progressive

Matrices (SPM) (1956; 1958). Set Variations B-8 to B-12 are based on Ravens CPM items 8 to 12. Set Variations I is based on items from the CPM levels A, Ab, and B. Set Variations II is based principles similar to SPM levels C, D, and E, but the items present greater novelty in the modality of presentation. The LPAD objective in the presentation of these problems to the examinee is to assess to what extent a rule and set of prerequisites acquired to solve a particular problem are adaptively used in variations of the task, and to what extent the learned elements of the original task become the facilitating factor in adaptation to the new task.

The Ravens instruments are administered according to LPAD procedures, using a "test-teach-retest" approach. The Set Variations instruments are constructed and administered on principles similar to those of Ravens, with a sample problem for each set of variations which receives intensive mediation, and then independent performance is observed on a series of problems similar to but also becoming progressively more difficult than the mediational example. The tasks require the learner to look at a series of designs, and complete the series by selecting a correct alternative from a number of choices. To choose the correct alternative, the subject must understand the relationship among the variables. The tasks progressively add variables and change the dimensions used to establish the relationships. What is assessed on these tasks is the subject's ability to think using analogies presented as figural (visual/perceptual) information, and his or her response to the teaching of strategies to solve the problem. The operations involved are those of perceptual closure and discrimination; and the generation of new information through synthesis, permutations and seriation, inferential thinking, analogical thinking, deductive reasoning, and relational thinking.

Representational Stencil Design Test (RSDT)

The RSDT is based on the Stencil Design Test of Grace Arthur (1930) but differs significantly in its structure and technique of application, primarily in its shift of the task away from the concrete, manipulative modality toward a representational, internalized modality. In the LPAD procedure, the design is constructed by the subject on a purely mental level. The instrument consists of 20 designs, which the subject must reconstruct representationally by referring to a page of model "solid" and "cut-out" stencils that must be mentally superimposed upon one another. The problems increase in level of difficulty (on dimensions of form, color, and structure) and are organized so that mastering simpler problems leads to the ability to successfully solve harder ones. The procedure of this test is to orient the subject to the Stencil page, offer a test page of problems, and then provide a training page to mediate various processes and strategies according to what is observed during performance on the test page. A parallel test is provided to be used following mediation. The instrument assesses the subject's ability to learn a complex task using internalized systems of organizing, and to use acquired learning to solve more complicated problems. Part of what is assessed in this instrument is how readily available the learner's inner (representational) processes are, and how easily and adaptively they are used in subsequent problems of increased complexity and abstraction. The modalities involved are figural, numerical, and verbal. The operations involved in successful mastery of the tasks are segregation, differentiation, representation, anticipation of transformation, encoding and decoding, and generalization.

Numerical Progressions

This test assesses the subject's capacity to understand and deal with relationships, identify them as rules, and apply them to building new information, using numerical and graphic modalities. The task presents progressions of numbers related to one another according to rules which must be deduced from the available information. At the end of a sequence of numbers the subject is asked to supply the two missing numbers. A correct response infers that the subject has understood how the numbers are related to one another. The format is that of a pretest, a learning phase, and two forms of a post-test. In the learning phase, the subject is encouraged to formulate and state the rule by which the answers were achieved. The examiner teaches relationships that are not understood and establishes strategies according to an analysis of needs (errors and performance on the pretest). Following mediation, a post-test is given to determine how well the subject has learned strategies for solving the problems. The parallel form of the post-test makes possible the assessment of the permanence and stability of what has been learned over time. The operations involved in this instrument are those of basic mathematics (addition, subtraction, multiplication, and division) and the more generalized mental operations of differentiation, segregation, inferential thinking, and deductive reasoning.

Organizer

This instrument presents the subject with a series of verbal statements consisting of sets of items which must be organized according to closed, logical systems. The task involves the subject placing the items (e.g., colors, objects, people) in positions relative to one another according to the determined attributes or conditions presented in the statements. A series of statements or premises is presented in each task. Each premise permits the extraction of only a part of the needed information required to determine a full and precise placement of the items. Thus, the subject must gather available information, develop and test hypotheses with succeeding information given, and generate information which is not immediately available in the given propositions. The tasks become more complex because of more units of information and the level of inference needed to solve them. What is assessed in this instrument is the subject's ability to gather new information through the use of inferential processes, formulate hypotheses and test them according to new information or assumptions generated, and apply strategies for discovering relationships. The instrument consists of pretest, learning, and test phases. The modality is verbal, with a numerical subcomponent. The operations involve decoding, encoding, representation, inferential thinking, transitive thinking, combinatorial skills, propositional reasoning, negation, with a heavy loading of mnemonic (memory) functions.

CONCLUSION

This chapter presented a brief overview of Mediated Learning Experience, Feuerstein's Instrumental Enrichment, and the Learning Propensity Assessment Device. Work with these models has been done with many different groups of children and their families. The principles described in this chapter are consistent with the emphasis throughout *The ICDL Clinical Practice Guidelines* to use an understanding of a child's developmental profile as a basis for creating individualized learning interactions. It is these individualized learning interactions that create the opportunity for growth. ■

REFERENCES

Arthur, G. A. (1930) *A point scale of performance tests: Clinical manual, Vol. I.* New York: Commonwealth Fund.

Feuerstein, R. (1995) *Revised LPAD examiner's manual.* Jerusalem, Israel: International Center for the Enhancement of Learning Potential.

Osterreith, P. A. (1945). Copie d'une figure complexe. Archives de Psychologie, 205-353.

Rey, A. (1959). *Test de copie d'use figure complexe.* Manual. Paris: Centre de Psychologie Applique.

Zazzo, R. (1964) *Le test de deuz barrages.* Neuchatel: Delachaux et Niestle.