How Young Can You Test (C)APD? The Auditory Skills Assessment (ASA)

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Pearson Webinar Series

Current Research

How young can I test for linguistic and non-linguistic auditory skills?

Allen & Nelles, 1996
- Found that the ability of normal hearing children ages 4–7 years on an auditory discrimination task improved with increasing age until age 7 at which time performance was adult-like
- The 7-year-olds and the adults were able to discriminate the sequence of tonal pairs with component frequencies
- As the sequences were increased, the 4- to 6-year-olds as a group were not able to perform the task

Jensen & Neff, 1993
- Children’s ability (ages 4–6 years) to discriminate between stimuli that vary along single acoustic dimensions is much poorer than that of adults
- Intensity discrimination was adult-like by age 5
- Frequency and duration improved with age, but remained poorer than adults’ discrimination for many 6-year-olds
- This may be reflected in general music skill development, as in the commonly observed difficulties of young children to stay “on tune” or in rhythm
Boets, Wouters, van Wieringen, & Ghesquiére, 2007
Katholieke University • Leuven, Belgium

- Found that the children who presented significant pre-school deficits in phonological awareness, rapid automatic naming, speech-in-noise perception and frequency modulation detection were those who had increased family risk and literacy impairment at the end of first grade.

Torgesen & Mathes, 1998

- Found that children can detect and compose rhymes by kindergarten.
- By the end of kindergarten, they can isolate and pronounce the beginning sounds in a word.
- Midway through 1st grade, they can isolate and pronounce all the sounds in two- and three-phoneme words.

Torgesen & Mathes, 1998

- By the end of 1st grade, children can isolate and pronounce the sounds in four-phoneme words containing initial blends.
- Although some children may acquire some rudimentary phonological awareness skills as early as 2½ to 3 years of age, more advanced skills are not mastered until the end of 1st grade.

Kraus, Koch, McGee, Nicol, & Cunningham, 1999

- Auditory discrimination skills are developed by age 6.
- They used just noticeable differences (JND) and mismatch responses for synthetic syllables that differed in formants. This does not require a behavioral response or attention.
- Many aspects of auditory perception of non-speech and speech stimuli are largely mature by school age but perception continues to develop during school-age years, which can be modified by auditory experience.

Burt, Holm, & Dodd, 1999
United Kingdom

- Children as young as 3 years of age can be aware of onsets and rimes, and a strong relationship has been established between the knowledge of nursery rhymes and the development of intrasyllabic awareness skills (Maclean et al., 1987).
- Phoneme isolation and segmentation have the best predictive validity for later reading skills (Liberman & Shankweiler, 1985; Yopp, 1988).

Auditory Skills in Special Populations

- Children with reading impairments show subtle speech perception deficits in quiet but very significant deficits in background noise (Ziegler, Pech-Georgel, George, Alario, & Lorenzi, 2005).
The Auditory Skills Assessment (ASA)

What are the components, the content areas, and the research behind this development effort?

Product Domains/Sections

<table>
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<tr>
<th>ASK DOMAINS AND SECTIONS</th>
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<tbody>
<tr>
<td>Speech Discrimination (27 items)</td>
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<tr>
<td>- For each item, one or two stimulus words are played from a stimulus CD</td>
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<tr>
<td>- Child must point to the one picture from a set of four that illustrates the word</td>
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<tr>
<td>Phonological Awareness (18 items)</td>
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<td>- For each item, a nonsense word that follows conventional English sound patterns is played from a stimulus CD</td>
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<td>- Part 1: Child points to the one picture from a set of six that illustrates the word</td>
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<td>- Part 2: Child is asked to say the blended word (no visual clues)</td>
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<tr>
<td>Non-Phonological Processing (14 items)</td>
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<td>- For each item, a word is played from a stimulus CD</td>
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<td>- Child is asked to say if the two words rhyme (yes/no)</td>
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Auditory Skills to be considered for Assessment

