The Roles of Concept Imagery, Phoneme Awareness, and Symbol Imagery in Cognitive Modifiability

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Lindamood-Bell Learning Processes™

Abstract

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Sensory-cognitive programs utilized by Lindamood-Bell™ are relevant to Feuerstein's theory of Cognitive Modifiability in three components of language learning. When oral and/or written language are deficient, three processing abilities typically need development: concept imagery, phoneme awareness, and symbol imagery. Genetic gifts to many individuals, they must be developed for others, irrespective of intelligence. With specific programs that engage at the sensory level to stimulate concept imagery, phoneme awareness, and symbol imagery, a processing base emerges enabling significant gains in spoken and/or written language competence for both children and adults. The key is intensive Socratic questioning that brings language, oral-motor feedback from articulation, and both symbol imagery and concept imagery into conscious integration until that processing and integration become automatic. Sensory-cognitive program procedures develop Feuerstein's Cognitive Function goals.

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If instruction principles that produce learner competence in one area are basic truths, they should be relevant to learner competence in other areas as well. This is strikingly borne out when Feuerstein's theory of Mediated Learning Experience (MLE) and his concepts of Instrumental Enrichment (IE) are compared with the principles and progression of intervention steps involved in sensory-cognitive programs implemented by Lindamood-Bell Learning Processes™ (LBLP). In authoring these sensory-cognitive programs for developing spoken and written language competence, we were unfamiliar with Feuerstein's work. Yet, the harmony of principles, and consistently beneficial effects, imply that important basic truths are involved in the approaches of both.

Similar and Amplified Goals

The sensory-cognitive programs utilized by Lindamood-Bell™ and Feuerstein's MLE and IE have similar goals and principles of interaction. Each approach has its own specific terms and procedures, which share their purpose: they label and bring to teachers' attention the key issues involved in successfully engaging students in discovery learning that results in independence, self-correction, and enjoyment of learning. Feuerstein's three criteria for mediated learning experience are Intentionality and Reciprocity, Mediation of Meaning, and Transcendence. His challenge to teachers is to be mediators who intervene between the learner and the stimulus and between the learner and the response, to assist students to be more effective learners. He has found this can be done through mediated intervention during problem solving experiences.

Paralleling Feuerstein's MLE, it is our position that the foundation for all learning is integrated sensory information. We have shown that discovery interaction between teacher and student can bring sensory input to awareness for students, that it can integrate information from different senses, and can result in what we call "sensory-cognitive development." Mediating sensory-cognitive development requires conscious perception of sensory information on the part of the mediator, and sensitivity to the power of language to clarify or confuse, to empower or overwhelm. Mediators' questions direct students to discover sensory input—to perceive. We cannot assume that because sensory information is available to students it is being processed. Pribram (1971) states that we cannot think about something of which we are not consciously aware, and we cannot be aware of something not perceived sufficiently at the sensory level to come to consciousness.

Mediators' questions help students to notice the specifics of sensory information that enable labeling, classifying, comparing, and categorizing. Specific units of sensory information can then be compared for the relationships involved. When mediators question well, perception, concepts, and self-correction can be seen emerging for children and adults in minutes which may not have occurred in many hours or years of traditional intervention when teachers tell their perceptions and concepts to students. When students have physically proven the knowledge through their own discovery experiences, they "own" it and can access it and think and reason with it.

All three features which characterize Feuerstein's MLE interaction goals of Intentionality and Reciprocity, Mediation of Meaning, and Transcendence are met in our technique of "responding to the response." This technique also mediates the learner difficulties Feuerstein calls to attention in the three problem-solving stages of Input, Elaboration, and Output, because it always meets the student where he or she is when an error occurs in problem-solving. Rather than assuming the student is accurately processing a particular aspect of sensory information that is critical in the problem to be solved, the mediator probes with a question. If the student's response indicates an error in processing, the mediator first acknowledges any part of the response that has relevance. This is important, because although the student is temporarily "lost," his answer has not been responded to in a negative way, and that tends to leave him open to continue to search and explore. The mediator now knows where the student "is." She can question to assist access and integration of additional sensory information so the student can modify the response, and enjoy the feeling of competency this engenders. The significance of what the student did in self-correcting is reinforced, as in Feuerstein's Mediation of Meaning. "Did I have to tell you how to change your answer, or did you figure that out yourself when you had more information? That's a good thing to do. Change your mind if you need to when you get more information." The mediator of sensory-cognitive processing acknowledges the student's competency, which, as Feuerstein also states, is a key responsibility of mediators if students are to reach independence.

