The Relationship Between Visual Processing Problems & Learning

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Vision Is More Than Seeing 20/20

Visual Perception/ Visual Information Processing

- Perception
  - an ACTIVE process of locating and extracting information from the environment
- Learning
  - the process of acquiring information through experience and storing the information.
- Thinking
  - the process of manipulating the acquired information to solve problems.

Models of Visual Perceptual and Learning Development

- Perceptual-Motor Theory
  - Kephart Model
- The Basic Sequence of Development
  - G. N. Getman, O.D.
- Skeffington’s Model of Vision
- Visual Information Processing Model
  - Eric Borsting, O.D.

Perceptual-Motor Theory

- Motor activity is the basis for the development of perception.
  - Motoric responses to a child’s environment is the central core to all behavior.
- Perceptual-Motor match
  - It relates to the discovery by the child that certain movements can affect his/her surroundings in a predictable way.
  - Certain movements, then, are learned and planned by the child for a particular purpose.

Hierarchical Order

- Each stage in development is important for the next level.
- If one stage is not mastered, it may lead to splinter skills.
- Learning disabilities, then, represent one of two things:
  - a general slowdown of achievement in motor development
  - a breakdown of achievement at some point
The Basic Sequence of Development

- Getman believed in a learning process of perceptual skills, like Kephart, but it differed in some fundamental ways.
- Getman's theories are more visually oriented than Kephart's.
- Vision perception is the supreme skill for mastering complex concepts.
- The development of learning follows a sequence in the pre-school years.

Skeffington’s Model of Vision

- Antigravity System (Vestibular)
  - Basic frame of reference for orientation and spatial localization
  - Internal Balance and position in space
- Centering (Convergence)
  - Directing body, head, and eyes toward area in space for information processing
  - Attention and orientation in external space

Skeffington’s Four Circles

- Identification (Accommodation)
  - Gathering meaning from areas of selected attention in external space
  - Resolution, discrimination, differentiation, and determination of relationships between details
- Speech-Auditory
  - Analysis and communication of what is seen

Visual Information Processing Model

- Visual-Spatial Skills
- Visual-Analysis Skills
- Visual-Motor Integration Skills
- Auditory-Visual Integration Skills

Visual Spatial Orientation Skills

- Awareness of one's own position in space relative to other objects
  - Where am I? Where are you?
  - Skeffington’s Centering
  - Skeffington’s Anti-gravity
    - Requires Vestibular System
- Location of objects relative to one another
  - Where is it in relation to another object?
Visual Spatial Orientation Skills

- Foundations needed:
  - body knowledge and control
  - bimanual/bilateral integration
  - ability to understand directional concepts
    - both internal and projected into external visual space.

- Important for:
  - balance
  - coordinated body movements
  - navigation in the environment
  - following spatial directions
  - understanding the orientation of symbols, letters, and numbers.

Signs and Symptoms of Visual Spatial Skill Deficiency

- Delayed development of gross motor skills.
- Decreased
  - coordination
  - balance
  - ball-playing skills.
- Confusion of right and left.
- Letter reversal errors when writing and/or reading.
- Inconsistent directional attack when reading.
- Inconsistent dominant handedness.
- Difficulty in tasks requiring crossing of midline.
- Poor spacing between letters and words when printing or handwriting.

Piaget Right/Left Awareness Test

- Ages normed for 5-11 years old.
- Patient must pass all parts of each Subset/Section to pass a section.
- Exam must be done at a table which an examiner and child can sit opposite of one another.
- No Time Limit

Gardner Reversal Frequency Test

- Ages 5-15 years old
- Child is given a pencil with an eraser
  - patient may erase or change answers.
- There is no time limit.
- Do not let the child write his/her name until after the test is completed.
Gardner Reversal Frequency Test

Jordan Left-Right Reversal Test (Revised)

Three Components:
1. Part I: Ages 5-12 years of age
   - Child recognizes correctly orientated and reversed letters and numbers.
2. Part II: Ages 9-12
   - Part IIA: Child recognizes reversed letter in a word.
   - Part IIB: Child recognizes reversed word in a sentence.

Jordan Left-Right Reversal Test (Revised): Observations

- Motor reinforcement
  - child traces over sample with finger or pencil
  - child writes letter on paper or in space (tactile/kinesthetic memory)
- Impulsivity or loss of concentration.
- Tracking problem-(skipping around page)
- Language-based or true letter reversals?