- Auditory Skills
  - Speech Discrimination in Quiet
  - Speech Discrimination in Noise
  - Memory
  - Phonological Awareness
  - Sound Blending
  - Rhyming
  - Non-Phonological Processing
  - Tonal Discrimination
  - Tonal Patterning

Auditory Skills Tested in Development Research

1. Speech Discrimination in Quiet (27 items)
   - For each item, one stimulus word is played from a stimulus CD
   - Child must point to the one picture from a set of four that illustrates the word

2. Speech Discrimination in Noise (27 items)
   - For each item, one stimulus word is played against a background of conversation-like noise from a stimulus CD
   - Child must point to the one picture from a set of four that illustrates the word

3. Mimicry (24 items)
   - For each item, a nonsense word that follows conventional English sound patterns is played from a stimulus CD
   - Stimulus words are 1–4 syllables long
   - Child is asked to repeat the word

4. Blending (24 items)
   - For each item, some phonemes of a common vocabulary word, separated by brief pauses, are played from a stimulus CD
   - Part 1: Child points to the one picture from a set of six that illustrates the word
   - Part 2: Child is asked to say the blended word (no visual clues)

5. Segmentation (18 items)
   - Concept of “first” and “last” sound taught through examples and practice items
   - For each item, a one-syllable nonsense word is played from a stimulus CD
   - Items 1–9: Child is asked to say the first sound in the nonsense word
   - Items 10–18: Child is asked to say the last sound in the nonsense word

6. Rhyming (15 items)
   - Concept of rhyming taught through examples and practice items
   - For each item, a pair of words is played from a stimulus CD
   - Child is asked if the two words rhyme (yes/no)
7. **Memory** (12 items)
   - For each item, a set of 2-4 unrelated, common vocabulary words are played from a stimulus CD.
   - Child is asked to repeat the words in the same order.
   - Responses were scored according to the number of correct words repeated (content score), plus a bonus point if words were given in the correct sequence (sequence score).

8. **Tonal Discrimination** (12 items)
   - For each item, a pair of musical tones are played from a stimulus CD: either one oboe and one piano, or two tones from the same instrument.
   - Child is asked if the two sounds are the same (yes/no).

9. **Tonal Patterning** (12 items)
   - Concept of "which played last" taught through examples and practice items.
   - For each item, two successive tones—one from each instrument (oboe/piano)—are played from a stimulus CD.
   - A card with a picture of an oboe and a piano is presented.
   - Child points to the picture of the instrument that was played last.

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**Research Questions**

1. **At what age can children understand and successfully perform the task** posed in each auditory skill subtest?
2. **At what age can reliable data be obtained** for each subtest?
3. **Do the subtests discriminate sufficiently between clinical and nonclinical cases?**
4. **Is there value to testing speech vs. non-speech discrimination?**

**Limitations of Testing Young Children**

- Memory and attention
- Many do not have intelligible speech
- Age-appropriate instructions and response requirements
- Concept limitations
- Difficult to test and obtain consistent responses
- Poor reliability

**General Administration Procedures Employed to Minimize Response and Concept Limitations**

- Select words likely to be recognized by young children.
- When picture pointing response is required, picture-word association training is provided.
- When mimicry response is required, provide items that are easily articulated.
**Administration Procedures**

- Studies 1 and 2 began with 49 training items.
- All subtests except Speech Discrimination in Quiet began with several practice items to ensure that children knew how to do the tasks.
- Teaching provided after failed practice items.
- Every effort was made to introduce and explain tasks in a way that young children would understand (child-friendly, scripted examiner text).

