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**Language Processing Therapy for children diagnosed
with a (Central) Auditory Processing Disorder**

PART ONE

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Speechpathology.com presentation**

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Relevant Financial Relationship

- Dr. Coen-Cummings is a paid employee of the Cincinnati Children's Hospital and will be referencing her place of employment along with actual case studies.
- Dr. Coen-Cummings has a family member who has been diagnosed with ADHD which is covered in the presentation. She is a reviewer for speechpathology.com and Learning By Design, Inc.

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Course Description

- This seminar will delineate the current research's stance on evidence-based treatment strategies for children diagnosed with a (central) auditory processing disorder, and how the overall intervention goal will vary, depending on whether a speech-language pathologist or an audiologist is delivering the treatment. In addition, the main focus is the DEMONSTRATION (via videos) of clinical application of language processing management goals that improve active listening skills.

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Learning Outcomes

After this course, participants will be able to..."

- Describe how evidence-based research can be applied to interventions for language processing to increase a child's active listening skills.
- Identify a child's problem area(s) and develop direct intervention goals that correspond to improving the deficit skills.
- Describe therapeutic tasks that address the appropriate, deficit-specific treatment goals.
- Describe home program suggestions (using games and apps) that facilitate the skills being addressed in treatment.

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- “The concept of CAPD as a unique diagnostic entity that could be assessed and treated in school-aged children continues to engender controversy”.
- David A. DeBonis American Journal of Audiology Vol.24 124-136 June 2015
- “Cacace and McFarland (2005) described the current status as stalled

- “Cowan, Rosen and Moore (2009 referred to the auditory processing-related research as ‘stagnated’(p.188); and even proponents of CAPD have admitted that the persistent lack of evidence validating the nature of the disorder and the most appropriate test protocol threatens its viability as a diagnostic entity”
- (Bellis,2002; Dawes & Bishop, 2009; DeBonis & Moncrieff, 2008) American Journal of Audiology Vol 24. 124-136 June 2015

Auditory Processing Defined

- Auditory processing is the efficiency and effectiveness by which the central nervous system utilizes auditory information. It encompasses the perceptible processing of auditory information in the central nervous system and the neurobiologic activity that underlies that processing and gives rise to electrophysiologic auditory potentials (ASHA, 2005).

CAPD Defined

- CAPD refers to limitations in the ongoing transmission, analysis, organization, transformational, elaboration, storage, retrieval, and use of information contained in audible signals.
- Kathy Fahey (Nov. 2004 speechpathology.com)

CAPD proposed by the Task Force on Central Auditory Processing Consensus Development (ASHA, 1996)

- Central Auditory Processes are the auditory system mechanisms and processes responsible for the following behavioral phenomena:
 - Sound localization and lateralization
 - Auditory discrimination
 - Auditory pattern recognition
 - Temporal aspects of audition, including temporal resolution, temporal masking, temporal integration, temporal ordering
 - Auditory performance decrements with competing acoustic signals
 - Auditory performance decrements with degraded acoustic signals

- “Although ASHA agrees that individuals who have CAPD exhibit deficits in processing that are more substantial in the auditory modality, it also admits that sensory processing involves modalities as well as support from cognitive and language systems, making complete modality specificity unlikely”.
- De Bonis, 2015...give reference

- “Medwetsky (2011) agreed that pure auditory processing is unlikely, stating that ‘the processing of spoken language entails the intertwining of auditory, cognitive and language mechanisms that are often engaged simultaneously”(p.291).

Language Processing Defined

- Language processing refers to the ability to attach meaning to auditory information and the utilization of mental operations by which we perceive, recognize, understand and remember sounds, words and sentences.
- (Chris Dollaghan, Ph.D CCC-S on www.apraxia-kids.org)

Language processing exists in tandem with auditory processing but is also independent from it