Feuerstein's Transcendence interaction occurs when our respond to the response is used for assisting and approving self-correction throughout the progression of tasks in each of our sensory-cognitive programs. The "respond to the response" questioning at the sensory level by the sensory-cognitive mediator is a dynamic in our programs overall, as well as the standard for interaction with a specific student in a given moment, in a given aspect of any problem-solving task. Simple and direct language is needed in the questioning because it also provides a model for students in the questions their brain must ask if they are to develop independent self-generating, self-correcting activity with spoken and written language.

Lindamood-Bell™ Sensory-Cognitive Programs

Our brain can only receive information from our senses. Research shows that the sensory system is the heart of good language processing or the root of the problem. Two levels of sensory processing are important for language processing and critical thinking. First, speed and magnitude of processing. How soon and with what vigor does the brain register incoming sensory information? Second, does that incoming information become consciously processed and integrated with language and imagery for the cognitive benefit of what Paivio (1986) calls dual coding?

We have developed intervention programs, commonly referred to as "Lindamood-Bell", that bring sensory information to a conscious level to be concretized and integrated with language in a dual coding support system. This conscious awareness developed by Socratic questioning enables individuals to "own" the sensory information and its relationship with language. The interactive relationship between language and sensory-input/imagery supports thinking and reasoning about relationships between parts and wholes involved in learning tasks.

Language processing can be thought of as a parts-whole spectrum, ranging from processing words (parts) on the left side of the spectrum to processing concepts (wholes) on the right side. Weakness in processing parts—sounds and letters within words—causes reading and spelling errors and the symptoms of dyslexia. Weakness in processing the whole of language causes difficulty in comprehension and expression of oral and written language, following instructions, critical or analytical thinking, and problem solving—and the symptoms of hyperlexia, autism, Asperger's Syndrome, and attention deficit.

The parts-whole issue is like two sides of a sensory processing coin. Each side uses sensory information in a specific manner, opposite in nature from the other side. For example, some individuals, and Einstein was one of these, are able to rapidly and automatically process the whole, the big picture. They easily and quickly create an imaged gestalt from what they read or hear and use that imaged gestalt to problem solve, think analytically, comprehend and express language. Indeed, Einstein said that imagination is more important than knowledge. However, these same individuals may have difficulty processing the other side of the coin—parts. They may experience difficulty reading and spelling words.

Or the reverse may be true. Some individuals easily get parts but not the whole. They can rapidly and automatically create images for parts—letters, isolated facts, names, and dates—and they can often read and spell words well. Their sensory system easily and rapidly gives them information about bits and pieces creating mental representations for parts of language, parts of conversations, parts of oral language, parts of directions, parts of written language, parts of movies, and parts of social situations. However, their sensory system may not quickly and easily image the whole and they experience difficulty with comprehension, problem solving, critical thinking and social interaction.

Our sensory-cognitive programs address the parts-whole issue by developing the sensory base needed to integrate imagery and language in harmony with Dual Coding Theory: Cognition is proportional to the degree to which images and language are integrated (Paivio, 1986). To develop either side of the sensory processing coin—parts or wholes—the sensory input of imagery triggers language and language strengthens the imagery. This reciprocal relationship between language and sensory input /imagery is the backbone of our three sensory-cognitive programs. The programs focus on the parts-whole relationships in cognition and their descriptions follow.

Visualizing and Verbalizing® for Language Comprehension and Thinking (V/V™)

The Visualizing and Verbalizing® for Language Comprehension and Thinking (V/V™) Program stimulates concept imagery—the ability to visualize the gestalt (whole)—as the sensory connection needed to develop language comprehension, language expression, and critical thinking.