Angels in the Snow

Tests for:
1. Body Knowledge and Control
   - Body Awareness, Body Image, Body Schema
2. Bilateral Integration
Ages 3-8 years old.

Observations:
- Motor Overflow
  - some movement in a limb other than the limb that the examiner touched.
- Segmentation
  - one limb moves first followed by the other

Chalkboard Circles

Tests for
1. Bilateral Integration
2. Visual-motor integration with peripheral awareness component
   - Ages 3-8 years old
   - The child makes five revolutions then reverses direction.
     - Symmetrical
       - hands going in opposite directions
       - Ex. In towards midline/ Away from midline
     - Reciprocal
       - hands in same direction
       - Ex. Windshield wipers
Harmon/Chalkboard Circles

Observations
- Relative Size:
  - 12 inches in diameter (size of a basketball)
- Circles should be level within 2 inches vertically
- Circles should not overlap.
- Equal Size Circles
- Hands should be synchronized and switching of directions/reversed should be smooth
- Attention maintained at the “X” and not at the hands.

Form Board

- Answers the following questions:
  - Can the child combine parts to make a whole, and place the pieces?
  - Has the child made the shift from tactile to visual performance?
- Evaluates form perception, visual-motor integration hierarchy, dominant hand, crossing of midline, visual planning
- Informal Assessment=Observations
- Three Form Board= At least by Age 3
- Six Figure Form Board=Age 3-5
- Six Figure Divided/ Split Form Board=Age 5-0 to 8-11 years old

Forms Boards

- Three boards; 3 piece, 6 piece and 12 piece
  - Watch for visually guided behavior
  - Watch for use of hands: lead-support (pick up with non-dominant hand and place the piece with the dominant hands).
  - Capable of handling the pieces with the diagonals.

Forms Boards

Visual Analysis Skills

- Skeffington’s “Identification” Circle
  - “What is it?”
- Examples:
  - Infants=Face Recognition
  - Preschool=Symbol Recognition
  - School=Word Recognition, puzzle solving
  - Adult=Understanding maps, graphs
  - OD=Is it corneal ulcer or corneal infiltrate?
Signs and Symptoms of Visual Analysis Skill Deficiency

- Delayed learning of the alphabet or letter identification
- Poor sight word vocabulary
  - Automatic recognition of words
- Difficulty with basic math operations
- Difficulty with classification of objects on the basis of their visual attributes (shape, size...)

Visual-Analysis Skills

- Form Constancy
  - Ability to be aware of distinctive features of forms including shape, orientation, size and distance.
  - Enables the individual to identify objects and shapes consistently and accurately regardless of changes in presentation

Visual Form Constancy

- Visual Closure
  - Ability to be aware of visual clues that allow him/her to determine a whole picture without needing all of the details
  - Examples:
    - Completing a word when only a part of it is seen
    - Identifying a dot to dot picture before you connect the dots
  - Crucial for reading
    - With each fixation, only part of the word or phrase is actually perceived.
    - As reading improves, less fixations occur so more information must be taken in with each one.

Visual Closure

Visual Figure Ground

- Ability to attend to a specific feature or form while maintaining an awareness of the relationship between this form and the background information
- Examples: Where's Waldo?, I-Spy, Hidden Pictures
- Important for attending to specific words or word phrases in a paragraph while reading
- Prerequisite for visual discrimination
**Visual Figure Ground**

- Visual Discrimination
  - The ability to identify differences and similarities between shapes, symbols, objects and patterns by their dominant features.
  - Examples
    - Recognizing the difference between same-sized fruits such as an apple and pear
    - Recognizing and reading a "b" rather than a "d"

**Visual-Analysis Skills**

- Visual Discrimination
- Visual Memory
  - Ability to recognize and recall visually presented information
- Visual Spatial Memory
  - Requires Simultaneous Processing
- Visual Sequential Memory
  - Requires Sequential Processing
Visual Sequential Memory
- The ability to recall a sequence of visual images
- Example: Copying from the board
- What would a child have problems with?
  - Spelling
  - Reading
  - Note taking
  - Recalling formulas and equations
  - Recalling the sequence of events following a demonstration

Visual Analysis: Test of Visual Perceptual Skills (TVPS)
- TVPS-3 (non-motor)
  - Ages 4-0 to 18-0 years old.
  - No time limit to answer questions.
  - Each subset can be scored individually or as a whole test
  - Recognition Test/ Multiple Choice Test
  - Normative sample
    - N=2008
    - All races but predominantly Caucasian
    - Over 50 sites across the United States