- The ASHA Task Force (1996) definition not only specifies the auditory aspects of processing, but it also makes a distinction regarding processing that is not dependent on acoustic signals. This distinction leads to a broader discussion of language processing. Consider the other modes we use to receive, perceive, analyze, store, retrieve, formulate and produce language. For example, we can use sign language to transmit and to comprehend messages. Individuals, who are deaf or hard of hearing, process language without the benefit of an intact auditory system. We "read" paralinguistic cues (facial expressions, body posture, gestures) as we communicate with others and know that such cues sometimes support, but other times do not support the verbal message that we hear. Written language is another way that we process language without direct auditory input. Reading and writing development is certainly facilitated by knowledge of verbal speech and language, but development is possible without verbal input. These examples show that language processing exists in tandem with auditory processing, but also independent from it.
- Kathy Fahey (Nov. 2004 speechpathology.com)

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Bottom-up vs top-down information processing

- In the 1980s, researchers and theorists debated bottom-up information processing and top-down information processing explanations for language learning. The bottom-up theories emphasize accurate reception and perceptual processing of sensory information prior to its higher level analysis and construction of meaning.
- Top-down models of language processing emphasize the influence of higher order thinking (whole-to-part) over perceptual analysis. Schemes are learned through experiences and are used to make predictions about sensory information.
- Interactive theories of information processing combine the views of bottom-up and top-down processing theories that occur through parallel processing and add the active participation of the learner and the clarity of the linguistic and nonlinguistic information as important characteristics (Nelson, 1998).
- Kathy Fahey (Nov. 2004 speechpathology.com)

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- “One of the main questions among professionals working with children with APD is whether the listening difficulties Are due to a specific auditory sensory processing deficit (bottom-up problem) or to a cognitive deficit (top-down problem).”
- (DeWit et al., 2016)

Modality specific or Multi-modal deficit???

In other words, is (C) APD modality specific, or is it a multi-modal deficit???

(e.g. Cacace & McFarland, 2014; Dillon, Cameron, Tomlin & Glyde, 2014; McFarland & Cacace, 2014; Moore, 2012, 2015; Moore & Fergusen, 2014; Moore & Hunter, 2013)

- Given that much recent literature is suggesting CAPD is multi modal, both ASHA and AAA stated that recommendations should include bottom-up (i.e., auditory training) and top-down (e.g., language intervention, strategy instruction) activities to address the fundamental auditory deficits and related communication difficulties”(DeBonis,2015)

Incidence vs. Prevalence of Auditory Processing Disorders

Prevalence of APD

Witton (2010) estimated that more than 10% of children may have APD.

As with all estimates of prevalence, this figure is influenced by the diagnostic criteria that are used to determine APD, and it may be an exaggerated estimate due to comorbidity with other disorders displaying similar symptoms (McFarland & Cacace, 2003; Sharma et al., 2009).

Prevalence

Sharma et al. (2009) suggested that the occurrence of APD, in the absence of other developmental disorders, is much lower than the 10% estimate.

They assessed 68 school-age children to determine the comorbidity of APD with language impairment and reading disability and found that only 4% of the children had APD exclusively.

Prevalence of Auditory Processing Disorder

- The prevalence of APD in the general population has not been firmly established. Chermak and Musiek (1997) estimated that APD occurs in 2 to 3 % of children, with a 2-to-1 ratio between boys and girls, while Cooper and Gates (1991) estimated the prevalence of adult APD to be 10 to 20 %. Neurological disorders, diseases, and insults, including neurodegenerative diseases, probably account for most acquired APD in adults; however, such disorders probably account for 5 % or fewer of diagnosed cases of APD in children, especially as APD relates to learning disability (Musiek et al, 1985, 1992).

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Co-morbidity

“Dawes and Bishop (2009) compared children with CAPD diagnosis to children diagnosed with dyslexia and found similarly elevated instances of attention, reading and language deficits in both groups”

Co-morbidity

“Further, Kelly et al. (2009) found that 76% of a sample of 68 children with suspected auditory processing disorder also had language impairment. Therefore, more than half (53%) demonstrated reduced sustained auditory attention and 59% demonstrated increased auditory memory”.

Co-morbidity

“Ferguson et al. (2011) concluded that “the current labels of CAPD and SLI (specific language impairment) may, for all practical purposes, be indistinguishable”(p.225).

Co-morbidity

- “Wallach (2011) concluded that children diagnosed with CAPD likely have disorders of a broader nature that would best be assessed by a multidisciplinary team”.