V/V™ has an important and direct relationship to dual coding theory. Paivio (1979) states that the most general assumption in dual coding theory is that there are two classes of phenomena handled cognitively by separate subsystems, one specialized for the representation and processing of information concerning nonverbal objects and events (imagery), the other specialized for dealing with language. The V/V™ program stimulates and integrates the two systems of language and imagery, resulting in the imaged gestalt for cognition.

By questioning for imagery, the V/V™ procedure develops concept imagery first at the level of a word, and extends the imagery to sentences, paragraphs, and pages of content. The specific steps follow.

1. Setting the Climate:

The goal is to help students understand what they will be doing and why—learning to visualize concepts they read and hear in order to make thinking and comprehension easier.

2. Picture to Picture:

The goal is to question and interact with students to develop fluent, detailed verbalizing about a given picture.

Structure Words—what, size, color, number, etc.—are introduced to provide concrete descriptive elements to notice and verbalize.

The teacher questions with "choice and contrast" to stimulate verbalization of the picture: "Your words are making me picture the boy wearing pants. Should I picture long pants or short pants? Red or blue?"

3. Word Imaging:

The goal is to question and interact with students to develop detailed visualizing and verbalizing (dual coding) for a single word.

The student describes a generated image for a high-imagery "Known Noun," such as clown or cowboy. The Structure Words are used to provide detailed, vivid imagery. The teacher asks sensory-driven questions to specifically develop imagery. "Are you picturing a white hat or a black hat on the cowboy? Does he have long hair or short hair?"

4. Phrase and Sentence Imaging:

The goal is to question and interact with students to extend the imagery and language from one word to a phrase and then to a single, simple sentence.

The student uses a previously imaged Known Noun as the subject of a sentence to be imaged. For example, "Keep the same clown we just visualized, and now picture this, the clown jumped on the green ball."

5. Sentence by Sentence Imaging:

The goal is to question and interact with students and extend the integration of imagery and language to a gestalt, sentence by sentence.

Beginning receptively with short paragraphs, the teacher reads each sentence to the student. The student visualizes and verbalizes each sentence, placing a colored square to anchor each image. Structure Words are used to develop detailed imagery for the first sentence. At the completion of the paragraph, the student touches each colored square and gives a Picture Summary by saying, “Here I saw…” Then, the colored squares are removed and the student gives a Word Summary, using imagery to paraphrase the gestalt.

6. Sentence by Sentence Imaging with Higher Order Thinking Skills (HOTS):

The goal is to question and interact with students to develop critical thinking and problem solving from the imaged gestalt.

After the Sentence by Sentence steps have built an imaged whole as the base, the student is asked main idea, conclusion, inference, problem solving and analytical questions that can be verified with the student's imagery. “What was the main thing you pictured from that paragraph? From all your images, why do you think…? What do you picture might happen if…?”

7-9. Multiple Sentence, Whole Paragraph, and Whole Page Imaging:

The goal in steps 7 through 9 is to increase and extend the language input, either receptive or expressive, to further develop the imaged gestalt and apply that cognitive base to critical thinking, problem solving, and interpretation.

Once the gestalt is imaged, it becomes the sensory information residing within the student for exercises in problem solving, analytical thinking, comprehending and expressing language, paragraph writing, following instructions, mathematics, and interpreting and responding appropriately to social situations

Lindamood Phoneme Sequencing™ (LiPS™) Program

As stated earlier, just as there are individuals unable to process the whole, there are individuals unable to process the parts of language—the letters and sounds. This is lack of phoneme awareness—the ability to perceive the identity, number, and sequence of sounds within spoken words. The discovery of the causal role of individual differences in phoneme awareness in the development of reading skills is one of the most important findings in reading research of the last 20 years. Without phoneme awareness students can learn phonics information—the letter P says /p/—but without phoneme awareness they cannot do phonetic processing. They cannot tell if what they say matches what they see. They cannot self-correct even when meaning signals an error, because they cannot determine the nature of their error.

