

Introduction

Processing. Language Processing. Auditory Processing. These words and phrases seem to dominate what we hear and read, from parent magazines to professional catalog offerings to child-study team discussions. The speech-language pathologist often plays a critical role in gathering relevant information and evaluating it to present a clear, accurate picture of a student with central auditory processing deficits (CAPD). The professional gathers information from across the environments of home and school and then carefully analyzes the information to prepare a prescriptive response. The following list specifies what the speech-language pathologist needs to consider and accomplish in conducting such an evaluation:

Understand and describe the student's behaviors, both at home and at school.

Understand relevant speech, language, and listening skill areas and how they affect academic performance and everyday interactions.

Know which formal tests to use to delineate areas of weakness within speech and language functioning.

Understand the tests used in audiological testing and their implications in preparing the prescriptive response.

Understand the role of the medical doctor in attempting to rule out attention deficit hyperactivity or hypoactivity disorders.

Understand the role of the learning disability specialist and the tests used in attempting to rule out a learning disability.

Examine language arts-related performances within the student's classroom or classrooms, including observations of behaviors, grades on report cards and projects, test scores for formalized tests such as *Cogats* and *ITBS*, and patterns of errors.

Certain behaviors are often associated with children presenting with CAPD. These behaviors are listed in the box on page 6. Please note that these behaviors can also be found in children with learning disabilities and/or attention deficit hyperactivity disorder. As with most disorders, not every child with CAPD exhibits all of these behaviors, and the intensity of a given child's behaviors may vary across time and situations.

The auditory skill areas most commonly addressed in intervention for children with CAPD are listed and described on pages 7-8. The corresponding units of the three books in this program provide specific training exercises to improve each of these skill areas.

Characteristics of Children with CAPD

Overall performance for auditory functioning is poor

- Responds inconsistently to auditory stimuli
- Difficulty localizing sound sources
- Easily distracted; short attention span
- Unusually bothered by loud or sudden noises or noisy environments
- Appears to perform better in quieter settings
- Poor auditory memory skills for numbers and words
- Poor sequencing skills and sense of rhythm

Weaknesses in receptive and expressive language

- Misunderstands what is said; confuses similar-sounding words
- Requires information to be repeated several times; often asks *Huh?* or *What?*
- Finds abstract information difficult to understand when presented orally
- Difficulty following simple and complex oral directions
 - Confuses or forgets directions when several are given at one time
 - Has difficulty with delayed directions
- Hesitant speech; responds to questions and instructions slowly or with delay
- Weak vocabulary
- Difficulty singing in tune
- Difficulty with spelling, reading, and writing
 - Difficulty with phonics and speech sound discrimination
 - Confusion with, or reversal of, letters
 - Poor reading comprehension

Often viewed as a behavior problem

- Fidgety behaviors; hyperactivity; often irritable
- Often disorganized and forgetful; tendency to procrastinate
- Unusually tired at the end of the day
- Mixed dominance; confusion between left and right
- Low self-esteem; tendency to be depressed and feel overburdened
- Often viewed as immature; easily frustrated
- Not motivated, or negative, about school
- Pragmatically inappropriate due to difficulty following conversations

Auditory memory involves immediate and delayed recall of numbers, words, sentences, and directions. Just because a person can repeat well does not mean that he can remember well! Effective auditory memory involves interpretation. Weaknesses in this area may translate into academic difficulties as follows:

- Difficulty recalling letters, words, and numbers
- Inconsistent recall for addresses and phone numbers
- Forgetfulness with sound-symbol relationships
- Difficulty following all parts of oral directions

Auditory discrimination involves differentiating isolated sounds in words and words in sentences. At a very basic level, auditory discrimination may involve discrimination of nonlinguistic material such as environmental, animal, and musical sounds. Weaknesses in this area may translate into academic difficulties as follows:

- Difficulty understanding oral directions
- Difficulty learning letter sounds and letter names
- Poor spelling, reading, and writing skills
- Tendency to repeat words, numbers, and directions incorrectly

Auditory closure involves the ability to supply information that was not heard completely. The ability to predict this information is based upon a student's ability to use the context of information effectively. Weaknesses in this area may translate into academic difficulties as follows:

- Difficulty understanding speech in noise
- Poor vocabulary
- Poor syntax
- Difficulty with sound recognition and sound blending in phonics tasks

Auditory synthesis involves the abilities to form a word from individual sounds and to identify individual sounds in words as they occur within words or sentences. Weaknesses in this area may translate into academic difficulties as follows:

