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Elaine Paden's phonological assessment of the hearing impaired

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Linguists define phonology as the study of speech sounds and their sequences. The actual articulation of an individual phoneme is just a subset under this broad term. Phonology focuses on the word level as the basic level of intervention because it is the smallest unit of meaning. Phonological treatment theory focuses on targeting a process and uses an "easy" example from that process to attain accuracy with it. After this one example is acquired, the other members of the process are probed for generalization. Phonological therapy typically takes less time overall for treatment because generalizations occur within processes. Many teachers and clinicians have been dissatisfied with the traditional articulation method for treatment and have looked to linguists to find their answers.

Elaine Paden has devised a phonological test--Identifying Early Phonological Needs for unintelligible hearing impaired children. This test attempts to look at the hearing impaired speech production from a phonological view point. This is the first published test of this kind and has yet to be proven as a useful clinical evaluation tool. I gave this test to young unintelligible hearing impaired children at Central Institute for the Deaf to assess the test and the usefulness of the test to plan speech therapy.

Basic Procedures

This test was given to seventeen severe-profound hearing impaired students in the Pre-Primary Department at Central Institute for the Deaf. The test was given to children with somewhat unintelligible speech and beginning language skills. Children in the department with very low vocabulary and children with high language and good speech were not tested because their skills were beyond the range of the test.

The children were brought into a testing room where a clinician showed them twenty-five stimulus cards. They were directed to name the picture and then imitate the clinician's spoken model. Some of the children had difficulty naming some of the pictures and clues or models needed to be given for the child to approximate the target word. This procedure was videotaped and watched at a later time for transcription and scoring purposes.

Transcription and Scoring

The video tape had to be viewed from 3-6 times to gain an accurate transcription of the children's utterances into the International Phonetic Alphabet (IPA). This was done using fine transcription, noting errors with diacritics. This fine transcription is very important for the scoring process because it indicates the true nature of the child's production.

Once the twenty-five items were recorded in IPA for both the spontaneous and imitated portions, the spontaneous portion was scored on the score sheet. If a child was unable to produce the word spontaneously, the imitated response would then be scored. The scoring is divided into five broad categories and then further subdivided. The five broad categories are: Word Patterns, Vowel Areas, Manner, Place and Voicing. The following is a description of the general scoring process.

The scoring on this test is not a bipolar decision. The analysis is designed to give the child some benefit (a higher percentage score) to indicate the approximation of the target rather than an all or nothing scale. An example would be the production of a targeted /i/. If the child correctly produces the /i/ the child receives a score of 3. If the /i/ is distorted in any way, the child receives a 2. If the child produces an /I/ a vowel located in the approximate place of production, the child receives a 1. If the child produces a vowel outside the vowel area, the child would then receive a 0. If no vowel were produced, the child would then receive a slash (-) indicating the absence of the targeted sound.

The scores are then multiplied by the number of occurrences and are totaled for each process. This total is then divided by the total number of points possible to yield a percentage score. This percentage score is not based on direct percentage correct, but on this weighted scale of correctness.

Word Patterns

This class is designed to assess suprasegmentals and word shape. The subdivisions are: syllables, stress, initial consonant, final consonant and intonation. The syllable section assess if the correct number of syllables were produced. The stress section targeted five words and stress was assessed to see if the child was monotone and/or used inappropriate stress. The initial and final consonant sections

assessed if any consonant was produced in that position. The intonation sub-set was omitted from this testing because it was deemed too difficult for these level children to ask a question using appropriate stress.

Vowel Areas

The basic vowel areas are addressed in this section. The areas are divided into: high front, mid-low front, low back and high back. Dipthongs are also addressed. The child is assessed on appropriate vowel production and area of production. The score sheet dictates which vowels are considered to be in the appropriate area. The rating scale gives the most points for correct production, while also giving points for approximate area of production, even though the correct vowel was not produced (e.g. the production of an i/I). It is assumed that a vowel approximation in the area of correct production is better than omitting or substituting of a greatly different vowel.

Manner

This class targets the basic manner characteristics: stops, nasals, fricatives and liquids. The correct production is weighted with the most points, but production of a consonant within the appropriate manner is also given points on this weighted scale (e.g. the substitution of a b/k is within the same plosive manner).