The LiPS™ Program is a phoneme awareness program, which also includes phonics instruction and application of phonemic awareness to phonetic processing in both reading and spelling. As with all our sensory-cognitive programs, the instruction is delivered in a discovery format through the use of questioning techniques that connect students to sensory experiences in order to form concepts. LiPS™ stretches from a prereading level where phonemic awareness is developed, into single syllable, multisyllable, and contextual reading levels where phonemic awareness and orthographic expectancies are applied. The specific steps follow

1. Setting the Climate:

   The goal is to help students understand what they will be doing and why—learning to feel, see, and hear speech sounds in order to make reading and spelling easier.

2. Consonant Labeling:

   The goal is to question and interact with students so they discover how each of the consonant sounds are articulated, and how they can use that sensory information to organize sounds into categories.

   Simple, high-imagery labels are attached to each category—Lip Poppers /p,b/, Tongue Lifters /l,r/—to enable teacher and students to communicate clearly about sounds within words in subsequent steps. For example, "When you say /clasp/, what are the last two sounds you feel? (Student labels those sounds.) How do they change when you say /claps/?”

3. Vowel Labeling:

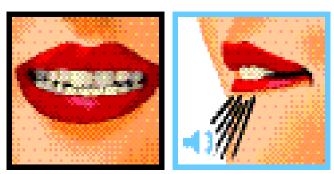
   As with consonants, the goal is to question and interact with students to discover how the vowel sounds are articulated, and use that sensory information to organize the sounds into mouth shape categories such as Smile, Open, and Round.

4. Tracking:

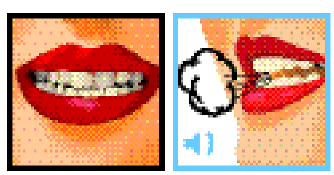
   The goal is question and interact with students to develop phoneme sequencing for single through multisyllable words, using articulatory feedback as the sensory base to verify sounds within words.

   As soon as they have awareness of the articulatory gestures for a few consonants and vowels, students begin using their oral-motor awareness to track the identity and order of phonemes in spoken words. They use mouth pictures to concretely show the sounds in words. For example:

“Show me.../if/.”



“That says /if/, now show me /it/."



Next, students use colored blocks to show sounds in words, in a more abstract tracking task.

The labels (Lip Popper, Tip Tapper, etc.) are used as the teacher asks questions about what students feel, and as students compare and verbalize contrasts between words. Thus, phonemes are dual coded with imagery and language at each step in Tracking.

Tracking establishes a conceptual base for students to grasp the alphabetic principle of coding speech sounds with letters for spelling and reading.

5. Decoding and Spelling:

The goal is to question and interact with students to apply the sensory information from articulatory feedback to reading and spelling tasks.

As phonetic processing emerges, orthographic expectancies are introduced so that students begin to integrate phonetic processing with an ability to predict how words will be spelled or read. Moreover, sight recognition of words is stimulated so students can be overlapped into fluent contextual reading and writing.

The intensive, concrete, dual coded processing stimulated in the LiPS™ Program makes it quite different from others labeled as phonemic awareness programs. Although various studies show training in phonemic awareness to be effective in helping students to understand the alphabetic principle and develop independent word reading skills, a common problem reported in research is that phonemic awareness training procedures may not be powerful enough to aid students who are most at-risk for the development of reading difficulties. For example, both Torgesen, et al (1992) and Vellutino, Scanlon and Tanzman (1994) found that a significant number of students were unable to profit from their phonemic awareness training procedures. These students are not 'missed' if phonemic awareness stimulation is very concrete, with sensory experiences captured by language, as in the LiPS™ Program.

Seeing Stars®: Symbol Imagery for Phonemic Awareness, Sight Words, and Spelling (SI™)

After many years of stimulating and developing phonemic awareness in both clinical and classroom settings, we began to uncover what appeared to be a universal trait with students: students whose phonemic awareness became rapid and automatic created mental representations—imagery—for the letters within words. The contrast was also true. Students whose phonemic awareness remained unstable—who had difficulty decoding words rapidly, learning sight words, and spelling accurately—did not create mental representations for letters within words. This led us to experiment and develop a measure for symbol imagery—the ability to create images for the number, identity, and sequence of letters within written words.

