

# Phonology

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- 
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## Teacher Input: Articulation

Student: \_\_\_\_\_ Date: \_\_\_\_\_  
 Teacher: \_\_\_\_\_ Grade/Program: \_\_\_\_\_

Your observations of the above student's speech will help determine if he or she has an articulation problem which adversely affects educational performance. Please answer all questions and return this form to \_\_\_\_\_.

- |  | Yes   | No    |
|--|-------|-------|
| 1. Is this student's intelligibility reduced (due to articulation errors) to the extent that you find it difficult to understand what she or he says at times?<br>If yes, check appropriate description: | _____ | _____ |
| (a) _____ occasional difficulty  |       |       |
| (b) _____ frequent difficulty  |       |       |
| (c) _____ considerable difficulty  |       |       |
| 2. Does this student make errors in writing (spelling) on the same sound symbols that he or she misarticulates?  | _____ | _____ |
| 3. Does this student misarticulate the same sounds when reading aloud as when speaking?  | _____ | _____ |
| 4. Does the student appear frustrated when speaking because of his or her articulation errors?   | _____ | _____ |
| 5. Does the student appear to avoid speaking in class because of his or her articulation errors?   | _____ | _____ |
| 6. Does the student have problems reading or with readiness activities because of articulation errors?   | _____ | _____ |
| 7. Is the student having problems discriminating sounds?   | _____ | _____ |
| 8. Do the articulation errors seem to interfere with his or her social interactions?   | _____ | _____ |
| 9. Has the student ever indicated that he or she is having problems producing sounds when speaking or shown concern about his or her sound production?   | _____ | _____ |
| 10. Has this student ever corrected any of his or her own articulation errors?   | _____ | _____ |
| 11. Does this student's speech problem distract listeners from what he or she is saying?   | _____ | _____ |

Additional observations/comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

It is my opinion that these behaviors:

- \_\_\_\_\_ Do not interfere with the child's participation in the educational setting.      \_\_\_\_\_ Do interfere with the child's participation in the educational setting.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Classroom Teacher's Signature

Adapted from *Speech and Language Services in Michigan: Suggestions for Identification, Delivery of Service and Exit Criteria*, edited by Elizabeth Loring Lockwood and Kathleen Pistano. East Lansing: The Michigan Speech-Language-Hearing Association, 1991. Used with permission.

# Phoneme Acquisition

As a rule:

- Vowels are acquired by age 3
- Diphthongs by 3 and ½
- Vocalic R (rhotacity) by 6 and ½
  
- Manner of Articulation
  - Affricates
  - Fricatives
  - Liquids
  - Stops
  - Nasals
  
- Place of Articulation
  - Palatials
  - Dentals
  - Velars
  - Alveolars
  - Labials
  
- Word Position
  - Across Words
  - Clusters
  - Final
  - Initial

Great Individual Variation

Source: Secord, W. *Intervention Based Assessment of Articulation and Phonology: When Enough is Enough!* Short Course Presentation at Connecticut Speech-Language-Hearing Association May 8, 1998

## DETERMINING INTELLIGIBILITY

The speech-language sample not only allows you to assess rate of speech, it also allows you to determine your client's intelligibility. Calculating overall intelligibility is necessary when considering the need for treatment, identifying factors that contribute to poor intelligibility, selecting treatment goals, recording baseline information, and monitoring the effects of treatment over time. An "Intelligibility Assessment Worksheet," Form 4-3, is provided to help you calculate intelligibility.

Naturally, the speech-language sample you use must be an adequate, representative sample of the client's speech in order to calculate a valid intelligibility rating. If you have difficulty obtaining an adequate sample, refer to "Speech and Language Sampling" on page 93 and "Conversation Starters for Eliciting a Speech-Language Sample" on pages 94-95 for specific suggestions and stimuli. We recommend that you audiotape or videotape the sample for analysis and future comparison. The speech-language sample you use can be from a clinical session, from the client's home, or from another environment (e.g., classroom, workplace, etc.). For some clients, you may wish to obtain representative samples from several different environments.