- Difficulty with phonics
- Difficulty with grammar
- Difficulty interpreting word stress

Auditory figure-ground involves listening in the presence of background noise from sources such as air conditioning units, noisy classrooms, radios, TVs, cafeterias, and playgrounds. Weaknesses in this area may translate into the following academic difficulties (listed on page 8):

Distractibility	Easily frustrated
Inattention	Negative feelings about school
Fidgety behavior	Procrastination
Intolerance and irritability	

Auditory cohesion involves higher-level linguistic processing skills, such as the ability to follow complicated conversations, understand jokes and riddles, make inferences, and draw conclusions. Weaknesses in this area may translate into academic difficulties as follows:

- Poor note-taking skills
- Poor reading comprehension, particularly compared to reading decoding strategies
- Pragmatically inappropriate behaviors
- Difficulty with written expression

Auditory binaural integration (interhemispheric functioning) involves the ability to make transfers between verbal and motor activities. Weaknesses in this area may translate into academic difficulties as follows:

- Difficulty functioning in classroom centers
- Difficulty learning within a whole-language environment
- Difficulty taking notes and writing to dictation
- Difficulty with music-related skills

Assessment and Diagnosis of CAPD

Speech-language pathologists often use the following instruments, arranged by publisher, to assess CAPD:

American Guidance Systems

Goldman-Fristoe Woodcock Test of Auditory Discrimination

Kaufman Test of Educational Achievement (KTEA)—particularly the Reading Decoding and Reading Comprehension subtests

Oral and Written Language Scales (OWLS)—particularly the Listening Comprehension Scale

LinguiSystems, Inc.

Language Processing Test-Revised (LPT-R)

The Listening Test

The Phonological Awareness Test

The Test of Problem Solving, Elementary-Revised (TOPS-R)

Western Psychological Services

Wepman's Auditory Discrimination Test (ADT)

Wepman's Auditory Memory Battery

Precision Acoustics

Auditory Continuous Performance Test (ACPT)

The Psychological Corporation

Clinical Evaluation of Language Fundamentals-3 (CELF-3)—particularly the Concepts and Directions, Recalling Sentences, and Word Classes subtests

Wechsler Individual Achievement Tests (WIAT)—particularly the Reading Decoding and Reading Comprehension, Oral Expression, Written Expression, and Listening Comprehension subtests

PRO-ED

Detroit Tests of Learning Aptitude-4 (DTLA-4)—particularly the Sentence Imitation, Reverse Letters, Word Sequences, and Story Sequences subtests

Lindamood Auditory Conceptualization Test (LAC)

Test of Language Development-Primary (TOLD-P:3)—particularly the Sentence Imitation, Word Discrimination, and Phonemic Analysis subtests

Token Test for Children and Revised Token Test (RTT)

Test of Auditory Perceptual Skills-Revised (TAPS-R)

The following audiological diagnostic instruments are often used for CAPD testing:

A Screening Test for Auditory Processing Disorders (SCAN)—This screening instrument consists of three subtests as follows:

1. Filtered Words—assesses auditory closure; may reflect difficulties in comprehending words within the acoustic environment and filling in auditory information that is lost to background noise
2. Auditory Figure-Ground—assesses word discrimination abilities in the presence of background noise; may reflect difficulties in focusing on auditory information within the typical noisy environment

3. Competing Words—assesses binaural integration via a dichotic speech task; may reflect difficulties with the ability to store and recall speech information

A Screening Test for Auditory Processing Disorders in Adolescents and Adults (SCAN-A)—This screening instrument differs from the SCAN in that there are a greater number of words, less delay in presentation, and an additional subtest for competing sentences; this subtest may reflect difficulties with binaural separation.

Phonemic Synthesis Test—assesses sound blending, discrimination skills, articulation, processing time, and sequencing; may reflect difficulties with auditory closure and decoding activities

Staggered Spondaic Word Test (SSW)—assesses binaural integration within a linguistically-loaded format; may reflect difficulties with decoding or receptive language weaknesses

Dichotic Digits Test (DDT)—assesses binaural integration within a non-linguistically-loaded format; may reflect difficulties with binaural separation in noise

Pitch Pattern Sequence Test (PPS)—assesses temporal patterning; may reflect difficulties with understanding inflectional patterns and recognizing and using prosodic speech features

Duration Pattern Sequence Test (DPS)—assesses temporal patterning; may reflect difficulties with the prosodic speech features

The sample case study below illustrates a typical report from an assessment of a child referred for suspected auditory deficits.