Research Implications for Evidence Based Practice Intervention

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Fey, Richard, Geffner, Kamhi, Medwetsky, Paul, Ross-Swain, Wallach, Frymark & Schooling Systematic Review (in LSHSS July, 2011)

Fey et al. (2011), completed a review of all peer-reviewed articles published between 1978 and 2008, which yielded 25 studies for analysis that used auditory or language interventions with school-aged children. Some support exists for the claim that auditory and language interventions can improve auditory functioning in children with APD and those with primary spoken language disorder. There is little indication, however, that observed improvements are due to the auditory features of these programs.

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Response (to Fey's previously cited work) in LSHSS Vol 43 July 2012 by Bellis, Chermak, Weihsing, & Musiek

- Points were argued that the research questions posed by Fey's literature review were not felt to address the efficacy of TRUE auditory interventions in remediation of auditory difficulties in children with (C)APD.
- Counterpoint by Fey (same LSHSS issue) suggested that "if auditory training leads only to auditory improvements, there is little reason for SLPs to be interested in the outcomes of auditory training research." (p. 390) "it is unlikely that an IEP goal of changing the latency or amplitude of a brainstem or cortical EEG waveform would be acceptable to the school, the SLP or the family"
- Fey, Kamhi & G. Richards' rebuttal maintained their viewpoint that although "some interventions that are principally auditory MAY provide limited benefit in auditory function & phonemic awareness....but no evidence supports they improve language or academic outcomes for children diagnosed with (C)APD."

Strong, Torgerson, Torgerson and Hulme (2011)

A systematic meta-analytic review by Strong, Torgerson, Torgerson, and Hulme (2011) led researchers to conclude that evidence does not exist to suggest that Fast ForWord is effective for remediating reading or language deficits.

Loo, Bamiou, Campbell and Luxon (2010)

Loo, Bamiou, Campbell and Luxon (2010) in a systematic review of studies that used computer-based auditory interventions in children with language, learning and reading difficulties, (that have also recently been recommended for children with a specific diagnosis of auditory processing disorder, despite limited research evidence to support this) concluded that positive effects on language and reading are not noted. This still is an area of contention, however, in the literature aimed at children who exhibit phonological awareness deficits.

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Research re: electrophysiological changes in children with CAPD

W.J Wilson, Arnott, and Henning (2013) described the evidence that auditory training results in quantifiable electrophysiological changes in children with CAPD is limited

Miller (2011) suggested that the inconsistent correlations between the electrophysiological data and behavior changes after intervention make definitive conclusions about causality difficult.

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Ahmed al 2014

- Ahmed and colleagues (2014) identified factors that may underlie the deficits in children with listening difficulties, despite normal pure-tone audiograms and labeled them suspected APD (susAPD) and aimed to clarify the role of attention, cognition, memory, sensorimotor processing speed, speech and non-speech auditory processing in susAPD.

Ahmed continued

- They performed a factor analysis of outcomes from 110 children (68 males, 42 females; aged 6 to 11 years) with susAPD on a widely used clinical test battery (SCAN_C) and a research test battery (IMAP) that have age-based normative data.
- Three factors that were extracted:
 - 1. general auditory processing
 - 2. working memory and executive attention
 - 3. processing speed and alerting attention

Impairments solely related to the “general” auditory processing factor were not common

**EBP for Language outcomes in response to
language/auditory therapy treatment
techniques in children with (C)APD**

**(Ollier, Pozniak, Prokop, Williams, Coen-Cummings and Timmler, poster
presentation at 2016 ASHA)**

I led a group of Miami University graduate students in an EBP research study using four key word formulas, (terms related to auditory processing, intervention, and language outcomes.)

PICO Question:

“Among individuals diagnosed with (central) auditory processing disorder (C)APD, what language/ auditory therapy treatment techniques are effective in improving language outcomes?”

Method

A systematic review was completed from PubMed, CINAHL, Cochrane, PsycINFO, ERIC, Google Scholar, and ASHA Wire and 2380 peer-reviewed articles (1978-2008) written in English were reviewed, 330 articles were analyzed and 7 were utilized.