Visual Analysis: Test of Visual Perceptual Skills
- Visual Discrimination
- Visual Memory
- Visual Spatial Relationships
- Visual Form Constancy
- Visual Sequential Memory
- Visual Figure-Ground
- Visual Closure
Visual Analysis: Motor-Free Visual Perception Test (MVPT)

- **MVPT**
  - Ages 4 to 95 years old and above
  - A single raw score is obtained which can be converted to a standard score, percentile rank or age equivalent
  - Normative data
    - N=1886
    - Over 100 sites across the United States

Spatial Relationships

- Visual Discrimination
- Figure-Ground
- Visual Closure
- Visual Memory

Visual Integration Skills

- **Visual Integration Skills**
  - Visual-Motor Integration Testing
    - Fine Motor Skills
  - Auditory-Visual Integration Testing
    - Auditory Skills
  - Visual-Verbal Integration Testing
    - Language Assessment

Visual Integration Skills

- Ability to integrate or coordinate visual information/ stimuli with another sensory mode.
  - **Intramodal**
    - Stimuli received (input) and output are the same sensory mode.
      - Ex. Visual-Visual
        - Child sees the word “bird” and a picture of a bird forms in the child’s mind
  - **Intermodal**
    - The coordination of sensory stimuli received (input) is different than the sensory output
      - Ex. Visual-Motor
        - Seeing a bird then drawing a picture of a bird.
      - Ex. Auditory-Visual
        - Hearing the word “bird” then mental picture of bird.

Visual-Motor Integration

- Visually guided motor response/ Eye-hand Coordination
- The ability to integrate visual information processing with fine motor movements.
  - Requires translation of abstract visual information into an equivalent fine motor activity.
  - Examples
    - Handwriting and copying skills
Visual-Motor Hierarchy

Visual-Motor Integration Signs and Symptoms
- Difficulty copying from the board
- Sloppy drawing or writing skills
- Poor spacing and inability to stay on lines
- Erases excessively
- Can respond orally but not produce answers in writing
- Difficulty completing written assignments in allotted period of time
- Difficulty writing numbers in columns for math problems

Tests for Visual-Motor Integration
- Beery-Buktenica Development Test of Visual Motor Integration (Beery VMI)
- Wold Sentence Copy Test
- Developmental Test of Visual Perception (DTVP-2): Eye-hand coordination
- Three, Six, and Divided-Six Form Board

Developmental Test of Visual Motor Integration (Beery VMI)
- Ages 3-0 to 17-11 years old
- Test may be ended after three consecutive items with no score.
- Record observations:
  - Working distance, pencil grip, motor overflow, paper rotation, dominant hand, non-writing hand for support, recognition of mistakes
- Allow only one try per item. NO ERASING!

Developmental Test of Visual Motor Integration (Beery VMI) Wold Sentence Copy Test
- Ages 6 to 13 years old
- 1st grade to 8th grade
- Evaluates visual-motor integration, copying skills, letter spacing, and perceptual speed.
- A child copies a non-sense paragraph as neatly and quickly as he/she can.
Visual Motor Integration: Wold Sentence Copy Test

- Observations
  - Spacing: Is spacing consistent? Any omitted letters or words?
  - Formation: Are letters correctly formed, any letter reversals, lower case and capital letters appropriate size relative to each other?
  - Speed: Is the speed consistent, how many letters are copied each fixation, can the child copy whole words each fixation?

Grooved Pegboard

- Kindergarten to 5th grade
- Evaluates fine-motor skills, visual attention, concentration, perceptual speed, and directionality.
- Test Dominant Hand and Non-Dominant Hand
- Used to evaluate lateralized brain damage in adults, adolescents, and children whenever manual dexterity is at issue.
- Consisting of 25 holes with randomly positioned slots
  - Requires more complex visual-motor coordination than most pegboards.
  - Pegs with a key on one side must be rotated to match the hole before they can be inserted.