As you assess your client's speech-language sample, realize that there are many factors that can negatively influence intelligibility. These include:

- ☐ The number of sound errors. Generally, the greater the number of sound errors, the poorer the intelligibility.
- ☐ The type of sound errors. For example, omissions and additions sometimes result in poorer intelligibility than substitutions or distortions.
- ☐ Inconsistency of errors.
- ☐ Vowel errors.
- ☐ The rate of speech, especially if it is excessively slow or fast.

Source: Shipley, K.G. and McAfee, J.G. Assessment in Speech-Language Pathology: A Resource Manual. San Diego: Singular Publishing Group, 1992, pp. 109-111. Reprinted with permission.

- ☐ Atypical prosodic characteristics of speech, such as abnormal intonation or stress.
- ☐ The length and linguistic complexity of the words and utterances used.
- ☐ Insufficient vocal intensity.
- ☐ Dysfluencies, particularly severe dysfluencies that disrupt the context.
- ☐ The lack of gestures or other paralinguistic cues that assist understanding.
- ☐ The testing environment (such as at home versus in the clinic).
- ☐ The client's anxiety about the testing situation.
- ☐ The client's lack of familiarity with the stimulus materials.
- ☐ The client's level of fatigue. Fatigue particularly affects very young children, elderly clients, or clients with certain neurological disorders.
- ☐ The clinician's ability to understand "less intelligible" speech.
- ☐ The clinician's familiarity with the client and the client's speaking context.

In most cases, there are multiple factors — some client-related, some clinician-related, and some environmentally related — that influence overall intelligibility. This means that clinicians need to:

- ☐ Identify factors that affect intelligibility.
- ☐ View the intelligibility rating as being approximate, rather than absolute or definitive.
- ☐ Take more than one speech-language sample, and seek varied environments when possible.
- ☐ Secure a representative sample of speech. The client or the client's caregiver can usually help you determine whether a particular sample was a typical representation of the client's speech.

We also recommend that clinicians:

- ☐ Use a high quality tape, and a tape recorder with an external microphone to prevent recording motor noise.
- ☐ Avoid stimulus items that tend to elicit play rather than talk (e.g., blocks, doll houses, puzzles, etc.).
- ☐ Use open-ended stimuli (e.g., "Tell me about the car.") rather than closed-ended stimuli (e.g., "What is that?" "What color is it?" "What is it used for?" etc.).
- ☐ Consider reporting intelligibility in ranges (e.g., 65–75%), particularly when intelligibility varies. For example, a child may be 90–100% intelligible when speaking in utterances of one to three syllables. However, the same child may be only 50% intelligible in utterances of four or more syllables.
- ☐ Compare intelligibility on word-by-word and utterance-by-utterance bases. For some clients, the results will be very similar. For others, they may be con-

#### ASSESSMENT PROCEDURES COMMON TO MOST COMMUNICATIVE DISORDERS

siderably different. For example, a client whose loudness and articulation deteriorate in longer utterances may have many intelligible words, particularly at the beginning of individual utterances. But the end of their utterances may be unintelligible. A child with a pragmatic or organizational language disorder may produce many intelligible words, but the connected discourse may be unintelligible. Jargon aphasic speech may also contain many intelligible words, but be contextually illogical.

**Form 4-3. Assessing Intelligibility Worksheet**

Name: \_\_\_\_\_ Age: \_\_\_\_\_ Date: \_\_\_\_\_

Examiner: \_\_\_\_\_

**Testing Situation:**

Stimuli (conversation, materials used, etc.): \_\_\_\_\_

Client's level of anxiety: \_\_\_\_\_

Talkative/Not talkative: \_\_\_\_\_

Prompts used: \_\_\_\_\_

Representativeness of sample: \_\_\_\_\_

**Instructions:**

1. Write out each word in each utterance (use phonetics if possible).
2. Use a dash ( — ) to indicate each unintelligible word.
3. An utterance is considered intelligible only if the entire utterance can be understood.
4. Calculate intelligibility for words and utterances.