Inclusionary criteria included children ages 6- 12 years old with a diagnosis of (C)APD and/or spoken language disorder . Exclusionary critiera included studies with participants who had co-occurring conditions such as Attention Deficit or Hyperactivity Disorder or Autism Spectrum Disorder.

Results (Ollier et al., 2016)

- **Earobics:** Both reviews included limited evidence for the efficacy of improving language with no clear functional benefits for overall language outcomes found. The exception to this was phonological skills, which were the only consistent language skill that resulted in gains after the intervention
- **Fast ForWord:** Of the twenty-three studies reviewed, sixteen studies reported statistically positive gains in language outcomes. More positive effects were observed in receptive language measures, than in expressive language measures.
- **FM Systems:** Significant gains were exhibited in language outcomes in both studies, however, different aspects of language were measured between the two. Therefore, general conclusions cannot be drawn as both studies must be analyzed separately. The results suggest that, a case can be made for using FM systems as a compensatory intervention for some children with a diagnosis of (C)APD.

Results

Non Speech & Simple Speech: Loo et al., 2010: Did not report overall significant group results, but did have individual participants make significant gains in language skills McArthur 2009: Intervention was not found to change reading, spoken language or attention skills in children with (C)APD. Sharma et al., 2012: Improvements were seen in the areas of frequency pattern testing, understanding concepts and directions, sentence recall, and general receptive and core language skills, as measured by the Clinical Evaluation of Language Fundamentals-four (CELF-4) (Semel, Wiig, & Secord, 2003)

Tomatis: McArthur (2009) came to the conclusion that the results of this individual study were inconclusive since the authors did not determine if participants in the study had poor vocabulary skills prior to intervention and therefore sufficient evidence is not present to come to a conclusion about the efficacy of the Tomatis Method's impact on language skills.

Results

Speech in Noise & Dichotic Listening: Treatments were found to be effective for individuals with (C)APD, however, findings should be taken with great caution due to inconsistency of results. In addition, more information is needed about whether the gains observed resulted in functional outcomes that could be seen by patients and families.

Language Training: From the information gathered in these two studies, there is insufficient evidence about the clinical and functional effectiveness of language training for individuals with (C)APD.

Conclusion

- At this time, there is insufficient evidence and a lack of consensus to make specific recommendations regarding the most effective treatment of (C)APD.

Limitations:

- Small sample sizes
- Lower quality research designs (e.g., case study)
- Short treatment periods
- Limited or no control for various nuisance variables such as consistent treatment environments
- Varying definitions of (C)APD
- Varying assessment protocols

EBP interventions for (C)APD... do they exist?

In a review by Kamhi (2011) of the evidence for auditory processing disorder, states there is little evidence that auditory perceptual impairments are a significant risk factor for language and academic performance and there may be limited evidence that auditory interventions provide any unique benefit to auditory, language or academic outcomes.

They conclude that SLPs should treat children who have been diagnosed with APD the same way they treat children who have been diagnosed with language and learning disabilities.

So where does this lead the treating SLP?

- Kamhi (2011) encourages clinicians to consider viewing auditory deficits as a processing deficit that may occur with common development language and reading disabilities rather than as a distinct clinical entity.

W. J. Wilson and Arnott (2013) go as far to suggest that, given that their review of 150 sample records of school children who completed at least 4 CAPD tests showed the rates of audiologist's diagnoses to vary from 7.3% - 96%, depending on the criteria used, it is recommended that "the use of CAPD as a global label be discontinued."

- While Wallach (2011) makes a strong case for the critical role of language in speech perception, and suggest that (C)APD assessment results are not confined to auditory skills areas and reflect broader underlying problems in language comprehension and metalinguistic awareness.