Developmental Test of Visual Perception (DTVP-2): Eye-hand coordination

- Revised version of Frostig with better norms and reliability
- Ages 4-11
- 8 subtests: Eye-Hand Coordination, Copying, Spatial Relations, Position in Space, Figure-Ground, Visual Closure, Visual-Motor Speed, and Form Constancy

Eye-Hand Coordination subtest

- Three forms are completed
- Straight line—Line pattern—Large Oval
- Scoring is based on distance from the center of the line
- Segments within each to see how far kid was off in the various sections
Developmental Test of Visual Perception (DTVP-2): Eye-hand coordination

Auditory-Visual Integration

- Ability to match a temporally distributed auditory stimulus to a spatially distributed visual stimulus or vice versa
- For example:
  - Reading sheet music and understanding how to follow the rhythmic notes
- Test: Birch-Belmont/ Auditory Visual Integration Test (AVIT)

Auditory-Visual Integration Deficits: Signs and Symptoms

- Difficulty with sound-symbol associations
- Difficulty learning to read phonetically
- Poor spelling ability
- Slow reading

Auditory Visual Integration Test (AVIT)

- Ages 6 to 15 years old
- Evaluates Auditory-Visual Integration, Auditory Discrimination (ability to identify the sequence and spacing of sounds), and Auditory Memory (remembering and recalling the sequence of taps)
- Examiner taps out a sequence, the patient remembers the sequence and matches it on a card shown afterwards.

Patient Instruction Set with Examples is very important.
- If child does not understand instructions and demonstration Cards A, B, and C, then do not administer test.
- Until Age 9-0 (9 years 0mos) only administer 10 cards, after age 9-0 administer all 20 cards.
- Observations: did the child count the taps, verbalize, tap out pattern to remember, reversals in pattern, perceptual style (reflective, impulsive, random)
**Auditory Memory**
- Ability to remember and recall auditory stimuli.
- Tests: Test of Auditory Perceptual Skills (TAPS)
  - Digit Forwards
  - Digit Backwards
  - Word Memory
  - Sentence Memory

**Auditory Discrimination**
- Ability to discriminate or tell the difference/sameness of paired words that have phonemically similar consonants, and/or vowel differences.
- Test: Test of Auditory Perceptual Skills (TAPS): Auditory Word Discrimination
- Ages: 4-0 to 13-0 years old
  - Example: "listen-lesson", "zinc-sink"

**Visual-Verbal Integration**
- Ability to rapidly retrieve a verbal label for a visually presented stimulus
- Dependent on rapid visual processing of stimulus
- Required for efficient reading and have an effect on speed of word identification.

**Visual-Verbal Integration Deficiencies: Signs and Symptoms**
- Difficulty learning the alphabet (letter identification)
- Difficulty with spelling
- Problems with sight word vocabulary (word recognition)
- Slow reading

**Visual-Verbal Integration Tests**
- Developmental Eye Movement Test (DEM) - Vertical Subtest A + B
- Rapid Automatized Naming Test

**Vision Training for Visual Spatial Deficits**
- Body Knowledge/ Body Awareness
  - Creep and Crawl
  - Touch and Draw
  - Angels in the Snow
- Bilateral Integration
  - Chalkboard Circles
  - Randolph Shuffle
  - Circle and square
Circle and Square Vision Training for Visual Spatial Deficits

- Laterality
  - Simon Says, Hokey Pokey
  - Floor Maze on Self

- Directionality
  - SUNY Hands, SUNY Hands and Feet
  - Kirshner Arrows
  - "b-d-p-q" Sorting
  - Floor Maze Projected (someone else goes through maze)

Vision Training for Visual Analysis Skills

- Visual Discrimination/Visual Form Perception/Visual Form Constancy
  - Parquetry Blocks
  - Geo Board

- Visual Closure
  - Computer Visual Closure

- Visual Figure Ground
  - Hidden Picture Workbooks

Parquetry Blocks

Parquetry Blocks

Parquetry Blocks
Parquetry Blocks

Geo Board

Vision Training for Visual Analysis Skills

- Visual Spatial Memory
  - Tachistoscope
  - Computer Visual Spatial Memory
  - Concentration
  - Parquetry Blocks with Memory

- Visual Sequential Memory
  - Tachistoscope
  - Visual Span
  - Word Projector Tachistoscope

Highest Levels of Visual Processing

- Visualization
  - Ability to create and manipulate visual concepts in space using one's mind

- Visual Thinking
  - Ability to visually plan ahead to solve problems

Vision Training for Visual Analysis Skills

- Visual Imagery/ Visualization
  - Computer Directionality
  - Parquetry Block Patterns with no lines
  - Spelling Word Visualization
  - Old Battleship Game

- Visual Thinking
  - Computer Visual Thinking
  - Playing Chess, Connect Four
Visual-Motor Integration

- Talking Pen
- Sanet Vision Integrator
- Wayne Saccadic Fixator

Thank You

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