**Example:**

Utterances	# Intelligible Words	Total Words	# Intelligible Utterances	Total Utterances
1. hi went hom	3	3	1	1
2. ar ju — tu go	4	5	0	1
3. — — θin	1	3	0	1
4. pwiz pwe wif mi	4	4	1	1
5. ai want tu go hom	5	5	1	1
<b>Totals</b>	<b>17</b>	<b>20</b>	<b>3</b>	<b>5</b>

$$\frac{\text{intelligible words: } 17}{\text{total words: } 20} = 85\%$$

$$\frac{\text{intelligible utterances: } 3}{\text{total utterances: } 5} = 60\%$$

# ASSESSMENT PROCEDURES COMMON TO MOST COMMUNICATIVE DISORDERS

Utterances	# Intelligible Words	Total Words	# Intelligible Utterances	Total Utterances
1. _____	_____	_____	_____	1
2. _____	_____	_____	_____	1
3. _____	_____	_____	_____	1
4. _____	_____	_____	_____	1
5. _____	_____	_____	_____	1
6. _____	_____	_____	_____	1
7. _____	_____	_____	_____	1
8. _____	_____	_____	_____	1
9. _____	_____	_____	_____	1
10. _____	_____	_____	_____	1
11. _____	_____	_____	_____	1
12. _____	_____	_____	_____	1
13. _____	_____	_____	_____	1
14. _____	_____	_____	_____	1
15. _____	_____	_____	_____	1
16. _____	_____	_____	_____	1
17. _____	_____	_____	_____	1
18. _____	_____	_____	_____	1
19. _____	_____	_____	_____	1
20. _____	_____	_____	_____	1
21. _____	_____	_____	_____	1
22. _____	_____	_____	_____	1
23. _____	_____	_____	_____	1
24. _____	_____	_____	_____	1
25. _____	_____	_____	_____	1
26. _____	_____	_____	_____	1
27. _____	_____	_____	_____	1
28. _____	_____	_____	_____	1
29. _____	_____	_____	_____	1

(continued)



**Form 4-3** (continued)

Utterances	# Intelligible Words	Total Words	# Intelligible Utterances	Total Utterances
30. _____	_____	_____	_____	1
31. _____	_____	_____	_____	1
32. _____	_____	_____	_____	1
33. _____	_____	_____	_____	1
34. _____	_____	_____	_____	1
35. _____	_____	_____	_____	1
36. _____	_____	_____	_____	1
37. _____	_____	_____	_____	1
38. _____	_____	_____	_____	1
39. _____	_____	_____	_____	1
40. _____	_____	_____	_____	1
41. _____	_____	_____	_____	1
42. _____	_____	_____	_____	1
43. _____	_____	_____	_____	1
44. _____	_____	_____	_____	1
45. _____	_____	_____	_____	1
46. _____	_____	_____	_____	1
47. _____	_____	_____	_____	1
48. _____	_____	_____	_____	1
49. _____	_____	_____	_____	1
50. _____	_____	_____	_____	1
<b>Totals</b>	_____	_____	_____	_____

**Findings**

Average # Words per Utterance \_\_\_\_\_

% Intelligibility — Words \_\_\_\_\_

% Intelligibility — Utterances \_\_\_\_\_

Factors contributing to reduced intelligibility: \_\_\_\_\_

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## Checklist of Factors Related to Speech Intelligibility

Check which of the following factors affect the intelligibility of the child's speech.

- \_\_\_\_\_ number of speech sound errors;
- \_\_\_\_\_ consistency of errors (e.g., some positions/all positions, some words containing sound/all words containing sound);
- \_\_\_\_\_ frequency of occurrence of errors;
- \_\_\_\_\_ types of sound errors;
- \_\_\_\_\_ types of phonological processes used;
- \_\_\_\_\_ morphology;
- \_\_\_\_\_ syntax;
- \_\_\_\_\_ length of utterance;
- \_\_\_\_\_ complexity of utterance;
- \_\_\_\_\_ type of speaking task (e.g., imitation/spontaneous, reading/speaking));
- \_\_\_\_\_ prosody (e.g., inflection, stress, pauses);
- \_\_\_\_\_ rate of speech;
- \_\_\_\_\_ accompanying nonverbal language (e.g., gestures);
- \_\_\_\_\_ environmental noise/distractions;
- \_\_\_\_\_ familiarity of listener with speaker;
- \_\_\_\_\_ familiarity of listener with content of speaker's message;
- \_\_\_\_\_ foreign accent or dialect and familiarity of listener with same; time of day;
- \_\_\_\_\_ fatigue of speaker;
- \_\_\_\_\_ positioning/posture of speaker (e.g., lying/sitting/standing; slouched/erect)
- \_\_\_\_\_ volume of speaker's voice;
- \_\_\_\_\_ hearing status of listener;
- \_\_\_\_\_ listener's patience; and
- \_\_\_\_\_ motivation of speaker and listener