Place

This class targets the broad place of positioning: labial, alveolar, and velar. The correct production is weighted with the most points while the production in the approximate area is given a lesser point value on the weighted scale (e.g. the substitution of a t/n has the same place of production).

Voicing

This class targets the voicing contrast: voiced or voiceless. The correct phoneme with the correct voicing receives the most points while an inappropriate phoneme with the correct voicing receives some weight on this scale (e.g. the substitution of a k/g has the same place and manner, but not voicing).

Analysis of Data

Once the analysis by pattern was completed, all the scores were tallied and given a percentage. This percentage reflects the child's ability to produce the

process correctly on a weighted scale, rather than to show the percentage of correct production of the individual phoneme.

These percentages do not necessarily target processes if the percentage is low. They give the examiner an idea of how well the child has mastered the process. LOW PERCENTAGES DO NOT NECESSARILY MEAN THAT THE PROCESS SHOULD BE TARGETED. The author indicates that these percentages should mainly be used for documenting the individual's progress over time and to assess the generalization of the therapy. There are no age norms. The author does not state that a child needs a certain score for therapy to target a process for therapy--much of it is decided by the teacher/clinician.

Much of the therapy should be based on the child's use of his/her auditory skills to discriminate the patterns. Discrimination of minimal pairs should proceed production of minimal pairs. The author indicates a basic guideline to program therapy (all of these should be targeted in words and/or phrases):

1. Suprasegmentals:

Suprasegmentals should be targeted first because they convey a great deal of meaning. Most hearing impaired children receive auditorally much of this low frequency/durational information. Low scores here indicate the under use of the auditory channel. The basic order they should be targeted is:

-duration
-stress
-and pitch.

2. Initial and final consonants:

The appropriate word shape is very important to convey meaning. The author indicates that the appropriate CVC (consonant-vowel- consonant) shape is extremely important to convey meaning. The phonological theory's view point is that appropriate word shape with inappropriate consonants is more meaningful than just an CV alone. (e.g. /dud/ for duck is better than /du/ for duck)

The word shape should be targeted before all consonant classes have been sufficiently acquired.

3. Vowels:

Vowels are important for deciphering meaning. They are the strength of the word. Most vowels have high intensity. When vowel height or place is targeted in therapy, use acquired consonants to formulate CVC words for practice. This focuses on the vowel as the target rather than difficult consonants or processes.

4. Dipthongs:

These are more difficult than vowels because there are two vowel elements present. The child must be able to produce each vowel separately before therapy is focused on the dipthong.

5. Consonants:

Target in the following order:
-manner (about 100 Hz.)
-place (about 2k Hz.) but some very visible
-and voicing (about 500 Hz.).

GENERAL RULE: Teach the patterns (processes) with the easiest produced exemplar of the process and have the expectation that the therapy will generalize to the other phonemes in the process (e.g. If the child has problems with producing high front vowels, target /i/ from the high front vowels and work on it in therapy until it is attained. The high front vowel /I/ is usually a little harder to produce and its production should be facilitated by the therapy on /i/ because of the generalization of therapy within the process.).

Targeting therapy and cycles

The IEPN therapy plan described in the test booklet is rather vague. It stresses that the child should be able to discriminate between the target and the error pattern in minimal pair contrasts before the child should be expected to produce it in speech. This idea follows the phonologic theory and targets the patterns at the meaningful word level. Elaine Paden and Barbara Hodson co-wrote the book Targeting Intelligible Speech that describes and defines assessment and treatment strategies for phonological disorders. They developed the cycle strategy method. This method targets a specific example from the targeted process and is worked on in therapy for 2-4 hours of therapy time. Regardless if the child has gained accurate facility with the process, the clinician will move on to the next stimulable target process and target an example from that process for 2-4 hours of therapy time. These processes will be re-cycled at a later date and carryover into the other components of the process will be assessed. The processes get re-cycled until the child has good facility with the process components.

The following are phonological assessments based on the IEPN test for four of the Pre-Primary children. The items with an asterisk (*) are to be targeted processes for therapy. Cycles on children B and C were done to give the reader an example of what real phonological targets might be selected. *Cycle one suggestions and examples are in italics.*

Child A (4 yrs.)

Word Patterns

1. She produces the correct number of syllables in the words.

* 2. She is not consistently using intensity/durational changes to mark stress in words.

