HEARING ACCESS, SHARED RESPONSIBILITY: SLP–AUDIOLOGIST COLLABORATION FOR STUDENT SUCCESS

Kristina Blaiser, PhD, CCC-SLP

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Agenda

- Introduction (5 min)
- What is audibility? (10 min)
- Why do SLPs care about audibility? (10 min)
- Impact across domains? (15 min)
- Assessment (15 min)
- Intervention (15 min)
- Collaboration (10 min)
- Case studies (10 min)

2

Changes in our fields

- Newborn hearing screening – average age reduced from 2.5 years to 2.5 months
- Technology improvements
- Improved outcomes of children who are DHH

3

Increase understanding “They turn their head so I know they can hear me”

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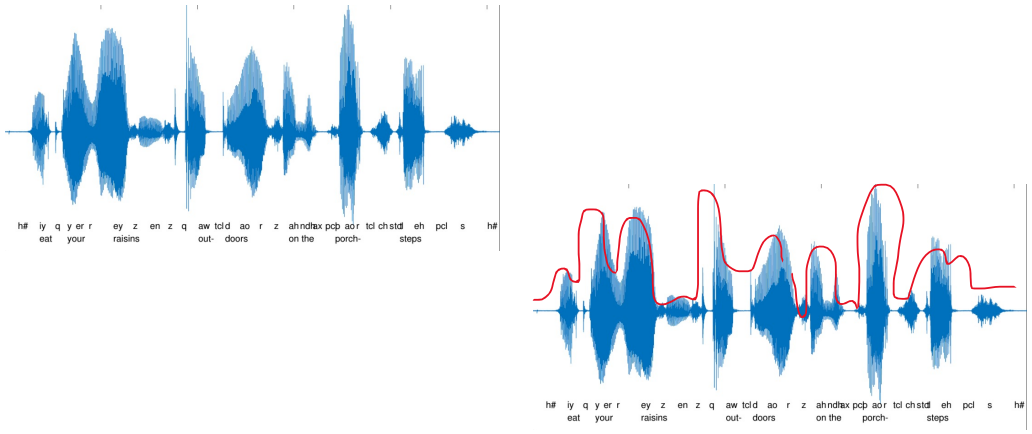

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What is audibility?

- Audibility expresses how much a child's hearing loss limits access to speech sounds on a % scale.
- Express how much a child's hearing aids help access communication

Sapp & Blaiser, 2026

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Why do SLPs care about audibility?

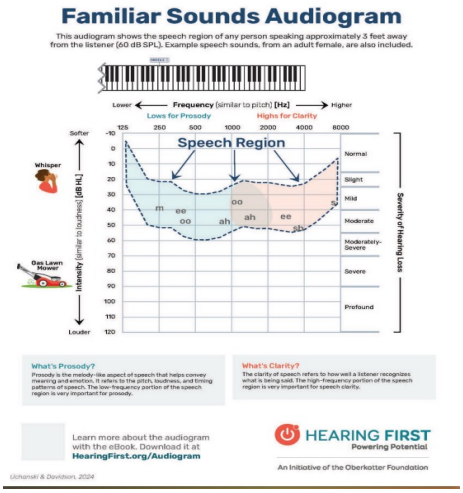

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Table 2–1. Speech Information Carried by the Key Speech Frequencies of 250–4000 Hz (± one half octave)

250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz
• First formant of vowels /u/ and /i/ • Fundamental frequency of females' and children's voices • Nasal murmur associated with the phonemes /m/, /n/, and /ng/ • Prosody • Suprasegmental patterns (stress, rate, inflection, intonation) • Male voice harmonics • Voicing cues	• First formants of most vowels • Harmonics of all voices (male, female, child) • Voicing cues • Nasality cues • Suprasegmentals • Some plosive bursts associated with /b/ and /d/	• The important acoustic cues for manner of articulation • Second formants of back and central vowels • Consonant-vowel and vowel-consonant transition information • Some plosive bursts • Voicing cues • Suprasegmentals • Unstressed morphemes	• The important acoustic cues for place of articulation • The key frequency for speech intelligibility • Second and third formant information for front vowels • Consonant-vowel and vowel-consonant transition information • Acoustic information for the liquids /r/ and /l/ • Plosive bursts • Affricate bursts • Fricative turbulence	• The key frequency for /s/ and /z/ audibility that is critical for language learning: – plurals – idioms – possessives – auxiliaries – third person singular verb forms – questions – copulas – past perfect • Consonant quality