Focus on Identifying Students who have general listening deficits

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Prior to managing, an SLP must be able to counsel

Know how to respond to family's questions about alternative treatments, and refer them to relevant websites with accurate information

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There are 4 therapies that parents may ask you about, as the treating clinician, and these are not supported by ASHA at this time as being evidenced- based:

- Therapeutic Listening
- Tomatis
- AIT (Auditory Integration Therapy)
- Brain Gym

Websites with typically reliable content to share with parents

Auditory Processing Disorders:

- ASHA www.asha.org/public
- National Coalition on Auditory Processing Disorders, Inc. www.ncapd.org

Attention Deficit:

- CH.A.D.D. www.chadd.org
- National ADD Assoc: www.add.org

Reading/Dyslexia:

- Reading Rockets: www.readingrockets.org
- International Dyslexia Assoc.: www.interdys.org
- Roads to Learning: www.ala.org

Learning Disabilities: <http://ldaamerica.org/>

Laws/IDEA, etc. <http://www.parentcenterhub.org/repository/idea/>

Auditory & Language Processing Disorders Management

- Management is determined by which of the auditory (and/or language processing) deficits that the child is exhibiting (Musiek, Bellis, Chermak, American Journal of Audiology, Dec. 2005)
- It is possible to have a primary and secondary deficit area
- Management should focus on 3 aspects:
 - Changing the learning or communication environment
 - Remediating the auditory deficit itself,
 - Improving the child's learning and listening skills by recruiting higher-order skills to help compensate for the disorder (Bellis, ASHA web page retrieved 9/20/08)

Management Goals cont.

- Learning accommodations such as acoustic room treatment to reduce echoes and background noise, repeating or rephrasing instructions, slowing down the rate of speech, providing visual cues, and/or using assistive listening equipment to amplify and enhance the teacher's voice through a wireless microphone/headset or speakers in the classroom.

Management Goals

- Lastly, a speech/language pathologist or an audiologist may help the child develop self-help techniques to improve overall communication.

Management Goals cont.

- Learning accommodations such as acoustic room treatment to reduce echoes and background noise, repeating or rephrasing instructions, slowing down the rate of speech, providing visual cues, and/or using assistive listening equipment to amplify and enhance the teacher's voice through a wireless microphone/headset or speakers in the classroom.

Management Goals

- Lastly, a speech/language pathologist or an audiologist may help the child develop self-help techniques to improve overall communication.

Management for the child “At Risk” of an APD

Musiek & Chermak (1995) suggested that children suspected of an APD (less than 8 years old), should be involved in a preschool program that focuses on auditory skills development and phonological awareness skills:

- Reading aloud for selective listening of specific words: "Clap each time you hear the word "Spot"
- Games such as Duck, Duck Goose and Musical Chairs can also facilitate selective listening
- Interhemispheric exercises using the child's left hand to reach into a Grab Bag & guess the item
- Games of Simon Says help improve attending and following directions
- Games of Guess the Emotion based upon listening to someone's voice can help develop prosody recognition

SUBPROFILES of CAPD (Bellis, 1996; Katz et.al, 1997)

You may still hear reference to sub-profile approaches, so these are included for you knowledge:

- AUDITORY DECODING/ DECODING
- ASSOCIATIVE DEFICIT/TOLERANCE-FADING MEMORY
- INTEGRATION/INTEGRATION
- PROSODIC
- OUTPUT-ORGANIZATION DEFICIT/ ORGANIZATION

APD research of the 1990's suggested treatment protocols based upon "sub-profile" categorization

- The sub-profiles were derived from research data that applied factor analysis to audiological (and various multi-disciplinary) test findings, resulting in APD "patterns"
- While these findings are still relevant because they provide "clues" for associated disciplinary evaluation (speech-language pathology, psychology, OT/PT, etc.), **the research now suggests that treatment focus should be deficit-specific and structured by a top-down (Ferre, 2002), or bottom-up framework (Bellis, 2003; Chermak, 2007; Ferre, 2006)**

Evidenced-based Practice

(from: Differential Processing Training Program, by Kerry Winget)