3. She produces initial consonants consistently.

* 4. Final consonants are almost always deleted.

* 5. She uses consistent high pitch.

Vowels

1. She has fairly good consistency producing the targeted vowel.

* 2. Some of her vowels are distorted and extended (especially the lower back vowels).

3. No errors were made in dipthong production.

Consonants

* 1. Most of her errors are deletions, as can be seen by her large number of slashes (-) in boxes for consonant production.

Manner

* a. She has deletions across all manners, but is especially apparent in the plosive manner (many of the final stops were omitted).

* b. She showed confusion with manner (e.g. substitution of n/l).

Place

a. She consistently produces labial consonants.

* b. Her productions of alveolar and velar consonants are weak. She had many omissions (usually the final consonant stop) and had no velars.

Voicing

a. She made no voicing errors when the target sound was produced (one consonant was partly devoiced).

Child B (3 yrs.)

Word Patterns

1. She produced the correct number of syllables for most of the two syllable words targeted.

* 2. She is not using intensity and/or durational changes to mark stress in words.

Depending on the child's level large intensity and durational cues can be stressed and once she has facility with that, then move on to spondee vs. trochee words emphasizing the stress difference.
e.g. hot dog vs. baby

3. Initial consonants were consistently produced.

* 4. Final consonants were almost always deleted.

Target acquired consonants in simple CVC words.
e.g. ham, man, knife ..

Vowels

* 1. She almost always produced a vowel, but that vowel was outside the appropriate area of production. She frequently neutralized her vowels.

Target vowels that contrast. Try to group one target area with an acquired vowel or vowel area.
e.g. beet vs. boot (high font vs. high back)
hat vs. hook (mid-low front vs. high back)

Consonants

Manner

* a. Omissions (scored -) were not manner specific. Most omissions appeared to be a function of their final position in words.

Previously targeted as final consonant deletion.

* b. Manner errors (scored 0) were seen frequently in a variety of contexts.

Target a manner that she does not have with one she does. Her strongest manner is nasals, so contrast target to nasals.
e.g. hat vs. ham
dash vs. dam

Place

a. She produced labials with good consistency.

* b. Most deletions were noted in the alveolar and velar place of production.

Contrast alveolars and velars with labials.
e.g. mat vs. mam
dog vs. done

Voicing

a. She consistently produced voiced voiced consonants when those consonants were produced.

* b. She did not produce unvoiced consonants with accuracy. Many deletions and five uses of opposite voicing were noted.

Contrast voiced vs. voiceless consonants.
e.g. hat vs. had
half vs. have
pat vs. bat

Child C (4 yrs.)

Word Patterns

1. She is producing the correct number of syllables for most of the words tested.

* 2. She does not produce consistent stress patterns.

Depending on the child's level large intensity and durational cues can be stressed and once she has facility with that, then move on to spondee vs. trochee words emphasizing the stress difference.
e.g. hot dog vs. baby

3. She consistently produces all initial consonants

* 4. She consistently produces all final consonants except final /f/ which was omitted twice.

Target final /f/ vs. acquired final sounds
e.g. safe vs. sat
tuff vs. tub

Vowels

1. She produces high and low back vowels and dipthongs with good consistency.

* 2. Her production of high front vowels and mid-low front vowels are not consistently accurately produced.

Target vowels that contrast. Try to group one target area with an acquired vowel or vowel area.
e.g. hit vs. hoot (high front vs. high back)
bet vs. but (mid-low front vs. high back)

Consonants

Her error patterns are across all patterns at different levels.

Manner

1. All areas of manner are not consistently correctly produced.

* a. Stops- she reduces clusters and fronts t/k.

Target specifically words that contrast with /t/ and /k/.

e.g. took vs. cook

boot vs. book

* b. Nasals- she extends the duration and aspirates (Mb) occasionally.

Target nasals vs. acquired consonant

e.g. ham vs. has

mat vs. bat

* c. Fricatives- she omits final /f/ and substitutes stops occasionally.

Final /f/ was previously targeted.

* d. Liquids- she nasalized an /l/ and glided w/l.

Target /l/ vs. nasals

e.g. lab vs. nab

mill vs. tin

Place

a. Labials were produced with fair consistency.

* b. Alveolar- some were backed k/s.