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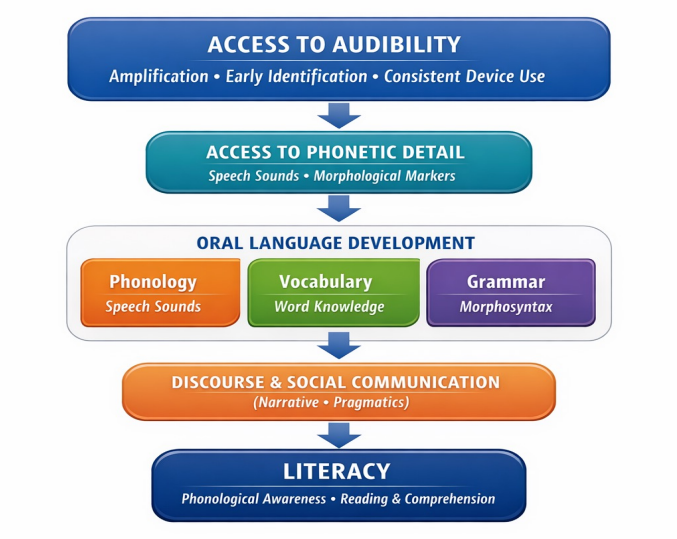

Created with author input and AI generation

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Audibility cuts across domains of language

- Form
- Content
- Use

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Differential Diagnosis of Speech

- Articulation
- Phonological Disorders
- Apraxia

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Differential diagnosis of speech with a child with a hearing difference

- Articulation
- Phonological Disorders
- Apraxia

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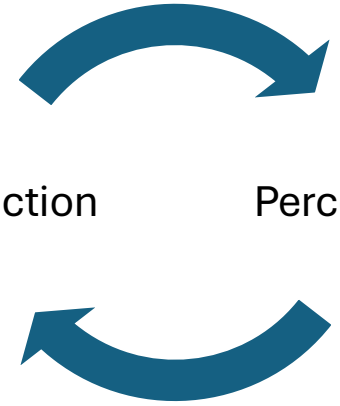
Phonology for children who are DHH



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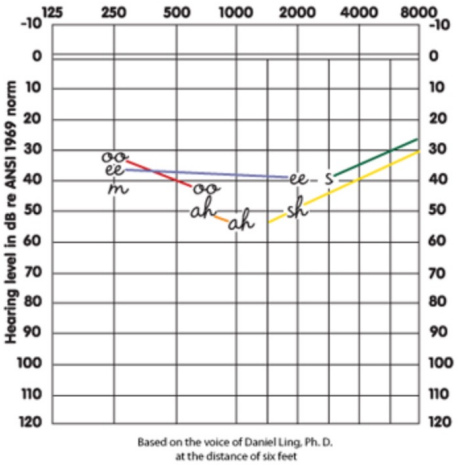
Considerations…

- Ling sound check
- Listen to the hearing technology
- Look at **patterns** in speech production



From http://www.jtc.org

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Chronological Age & Red Flags	Use of Sounds
RED FLAGS 10-12 months	Delayed onset of babble in spite of good audibility & consistent device use.
RED FLAGS 12 months	Limited use of voice for communicative purposes (after 12 mos).
RED FLAGS **12-21 months**	Limited inventory of consonants (18 mos+) and limited changes in inventory of consonants produced in second year of life
RED FLAGS **18-24 months+**	Primary reliance on simple vocalizations (vowels, glides + vowels) or low proportion of babble relative to other types of pre-lexical vocalizations across the second year of life.

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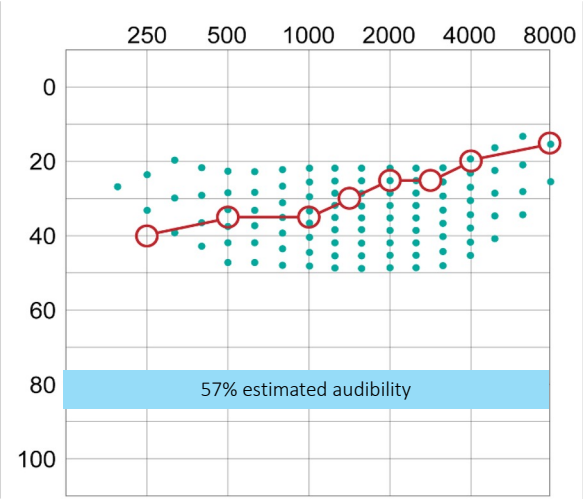
Visualizing Audibility on the Audiogram