Sample Case Study

This ten-year-old, fifth grade student was seen to rule out a central auditory processing weakness. Relevant medical history includes frequent middle ear infections in early childhood. Behaviors observed by the mother reflect that the student often needs messages repeated; has difficulty spelling dictated words; has problems following oral directions that require remembering a sequence of commands; shows confusion with the order of syllables; shows difficulty with the phonetic spelling approach; exhibits extreme distractibility in a noisy situation; has poor retention of verbal information after a short period of time; and misinterprets words, phrases, and sentences.

Audiological Evaluation

Pure-tone testing revealed normal hearing sensitivity with a slight asymmetry in the low frequencies, the left ear being the poorer ear.

Speech recognition ability (stimuli presented dichotically at +5 s/n) was 84% for the right ear and 96% for the left ear at 45 dBHL. This is within normal limits.

Tympanometry revealed normal Type “A” tracings bilaterally. A visual inspection of the ears was normal.

Distortion Product Otoacoustic Emission (OAE) testing revealed slightly reduced emissions for the left ear at 1000 and 1500 Hz. Emissions were present in the normal range for all frequencies in the right ear.

Central Tests

A *Screening for Auditory Processing Disorders (SCAN)* test was given.

The Filtered Words subtest is a low-pass filtered speech test that assesses auditory closure, the ability to “fill in” the missing parts of speech. The student’s score was very poor for this skill (1st percentile).

The Auditory Figure Ground (AFG) subtest assesses word discrimination abilities in the presence of competing background noise. The student’s score was fair for this skill (9th percentile).

The Competing Sentences subtest is a dichotic speech task that reflects the development and maturation of the auditory system. The student’s score was poor for this skill (2nd percentile). The pattern of errors in the left ear only suggests a possible delay in the maturation of the auditory system. Left ear performance usually does improve over time.

The Competing Words subtest is a dichotic test in which different speech stimuli are presented to the two ears simultaneously. The student’s score was fair for this skill (2nd percentile). A depressed score may suggest that a child’s auditory system is functioning similar to that of a younger child.

The *Staggered Spondaic Word (SSW)* test assesses binaural integration and requires the subject to respond to spondee words presented to both ears. The second syllable of the first word and the first syllable of the second word are presented simultaneously. The patient is asked to repeat all four words. Scores were in the normal range for all four test conditions. The student did have a significant number of reversals. He could not remember the four words in sequence, so he would often repeat the second compound word first, followed by the initial compound word. This compensatory strategy is often displayed when a child has poor auditory memory or sequencing skills.

The *Phonemic Synthesis Test* involves blending sounds into words. It tests discrimination skills, articulation, blending, processing time, and sequencing. The test was given under earphones at 50 dBHL bilaterally. The student’s score placed him at the early first grade level. The student had significant difficulty with voiceless blends. He seemed to show difficulty discriminating the phoneme sounds /s/ from /sh/ or /st/ and also /sh/ from /ch/.

Summary

The student's test results are consistent with an auditory decoding deficit, characterized by poor performance on tests of monaural, low-redundancy speech and speech-in-noise. These children often exhibit difficulty in reading, particularly when an auditory phonics approach to reading is applied. Likewise, speech-to-print skills, vocabulary, syntax, and semantic skills may be weak. These students usually do well in math because phonemic decoding is not required. Since this deficit reduces a child's phonemic representation ability, sound blending, discrimination, and retention of phonemes is poor. The deficit manifests itself in the inability to achieve auditory closure due to breakdown in the intrinsic redundancy of the central auditory nervous system when portions of the auditory signal are distorted or missing. Although the student showed no significant weakness with auditory memory skills, auditory sequencing problems were evident throughout testing.

Recommendations

Repetition may help children with closure deficits, but only if the repetition is acoustically clearer than the original presentation of the message. The child's ability to comprehend the message will be good as long as the child is able to decode the message. Improving the acoustic clarity of the signal may be achieved by preferential seating away from noise sources in the classroom and using an assistive listening device during therapy sessions to improve the signal-to-noise ratio. Implement activities to develop and strengthen auditory sequencing skills.

The student may benefit most from phoneme training at the syllable level, specific training of speech-to-print skills, auditory closure activities designed to teach the use of contextual clues, and auditory sequencing of speech sounds and patterns of loudness and rhythm. These activities should be conducted by a speech pathologist.

An analysis of this report indicates therapy direction as follows:

- Auditory closure activities

- Activities involving word discrimination in the presence of background noise

- Auditory memory activities

- Auditory sequencing activities

- Sound blending activities