Research with thousands of students of all ages is verifying that symbol imagery is a neurological, sensory-cognitive function critical to literacy development. The research documenting difficulty in segmenting and sequencing phonemes within spoken syllables has been extensive. However, rapid comparing of phonemes in words requires symbol imagery to aid processing of internal parts. Given that our reading and spelling system is a visual code, phonemes alone do not suffice; they need an anchor in the sensory system and that anchor is symbol imagery. Recent research has noted that abnormalities in phonological processing are invariably present in dyslexia; however, deficits in visual processing are also commonly seen (Eden, 1999).

The relationship between imagery and reading/spelling skills has been considered important by a number of researchers over the years. The difference between good and poor readers on auditory discrimination tasks may arise not only from deficient auditory skills in poor readers, as is now known, but also from the ability, as evidenced in good readers, to image written language symbols to improve their ability to discriminate sounds (Ehri, 1980).

The Lindamood Auditory Conceptualization (LAC) Test was a significant contribution to the field of reading in understanding the role of phonological processing for literacy skills. Our new measure of symbol imagery appears to be making a similar contribution. The Symbol Imagery Test (Bell, 1999) documents the strong correlation between the ability to image letters within words and a student's function in phonemic awareness, word attack, word recognition, and spelling. More important than the existence of symbol imagery as a sensory-cognitive process and its relationship to written language processing is that it can be stimulated and produces significant gains in phoneme awareness, decoding, spelling, and reading in context.

Compared to the VV™ Program, which develops imagery for the whole, the Seeing Stars™ Program develops imagery for the parts: not the ability to image the meaning of language but the ability to image the orthography of language, the letters and letter patterns of the written language.

The steps of Seeing Stars™ range from imaging single letters, to imaging simple syllables (such as if, fip, and cab), to imaging complex syllables (such as ask or streak), to imaging multisyllable words, to using imagery to learn specific sight words and spelling words, to applying symbol imagery to reading in context. Each step includes specific symbol imagery exercises. As with all Lindamood-Bell™ programs, the teacher's language focuses the student on the relevant sensory information for the task. The specific steps follow.

1. Setting the Climate:

   The goal is to help students understand what they will be doing and why—learning to image speech sounds/letters in order to make reading and spelling easier.

2. Imaging Isolated Letters:

The goal is to question and interact with students to develop imagery for the sound/letter relationships of consonants and vowels, including the name of the letter.

The student is shown a letter card and given the name and sound of the letter(s). The card is taken away. The student then says the name/sound of the letter and writes it in the air.

3. <u>Syllable Cards:</u>

The goal is to question and interact with students to develop symbol imagery for syllables and words, using orthographic expectancies.

The student is shown Syllable Cards, progressing from simple to complex words and eventually into multisyllable patterns. The card is taken away. The student decodes the word from memory and then air-writes the word, saying each letter.

To anchor the imagery, the teacher asks specific questions such as, "What is the third letter you pictured? Say the letters from right to left."

4. <u>Syllable Boards:</u>

The goal is to question and interact with students to develop symbol imagery from a spoken word (whole to parts) or spoken letters (parts to whole).

Students write imaginary letters for a given word on their Syllable Board. Moving from simple to complex patterns, the task reinforces imagery and is less threatening than writing with a pencil where the shape of the letter or the accuracy may cause the student concern.

The teacher asks specific sensory questions, such as, "What is the second letter you pictured? Now, take out that R and put in an L, and what would the word say?"

5. <u>Imaging Syllables with and without a Chain:</u>

The goal is to question and interact with students to develop symbol imagery for single syllable words, simple and complex, and reinforce orthographic expectancies.

The teacher says a real or nonword and the student air-writes the word, saying each letter. The teacher adds, omits, or substitutes one letter. "Now what is the second letter you picture? Say the letters backwards."

6. <u>Imaging Sight Words:</u>

   The goal is to develop visual memory and instant recognition of 1000 sight words, in order of frequency used in English.

   Students move through a series of sight words, using symbol imagery to anchor orthographic expectancies that are not phonetically regular. After showing a student a sight word, which the student decodes and air-writes, the teacher questions to the student's symbol imagery. "What is the third letter you pictured in the word rain?"

7. <u>Imaging Spelling:</u>

   The goal is to develop visual memory for orthographic expectancies and real word spelling for 1000 words and beyond.