Comments:

Adapted From: Gordon-Brannan, M. "Assesing Intelligibility: Children's Expressive Phonologies." *Topics in Language Disorders* 1994: 14 (2), 17-  
Crary, M. A. "Clinical Evaluation of Developmental Motor Speech Disorders." *Seminars in Speech and Language* 1995: 16 (2), 110-125.

**Form 5-1.** Comparison of Sound Errors from an Articulation Test and Connected Speech

Name: \_\_\_\_\_ Age: \_\_\_\_\_ Date: \_\_\_\_\_

Examiner: \_\_\_\_\_

**Instructions:** Compare speech errors identified during an articulation test and connected speech. Here are recommended ways to mark errors:

- Omission: use a dash (—) or write *omit*
- Distortion: use diacritics; describe the error; or use a D or write *dist* and indicate severity with 1 (mild), 2 (moderate), or 3 (severe). For example, D<sup>3</sup> is a severe distortion.
- Substitution: transcribe the error
- Addition: transcribe the error
- Stimulable: use a (✓) or a (+); if the error is improved but not perfectly correct, mark an upward arrow (↑) or describe the nature of the improvement.
- Not Stimulable: use NS (not stimulable) or zero (0)

Then summarize your findings to identify error patterns.

Sound	Articulation Test Errors			Connected Speech Errors		
	Initial	Medial	Final	Initial	Medial	Final
p	_____	_____	_____	_____	_____	_____
b	_____	_____	_____	_____	_____	_____
t	_____	_____	_____	_____	_____	_____
d	_____	_____	_____	_____	_____	_____
k	_____	_____	_____	_____	_____	_____
g	_____	_____	_____	_____	_____	_____
f	_____	_____	_____	_____	_____	_____
v	_____	_____	_____	_____	_____	_____
θ	_____	_____	_____	_____	_____	_____
ð	_____	_____	_____	_____	_____	_____
s	_____	_____	_____	_____	_____	_____
z	_____	_____	_____	_____	_____	_____
ʃ	_____	_____	_____	_____	_____	_____

(continued)

**Form 5-1** *(continued)*

	Articulation Test Errors			Connected Speech Errors		
Sound	Initial	Medial	Final	Initial	Medial	Final
3	_____	_____	_____	_____	_____	_____
h	_____	_____	_____	_____	_____	_____
tʃ	_____	_____	_____	_____	_____	_____
dʒ	_____	_____	_____	_____	_____	_____
w	_____	_____	_____	_____	_____	_____
j	_____	_____	_____	_____	_____	_____
l	_____	_____	_____	_____	_____	_____
r	_____	_____	_____	_____	_____	_____
m	_____	_____	_____	_____	_____	_____
n	_____	_____	_____	_____	_____	_____
ŋ	_____	_____	_____	_____	_____	_____
i	_____	_____	_____	_____	_____	_____
ɪ	_____	_____	_____	_____	_____	_____
e	_____	_____	_____	_____	_____	_____
ɛ	_____	_____	_____	_____	_____	_____
æ	_____	_____	_____	_____	_____	_____
ʊ	_____	_____	_____	_____	_____	_____
ə	_____	_____	_____	_____	_____	_____
ə	_____	_____	_____	_____	_____	_____
ʌ	_____	_____	_____	_____	_____	_____
u	_____	_____	_____	_____	_____	_____
ʊ	_____	_____	_____	_____	_____	_____
o	_____	_____	_____	_____	_____	_____
ɔ	_____	_____	_____	_____	_____	_____
ɑ	_____	_____	_____	_____	_____	_____