- Right ear, "mild hearing loss rising to hearing within normal limits"
- Teal dots represent the distribution of speech sounds.
- Audibility captures **how much of this speech information is accessible based on the underlying hearing loss**.
- The value is more precise when we account for a child's ear canal shape and size



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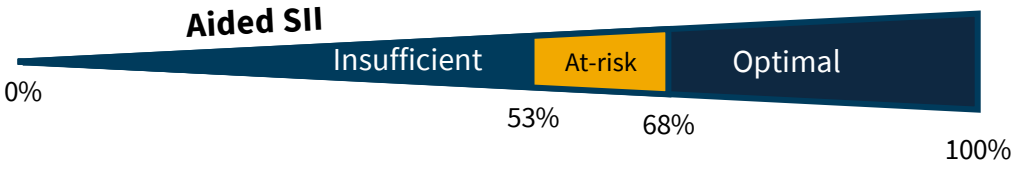
Audibility guidelines



Aligns with other estimates:
Stiles et al. (2012) - 65%
Tomblin et al. (2020) – 71%

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Exchanges between providers

SLP/Educator	Audiologist
☐ What patterns you see	☐ What is SII (in different conditions)
☐ What you have tried	☐ How programming has addressed
☐ Provide feedback	☐ What to look for in intervention
	☐ Contact if…

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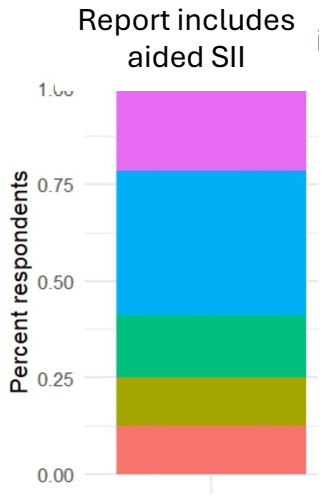
Differential diagnosis

Until you have ensured the child is hearing across all frequencies (optimized audibility) you **cannot** make a clear differential diagnosis.



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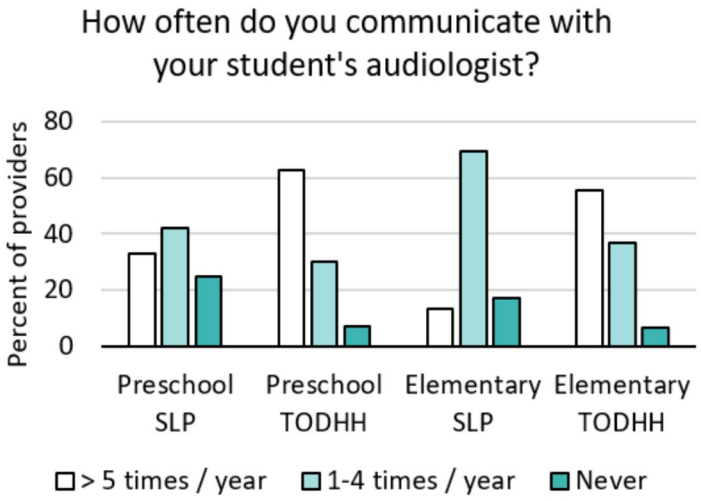

Page et al 2018

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The audiologist should welcome your questions!

Unaided audibility

- What does the child hear without their hearing aids? (unaided SII)
- How has their auditory access changed over time?
- Can I hear a simulation of his/her hearing loss?

Aided audibility

- What kind of boost does my child get from wearing their hearing aids?
- Are hearing aids still the right choice?
- Is their aided audibility in the range we expect for their level of hearing loss, and if not why?