**Method**

**Study 1 (May–June 2007)**
- \( N = 547 \)
- Ages 3:6–6:11
- Nonclinical cases of children with no prior diagnosis of hearing loss and no current ear infections
- Subtests: Speech Discrimination in Quiet, Speech Discrimination in Noise, Mimicry, Rhyming, Blending, Segmenting, Memory

**Study 2 (July–August 2007)**
- \( N = 209 \)
- Ages 3:6–6:11
- Nonclinical cases of children with no prior diagnosis of hearing loss and no current ear infections
- Subtests: Nonspeech Processing—Tonal Discrimination and Tonal Patterning

**Research Questions**

1. **At what age can children understand and successfully perform various types of tasks that reflect different auditory skills?**
2. **Can reliable data be obtained for children of a certain age performing particular auditory skills tasks?**

**Analysis**

The following results would suggest that a particular subtest is an age-appropriate assessment tool:

- Fewer than 20% of children with normal hearing acuity score at or near the “guessing” or “chance” level
  - Indicates task is comprehensible for children at this age
- Internal-consistency reliability statistics obtained for the subtest for a particular age group are acceptably high
  - Indicates subtest is measuring a specific construct
Results

Analysis of the data from Studies 1–3 found that reliable data could be obtained for children as young as 3 years 6 months for the following subtests:

- Speech Discrimination in Quiet
- Speech Discrimination in Noise
- Mimicry
- Memory

Reliable data could be obtained for children as young as 5 years for:

- Mimicry
- Blending
- Rhyming
- Non-speech Processing—Tonal Discrimination & Tonal Patterning

Reliable data could be obtained for children as young as 5 years 6 months for:

- Segmentation

Research Questions

3. Do the subtests discriminate sufficiently between clinical and nonclinical cases?

4. Is there value in testing speech vs. non-speech discrimination?

Non-speech Processing

Among the various tasks presented to young children (ages 3.6-6.11) discriminating between two musical instruments and their patterns was the most discerning between a typical population and those at risk for CAPD.
ASA Standardization

- December 2008 through May 2009
- 600 + children at 123 sites
- Final norms based on nationwide sample of 475 children, ages 3 years 6 months through 6 years 11 months
  - Stratified by sex, race/ethnicity, SES (mother’s education level), and geographic region.

ASA Standardization

- Norm sample
  - Normal hearing acuity
  - English as primary (most frequently spoken) language
  - Normal vision
  - Free of upper respiratory problems or ear infections at the time of testing

ASA Standardization

- Norm sample exclusionary criteria
  - Prior diagnosis of hearing loss
  - History of chronic or recurring ear infections
  - Had PE tubes
  - Receiving Sp.Ed services or a clinical diagnosis that would impact their language or cognitive functioning
  - At risk for auditory skill deficits, including auditory processing disorders

ASA Standardization

- Clinical sample
  - Judged by an audiologist or SLP to have difficulty with auditory skills
  - Normal hearing acuity
  - English as a primary (most frequently spoken) language
  - Normal vision
  - Free of upper respiratory problems or ear infections at the time of testing
  - Use of a criterion referenced questionnaire

ASA Standardization

- Clinical sample exclusionary criteria
  - Prior diagnosis of hearing loss
  - History of chronic or recurring ear infections
  - Had PE tubes
  - Receiving Sp.Ed services or a clinical diagnosis of intellectual disability or autism spectrum disorder

ASA Cut Scores

- An overall cut score was determined for each 6-month age group, indicating a cutoff at the total score level between normal and at risk cases based on the norm sample, the clinical sample, and a matched control sample.
ASA Clinical Validity

- Compared to the matched control sample, the clinical sample's average scores are significantly lower (p<.01) on all ASA domains and the overall total scores for both age ranges reported (3:6-4:11 and 5:0 – 6:11).

ASA Cut Scores

- The sensitivity and specificity of the cut scores are .77 and .68, respectively.
- In setting the cut scores, preference was given to attaining high sensitivity because of the importance of flagging children who truly have poor auditory skills.

Administration Time

- 5 min for 3-6 years old
- 15 min for 5-6 years old

What makes ASA different?

- Large, full-color illustrations tested to appeal to young children
- No headphones or specialized equipment
- Quick administration

Applications

- Early identification and intervention
  - Possible candidate for in-depth evaluation and/or intervention
- Universal screening
  - Possible companion to hearing screening
- Progress Monitoring
  - Check progress of intervention