## Phonological Processes

Phonological Process	Description	Example	Developmental Information
<b>A. Syllable Structure Processes</b>			
1. Deletion of Final Consonant	Reduction of CVC words or syllables to CV form, not usually sound specific	book → /bʊ/	Children who are developing language normally will begin to include final consonants by age 3. <sup>1</sup>
2. Cluster Reduction	Simplification of clusters of consonants usually by deleting the one that is most difficult to produce	tree → /ti/	Most children (90%) do not use cluster reduction after age 4. <sup>1</sup>
3. Weak Syllable Deletion	Deletion of unstressed syllables	telephone → /t fon/	Process does not exist in speech of normally developing children beyond age 4. <sup>1</sup>
4. Glottal Replacement	Replacement of final consonant of a syllable, usually in the intervocalic position, by a glottal stop; may mark the place of a consonant that is deleted	kitchen → /kɪʔən/	
<b>B. Harmony Processes</b>			
1. Labial Assimilation	Substitution of a labial phoneme for a non-labial phoneme due to influence of a dominant labial phoneme contained within the word	thum → /wʌm/	
2. Alveolar Assimilation	Substitution of a phoneme which is produced with alveolar placement for a non-alveolar phoneme due to influence of a dominant alveolar phoneme within the word	yellow → /lɛlo/	
3. Velar Assimilation	Substitution of a phoneme which is produced with velar placement for a non-velar phoneme due to influence of a dominant velar phoneme within the word	dog → /gag/	
4. Prevocalic Voicing	Substitution of a voiced stop for its voiceless cognate due to influence of the following vowel	pig → /big/	
5. Final Consonant Devoicing	Substitution of a voiceless stop for its voiced cognate due to influence of the silence following the word	bed → /bɛt/	Devoicing of final consonants does not occur after age 3 in normal phonological development. <sup>1</sup>

(continued)

<sup>1</sup>Phonological Disability in Children, cited by Linda M. Laila Khan, "A Review of 16 Major Phonological Processes," Language, Speech, and Hearing Services in Schools, (April 1982), pp. 77-85.

From *Speech and Language Services in Michigan: Suggestions for Identification, Delivery of Service and Exit Criteria*, edited by Elizabeth Loring Lockwood and Kathleen Pistano. East Lansing: The Michigan Speech-Language-Hearing Association. 1991. Used with permission.

## Phonological Processes (continued)

Phonological Process	Description	Example	Developmental Information
C. Feature Contrast Processes			
1. Stopping	Substitution of a stop for a fricative	sun → /tʌp/	
2. Affrication	Substitution of affricatives for fricatives; usually occurs more often with sibilant fricatives than others	sun → /tsʌn/	Most fricatives should be correctly produced by age 4. <sup>1</sup>
3. Fronting	Substitution of phonemes by others which are produced anterior to the target phonemes; occurs commonly with velar stops	wagon → /wʌdn/	Reported to no longer be evident by age 4 in normally developing children. <sup>1</sup>
4. Gliding of Fricatives	Substitution of glides for fricative phonemes	soap → /jop/	
5. Gliding of Liquids	Substitution of /w/, and /j/ for /l/ or /r/; simplification process	red → /wɛd/	Majority of children reported to produce correct liquids by age 4. <sup>1</sup>
6. Vocalization	Substitution of vowels for syllabic consonants, most frequently /ʊ/ and /o/	table → /tebo/	Syllabics are usually acquired by age 4. <sup>1</sup>
7. Denasalization	Substitution of stops for nasals; usually affects word-initial and word-medial nasals more than word-final nasals	smoke → /bok/	

<sup>1</sup> Natural Process Analysis, cited by Linda M. Laila Khan, "A Review of 16 Major Phonological Processes," Language, Speech, and Hearing Services in Schools, (April 1982), pp. 77-85.

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**Examiner:** \_\_\_\_\_

### Child's Production

### Intended Production

## Phonological Processes

[illegible]

**Consistent Sound Errors:**

**Sounds Containing More Than One Error:**

**Patterns of Sound Errors:**

**Consistent Correct Sound Productions:**