Sapp & Blaiser, 2025

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Trusting your professional judgment

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Communication/Collaboration

- Positive relationship between speech production and speech perception
- Speech perception practices are also in transition as we have younger populations performing better (Muñoz, Blaiser, & Schofield, 2012)

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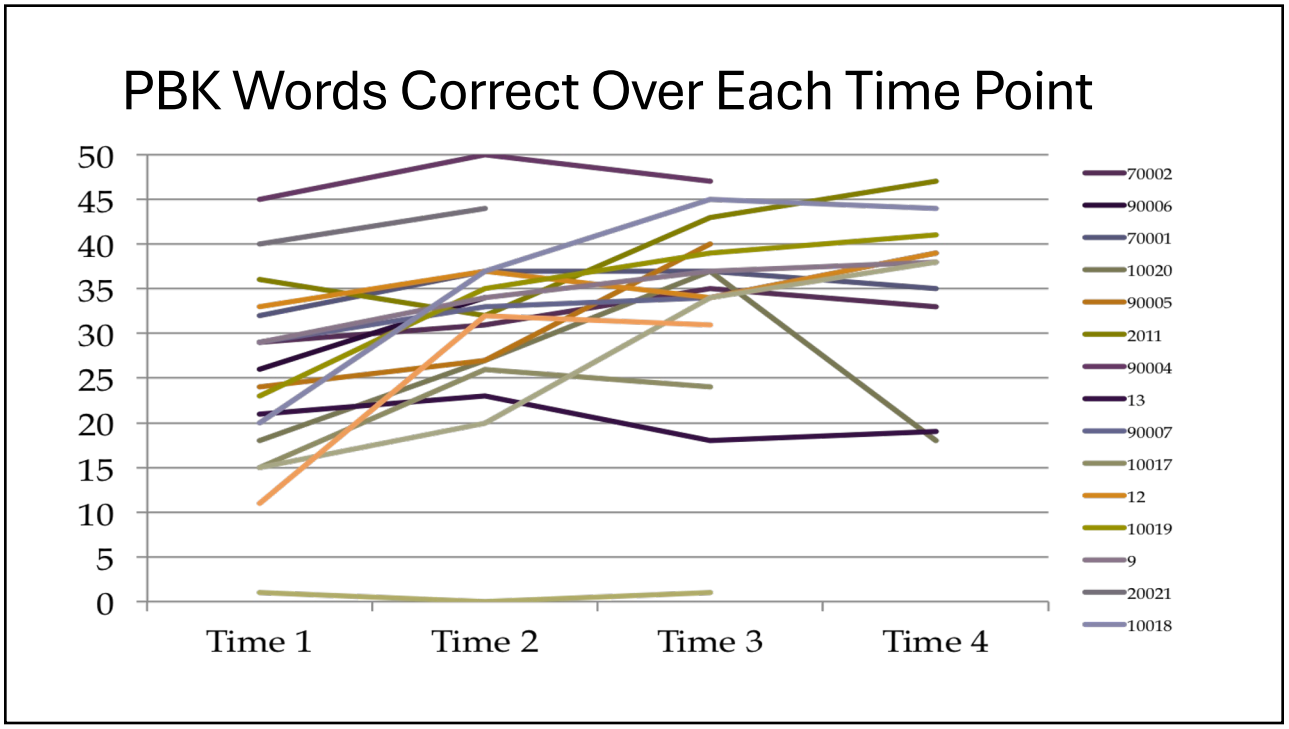
PBK Words Correct Over Each Time Point
50
45
40
35
30
25
20
15
10
5
0
Time 1
Time 2
Time 3
Time 4
70002
90006
70001
10020
90005
2011
90004
13
90007
10017
12
10019
9
20021
10018