Target /s/ vs. velars

e.g. sit vs. kit

son vs. sock

bus vs. buck

c. Velar- low percentage, many fronting problems t,s/k.

Voicing

1. Voiced consonants are produced consistently.

* 2. Unvoiced consonants are produced when the target phoneme is produced (the final unvoiced consonant was the consonant most omitted).

Previously targeted in final consonant deletion and manner-ficative.

Child D (5 yrs.)

Word Patterns

* 1. She is producing the correct number of syllables with 80% accuracy.

* 2. She is stressing words appropriately with 80% accuracy.

3. Initial and final consonants are always produced.

Vowels

1. She produces high-front, high and low back vowels with 100% consistency.

* 2. She tends to extend the mid-low front vowels.

3. Dipthongs are produced with 100% accuracy.

Consonants

Manner

a. She produces stops, nasals, and fricatives consistently.

* b. Her weakest manner of production is liquids. She substitutes w/r and extends or omits /1/.

Place

a. She has good consistency producing the appropriate place.

Voicing

1. She consistently accurately produces consonants with the correct voicing.

Weaknesses

The immediate problem found with analyzing phonological processes with hearing impaired individuals is the fact that the hearing impaired child cannot hear the adult process and simplify it. This is the basis underlying the phonological theory and simply does not fit with the hearing impaired person's production. Hearing impaired people who display process simplification may be proponents for stages of production processes rather than simplification of the heard adult form.

The phonological theory emphasizes targeting words as the smallest target of production. The theory does not state what should be done with the highly unintelligible child who can only produce a vowel or a consonant-vowel. It seems highly unlikely that the child would get much benefit from therapy on the word level rather than the isolation or syllable level when his/her productions are at such a low level.

This test is not designed for intelligible children. Children with mild-moderate hearing losses and rather intelligible speech are not good subjects for this test even if their speech contains phonological errors.

Much of the therapy to be targeted must be prescribed by a person who is familiar with the phonological processes and can analyze the substitutions and/or omissions made by the child. The instruction manual would not be sufficient for an examiner unfamiliar with the phonological theory and intervention.

The test samples the vowels five times in five different clusters but does not sample all the vowels or even an accurate enough sample to make generalizations. An example of this is dipthongs-- /ai/ and /au/ were tested twice each (4/5), the other dipthongs were not tested at all.

This test of 25 words took anywhere from 1-3 hours of transcription, scoring and therapy planning. Much of the challenge is transcribing the child's production into IPA using fine transcription. To expect a teacher/examiner with no phonological background to give and score this test would not be practical. The teachers/examiners need to be trained with a basic phonological background and a class on administering this test. This is very time consuming.

Strengths

This test realistically brings the phonological theory to the hearing impaired. Assessing patterns and targeting therapy on these patterns rather than the basic time consuming traditional articulation method may be a breakthrough in speech remediation. However, the practical application for the hearing impaired child has yet to be proven.

The weighted scales of production and percentage points are a definite strength. Not only do we get an idea of how well they produce the individual phoneme, we get a percentage scale to document the therapy progress.
It analyzes the basic processes-the building blocks of the phonological therapy. The processes targeted by the test are the basic tools needed for producing intelligible speech. Many of the more complex processes (e.g. backing) have been deleted from the test, but the trained teacher/clinician can detect these through his/her analysis of the substitutions and omissions made in the transcriptions.

The vocabulary choice is limited but should be in most children's lexicon. It targets a variety of productions for the limited number of productions tested. The known targeted vocabulary item on this test provides an target for production. Other phonologic tests rely on analysis of spontaneous speech, where the targeted item is not always known.

This test targets non-segmental production of important meaning conveying productions that are typically not found on inventories of speech sounds. Voicing, word shape, vowel height and suprasegmentals all fall into this category. This perspective of looking at speech as part of a word is very new and untested for use with the heating impaired. All these processes working together are used to

produce words and to convey information from one person to another. Word shape and suprasegmentals are the two main bonuses of this test. It looks at the conveying of information rather than accurate production of isolated segments.

Conclusion

These test results will be made available to the teachers in the Pre Primary Department, but as stated earlier, if they do not have a phonological background, the goals and the therapy would not be phonologically based.

The test has many strengths and weaknesses. The amount of time it took and score probably far out weighed the benefit that was gained. If phonological therapy is not done, these scores are practically useless other than for documenting progress over time.

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