   Students "Analyze, Visualize, and Write" words on their Visual Spelling Chart. The "write" part of the task is first air-writing and then pencil-writing. Symbol imagery is questioned.

8 <u>Multisyllable Reading, Spelling, and Imagery:</u>

   The goal is to question and interact with students to develop reading and spelling of two, three, and four syllable words.

Affixes are imaged, multisyllable sound/letter sequencing is developed with the Syllable Board (which is now turned over to the multisyllable side), and air-writing and decoding/spelling are practiced with two through four syllable words.

9 Contextual Integration:

The goal is to apply word attack and word recognition skills to contextual reading, stimulating symbol imagery-to-print-comparing for rapid self-correction.

Symbol imagery stimulation impacts more than sound/symbol associations; we have shown its effects beyond phonics knowledge on phonemic awareness and phonetic processing. Students who receive symbol imagery stimulation show significant gains in word attack, word recognition, spelling, phonemic awareness, and contextual accuracy and fluency.

By combining the LiPS™ and SI™ Programs for both articulatory feedback and symbol imagery for students, students' grasp of the alphabetic principle is very strong, and reading and spelling performance is significantly strengthened. Students have a concrete sensory reference for the elusive phonemes within words (articulatory feedback) and a rapid visual sensory reference as well (symbol imagery). Thus, when they need to, students can do slow and careful phonetic processing using articulatory feedback, and, using symbol imagery, can shift to faster processing that fluency requires.

Sensory-Cognitive Procedures and IE Cognitive Function Goals

The three sensory-cognitive programs described above are different from Feuerstein's IE activities in procedures and focus. Their similarities lie in the cognitive competence goals they have for students. To illustrate this we will look at the major cognitive functions developed in ten IE activities involving problem-solving with oral and written language. Our programs stimulate these same important cognitive functions by directing attention to the appropriate sensory processing involved. Below is an example for each IE goal.

IE Cognitive Functions	**V/V™, LiPS™, & SI™ Procedures**
Defining the problem	Setting the Climate - first task in all three programs is establishing what we will do and why. Exploring how mind tells parts of brain to work together so "knowing" is easier, and why teacher's job is asking questions and student's job is telling what he thinks. Immediate "right" answer not important; student needs to discover what questions to ask self. Not knowing does not mean cannot. Just means do not know yet. Setting the Task – at start of each activity, to establish teacher's job, student's job, and why.
Task Intrinsic Motivation	All programs in progression of small steps, moving from most simple to most complex. Mastery of each step used for mastery in next. Student highlights introduction and mastery of each step on Progress Chart.
Selection of Relevant Information	V/V™ - Structure words elicit imagery detail. LiPS™ - Discover place and manner of articulation to categorize 24 consonants into 11 groups. SI™ - Naming of letters in imaged sequence.

Planning Behavior	<u>V/V™</u> - Colored squares placed to anchor sentences and imagery. <u>LiPS™</u> - Student uses 4 steps to verbalize tracking phonemes in words. <u>SI™</u> - Writing letters in air to aid imagery of sequence.
Hypothetical Thinking and Use of Logical Evidence	<u>V/V™</u> - Justify verbal conclusions and inference by deduction from images. <u>LiPS™</u> - Use of oral-motor feedback to self-correct errors in categorizing consonants. <u>SI™</u> - Citing change of letter in imaged sequence due to input of phoneme change.
Summative Behavior	<u>V/V™</u> - Touch colored squares and recall images for picture summary of verbal content. <u>LiPS™</u> - Assemble 15 vowel graphemes on vowel circle to represent 15 vowel sounds in four oral-motor categories. <u>SI™</u> - Verbalize pronunciation of word from imaged letter sequence.
Hold Number of Comparison Parameters in Mind	<u>V/V™</u> - Independent use of structure words to elicit various attributes of imaged detail.