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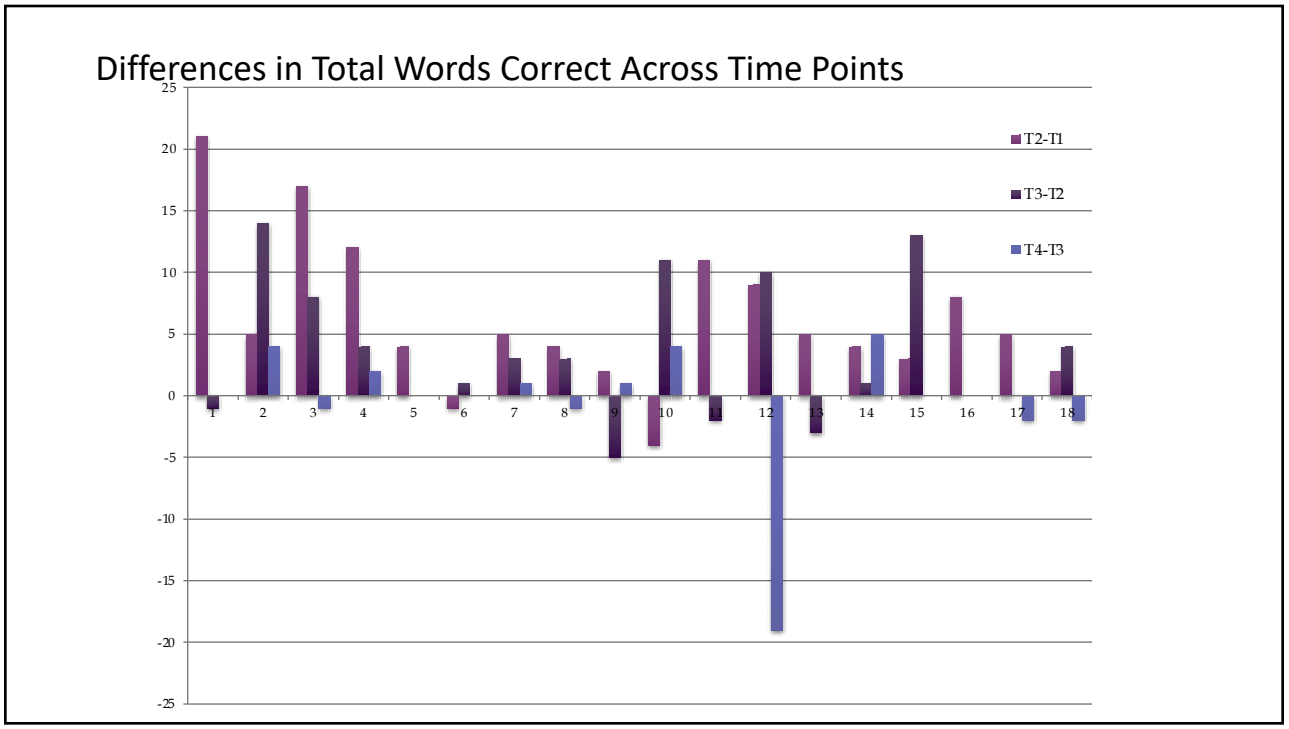
Differences in Total Words Correct Across Time Points
25
20
15
10
5
0
-5
-10
-15
-20
-25
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
T2-T1
T3-T2
T4-T3

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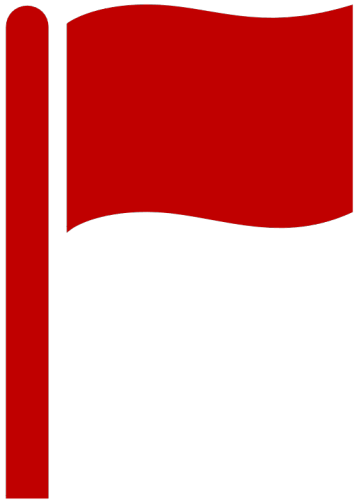
Red flags: School-Age

- Decrease in speech production
- Decrease in intelligibility
- “Slushy speech”
- Omission or substitution of phonemes



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Morphology

Audibility impacts more than speech

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Mommy going drive in mommy car and daddy going to drive in dad car
Mommy gonna ride in the boat, and daddy gonna ride in the boat.
Where the water?
That daddy boat!
Stay in the boat. Don't fall down in the ocean! That the ocean.
Don't fall down
They got wet!
Don't fall in the ocean again!
That a captain and that a captain
There two captain
That mommy boat and that daddy boat
I think he going ni-night
I think he not going ni-night. I think he going to bite!
Now mommy going to eat the apple

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Mommy IS going to drive in mommy'S car and daddy IS going to drive in dad'S car
Mommy IS gonna ride in the boat, and daddy IS gonna ride in the boat.
Where'S the water?
That'S daddy'S boat!
Stay in the boat. Don't fall down in the ocean! That IS the ocean.
Don't fall down
They got wet!
Don't fall in the ocean again!
That'S a captain and that'S a captain
There'S two captainS
That'S mommy'S boat and that'S daddy'S boat
I think he IS going ni-night
I think he IS not going ni-night. I think he IS going to bite!
Now mommy'S going to eat the apple