| Skills | Ages |
|--|--|
| <ul style="list-style-type: none">■ Auditory Processing■ Listening | <ul style="list-style-type: none">■ 6 through 12 |
| | Grades |
| | <ul style="list-style-type: none">■ 1 through 7 |
| Evidence-Based Practice | |
| <p>According to the American Speech-Language-Hearing Association Technical Report on Central Auditory Processing Disorders (www.asha.org/members, 2005), the Clinical Guidelines of the Royal College of Speech & Language Therapists (www.rcslt.org/resources, 2005), and research conducted by Chermak and Musiek (2002), the following therapy principles are supported:</p> <ul style="list-style-type: none">■ The ability to process sounds, to discriminate them accurately, and to interpret them correctly are critical skills for speech and language development.■ Intervention for auditory processing disorders using direct skills remediation and auditory training should incorporate a bottom-up (acoustic signal and auditory training) approach.■ Auditory training activities should include acoustically controlled tasks of sound intensity, frequency and duration discrimination, as well as sound pattern recognition and sound localization.■ Recognition of auditory information in background noise simulates functional listening requirements in the classroom, community, and home environments. <p>The exercises in this book incorporate the above principles and are also based on expert professional practice.</p> | |

Treatment Plan's intentions

Your treatment plan/therapy goals should remain focused on improving the child's deficits (whether auditory, phonological awareness, or language-based) and be driven by evidenced-based practices.

Language Processing Therapeutic Goals **handout**

Order of presentation

- Although a bottom up approach would indicate we'd begin with LTG 4 (to address BASIC auditory skills), many children diagnosed with APD do not have this issue, and instead have listening deficits when in the presence of background noise.
- Thus, we will follow the handout out, in order, by common symptomology

Therapeutic Goal Examples Handout

Problem Statement:

Deficit in auditory figure-ground skills.

This issue will impair the child's ACTIVE listening when in an environment containing background noise.

Mgt strategy for a deficit in auditory figure ground (extracting a primary message from background noise)

Classroom

- Change the physical environment
 - place rubber tips or tennis ball halves on chair legs and desks
 - Place sound absorbing rubber or felt insulation around windows and doors
 - Use bookshelves as room dividers
 - Use corkboard as bulletin boards
 - Ceiling tiles, carpeted floors, cushioned chairs, curtains

Modifying the acoustics in the physical space of the classroom is the start...but now THERAPY begins!

The SLP's treatment is critical to the child's classroom success because:

"Listening/Attending" skills must be taught if preferential seating is to have an effect (for specific treatment ideas reference Chapter 2 "attending skills" in A Metacognitive Program for Treating APD, Hamaguchi, P. M. (2003)

Auditory Figure Ground Deficit (cont)

Improve acoustic access to auditory information

- Flexible preferential seating
- Personal FM systems (for elementary aged students) directed at stronger ear (refer to child's audiology report)
- Soundfield amplified classroom
- Repeat information only if you can say it more clearly, otherwise, rephrase using additional language cues
- Provide visual cues to augment auditory information

Environmental Modifications Signal to Noise Ratios

(from Geffner, ASHA Schools Conference, 2005)

- Adults need at least a +6 dB signal-to-noise ratio for maximum communication
- Children with normal hearing acuity require a +10 dB signal-to-noise ratio (Crandell & Smaldino, 2004)
- Children with “high risk” listening conditions require +12 to 20 dB s/n ratio

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Problem statement 1: Auditory Figure Ground

- Compensatory Strategies
 - Active vs passive listener
 - Recognition of adverse listening conditions and how to address them
 - Methods of clarification of auditory instructions
 - Using visual cues to augment auditory information
 - Self-advocacy
 - Use of an FM system in the classroom

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Treatment Programs to Improve Auditory Figure Ground Skills

The Assistive Listening Device is a beginning,
but auditory training is also necessary, first under
quiet conditions then in background noise

Home Program for Auditory Training**

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LTG 1: to improve active listening (audiological data will show deficits in auditory figure ground)

STG a: Extracting a primary message when
background WHITE NOISE is present

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LTG 1: to improve active listening

STG b: Extracting a primary message when
background non-lyrical music is present

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LTG 1: to improve active listening

STG c: Extracting a primary message when
background UNKNOWN lyrical music is present

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LTG 1: to improve active listening

STG c, step 2: Extracting a primary message
when background WELL KNOWN lyrical
music is present

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LTG 1: to improve active listening

STG d: Extracting a primary message when
background verbal message of disinterest is present

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LTG 1: to improve active listening

STG d, step 2: Extracting a primary message
when background verbal message of
INTEREST is present

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Additional Handouts

- Apps to use for increasing Active Listening Skills
- Home Program Games to

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