	LiPS™ - Self-correcting association of given sound, mouth picture, label, and grapheme by comparing to oral-motor parameter or symbol imagery parameter.
	SI™ - Judgment of number of imaged letters to a given word pattern, comparison of sequence of imaged letters to given oral word.
Perception of Parts to Whole or Whole to Parts	V/V™ - Connecting images from sentence-to-sentence parts, to form comprehension gestalt of paragraph main idea.
	LiPS™ - Within wholeness of spoken word, using oral-motor feedback or symbol imagery to recognize identity, number, and order of phonemes comprising it.
	SI™ - Imaging letters (parts) from a given word (whole) or imaging and pronouncing the word (whole) from the letters (parts).
Spontaneous Comparison To Model	V/V™ - Independent comparing of match between language and images.
	LiPS™ - Self-correcting decoding errors during reading in context by comparing phoneme/grapheme match and/or concept images.

	SI™ - Self-correcting phonetic spelling of a word to its orthographic irregularity through feedback of symbol imagery.
Detaching Self from Own Opinion of an Experience	V/V™ - Comparing equal appropriateness of other concept images different from own, and use of imagery for pragmatics and social situations.
	LiPS™ - Responding to teacher's question directing attention to articulatory input, to change decoding student thought was correct.
	SI™ - Responding to teacher's question directing attention to symbol imagery input, to change decoding student thought was correct.

Evidences of the Need for Sensory-Cognitive Development

Our sensory-cognitive programs emerged out of concern that students within a range of intelligence—from developmentally delayed to average and even above-average—were spending years in traditional language and literacy instruction without acquiring the spoken and written language skills that would enable their full intellectual potential to be realized. We heard these students expressing concern that they were dumb and stupid because they saw fellow students learning from the same instruction that wasn't meaningful for themselves. We saw their body language and facial expressions reflecting lack of confidence and loss of self-esteem in general, and particularly in academic activities that required spoken and written language skills. We saw these individuals subjected to derogatory comments from fellow students about their learning ability. We heard them subjected to negative comments about their motivation and efforts to learn by teachers and parents who didn't understand why the instruction that was productive for other individuals wasn't productive for them.

These students had not been successful in grasping information presented to them in an already organized and associated form. Clearly, they needed to develop a learning process before learning specific content. We wanted them to be able to prove information for themselves as much as possible, so they would know they knew and would know how they knew. We reasoned that sensory processing is the first and most basic processing that intervention must address.

We find teachers have not been alerted to individuals' genetic differences in sensory perception, beyond acuity, that medical research is documenting. Schools now routinely screen students for visual and auditory acuity. But it is generally assumed in educational settings that if visual and auditory acuity are within the normal range, students are equipped to successfully process visual and auditory input if they will pay attention and try. Therefore, even with the helpful categories that Feuerstein has provided, educators using MLE and IE intervention may be assuming sensory awareness.

We add a concern for the processing abilities of the teacher-mediators in the three areas of sensory processing we address—their processing in these areas must be intact if they are to be competent in analyzing and addressing the needs of their students. Our findings indicate 30% or more of teachers and speech-language pathologists are candidates for further refinement in one or more of these areas of sensory-cognitive processing (Lindamood, 1993; Lindamood & Goebel, 1998). They are intelligent people who are products of school systems and professional training programs that have not become knowledgeable about and organized for diagnosing and attending to the sensory-cognitive abilities involved. It is our experience that, to enable all students to achieve their cognitive potential, teaching teachers how to mediate will not be enough. A significant segment of teacher-mediators will first need to participate in developing their own sensory-cognitive processing, before they can learn to do the same for their students.

Summary

Like Feuerstein, our experience has established that when children or adults have learning difficulties it is not appropriate to use those difficulties to assign limits on their potential. Instead, the challenge is to diagnose the basic processing problems underlying those difficulties, and involve in interaction that will develop the processing abilities needed so the individuals can progress toward their potential.

We suggest that a complementary relationship exists between our approach and Feuerstein's. Our programs and goals amplify his by adding concentrated attention to connecting sensory information to language (parts to wholes) and language to sensory information (wholes to parts), and are very effective with children 5 years of age or even younger. The stimulation of the cognitive processing in younger children and integration of sensory information from different modalities at more simple levels, which is often assumed by teachers and parents, could conceivably contribute to stronger responses to the complex cognitive tasks in IE problem-solving activities. If studies are done in a combined approach with upper elementary and older students, they may reveal powerful effects on thinking, reasoning, and learning.

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