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ASSESSMENTS

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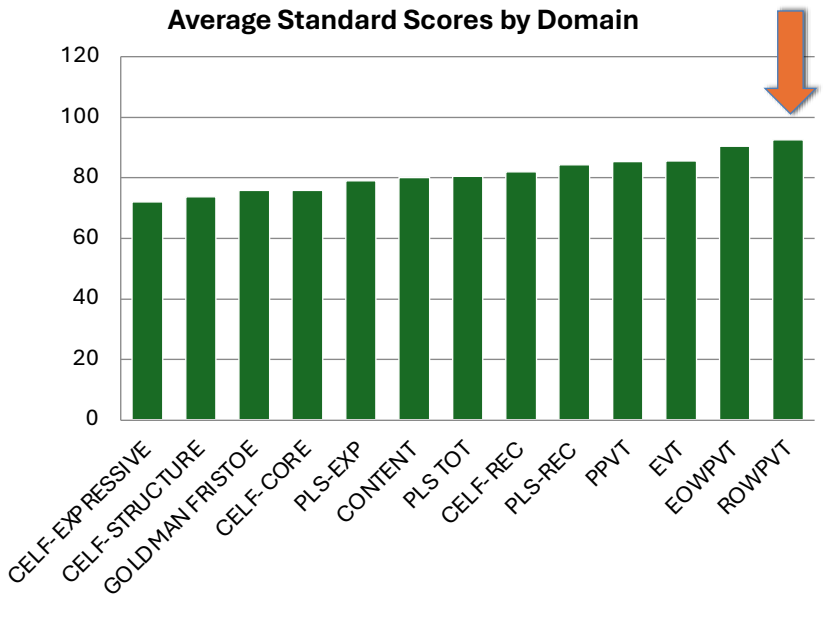

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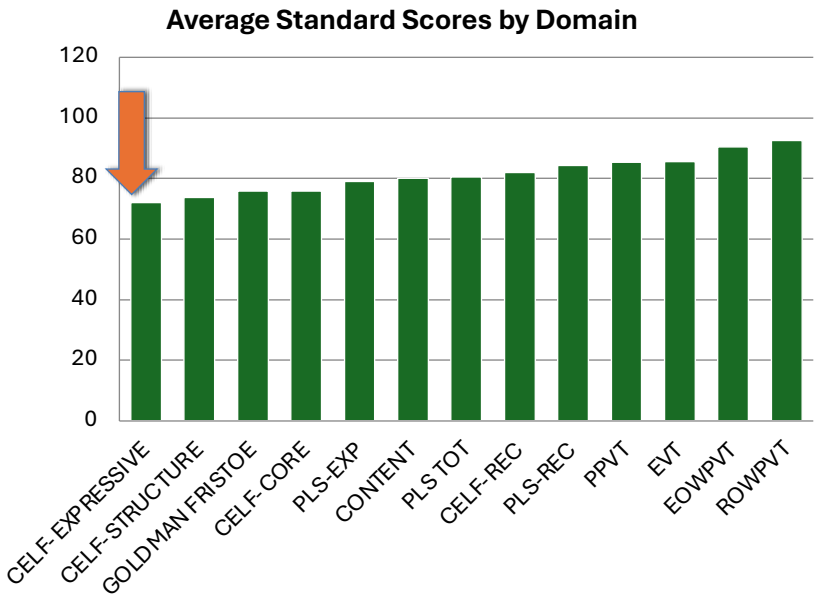

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Participants

- 47 preschool children who are DHH
- All attended oral preschool programs across the US

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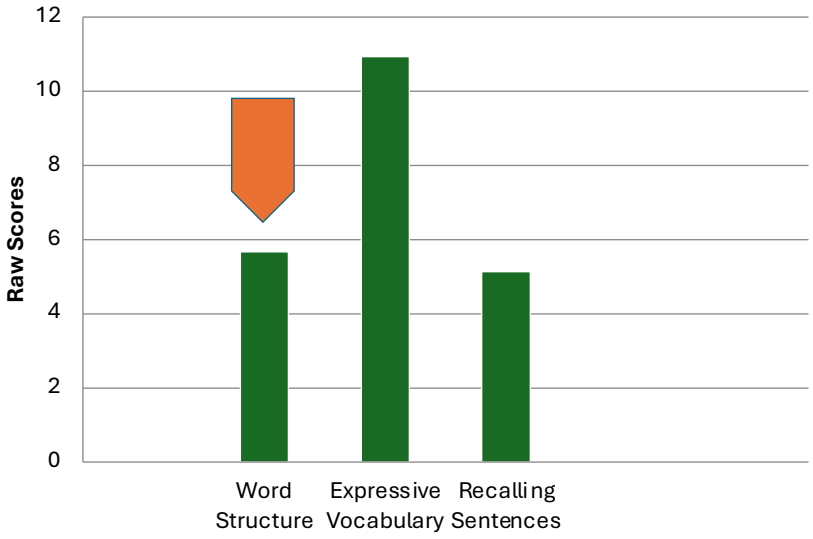
Within the composite scores (Expressive)



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Word Structure (WS)

Scores	Materials Needed	Repetitions	Discontinue Rule
Core Language score Expressive Language index Language Structure index	Stimulus Book 1	Allowed	After 8 consecutive zero scores

Circle 1 for a correct response and 0 for an incorrect response. If the child gives a response that is different from the expected response, but demonstrates the target and is meaningful to the context of the item, write it in the space provided and score the response as correct.

Demo Here is a boy [point] and here… [point] is a girl.

Trial 1 This boy [point] is standing. This boy is [point] _____. (sitting)

Trial 2 This girl [point to the girl on the left] has two cats. This girl [point to the girl on the right] has two _____. (dogs)

	Score
1. sleeping	1 0
2. walking	1 0
3. in/inside the box	1 0
4. hers	1 0
5. on the chair	1 0
6. her	1 0
7. It is/It's big.	1 0
8. him	1 0
9. sleeps	1 0

	Score
10. horses	1 0
11. flies	1 0
12. king's/queen's	1 0
13. singer	1 0
14. He is./He is standing.	1 0
15. will slide/will be sliding	1 0
16. herself	1 0
17. climbed	1 0
18. faster	1 0

	Score
19. fastest	1 0
20. She does.	1 0
21. She is.	1 0
22. They are.	1 0
23. blew	1 0
24. fell	1 0
Raw Score	

CELF Preschool-2 Record Form 3

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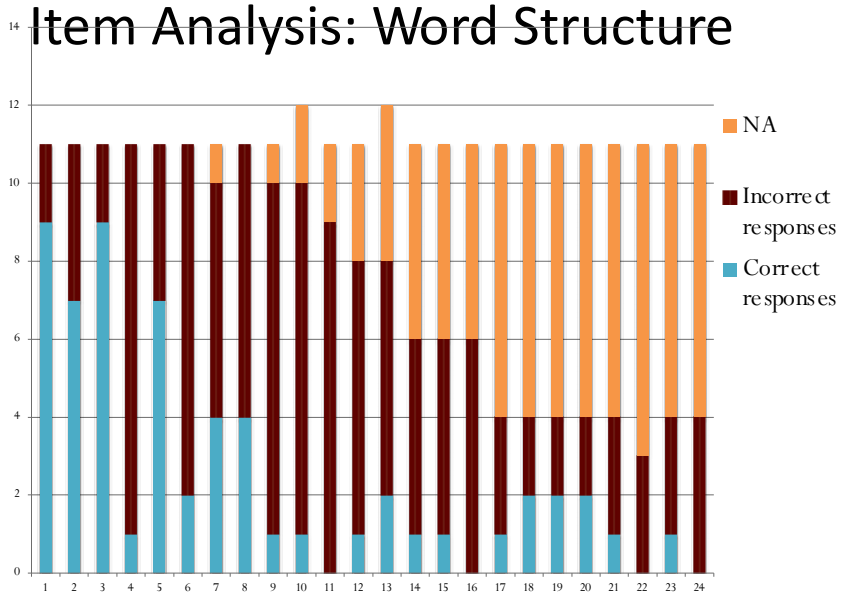
Item Analysis: Word Structure



N=47

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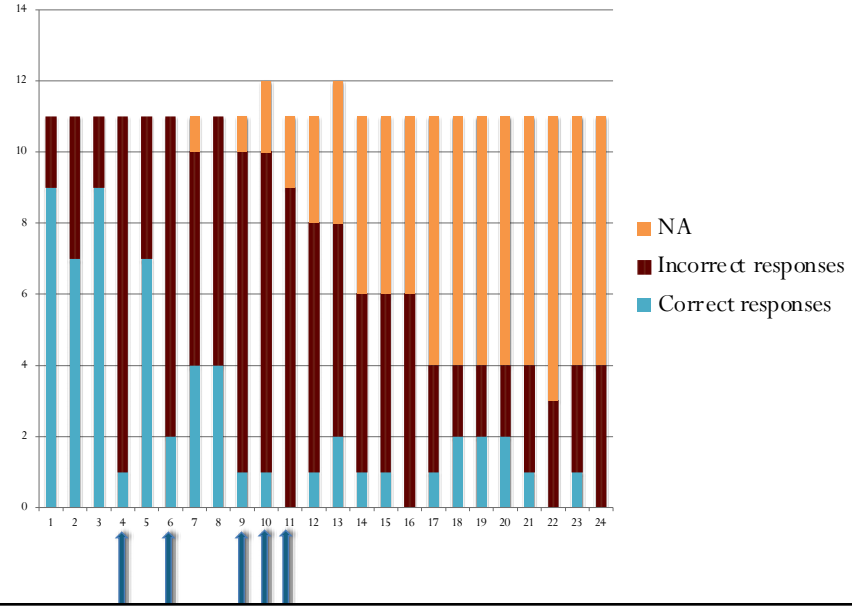
Item Analysis: Word Structure



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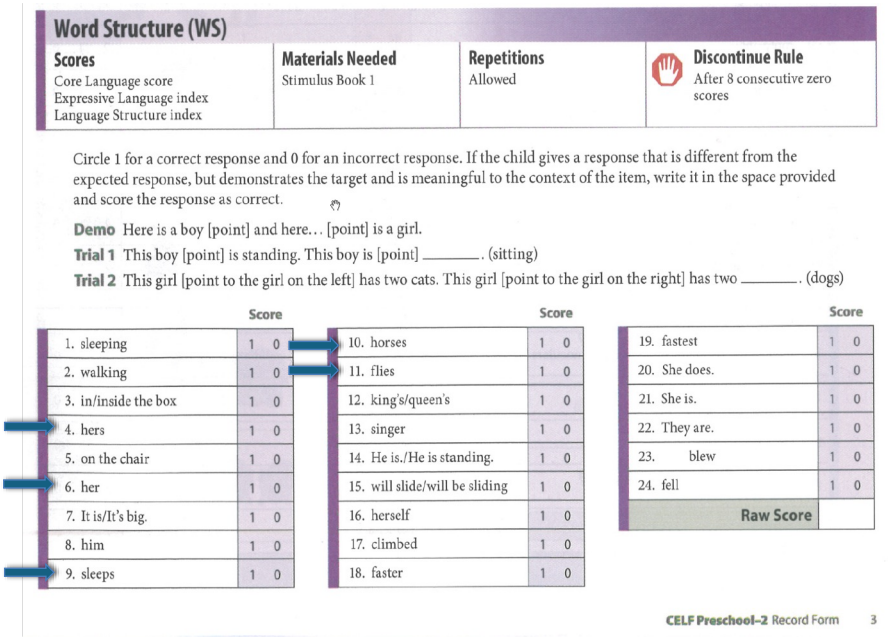

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	Score		Score		Score
1. sleeping	1 0	10. horses	1 0	19. fastest	1 0
2. walking	1 0	11. flies	1 0	20. She does.	1 0
3. in/inside the box	1 0	12. king's/queen's	1 0	21. She is.	1 0
4. hers	1 0	13. singer	1 0	22. They are.	1 0
5. on the chair	1 0	14. He is./He is standing.	1 0	23. blew	1 0
6. her	1 0	15. will slide/will be sliding	1 0	24. fell	1 0
7. It is/It's big.	1 0	16. herself	1 0	Raw Score	
8. him	1 0	17. climbed	1 0		
9. sleeps	1 0	18. faster	1 0		

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Grammatical Morphemes Acquired In Early Childhood

Adapted from Brown, R.,1973

Grammatical morpheme	Age (in months)	Example
Present progressive –ing	19-28	*"Mommy eating"*
Plural –s	27-30	*"Baby shoes"*
Preposition *in*	27-30	*"Hat in box"*
Preposition *on*	31-34	*"Hat on chair"*
Possessive 's	31-34	*"Baby's ball"*
Regular past tense –ed	43-46	*"Kitty jumped"*
Irregular past tense	43-46	*"We ate"*
Regular third person singular –s	43-46	*"Mommy drives"*
Articles *a, the, an*	43-46	*"The car"*
Contractible copula *be*	43-46	*"She's happy"*
Contractible auxiliary	47-50	*"She's coming"*
Uncontractible copula *be*	47-50	*"We were here"*
Irregular third person	47-50	*"She did it"*

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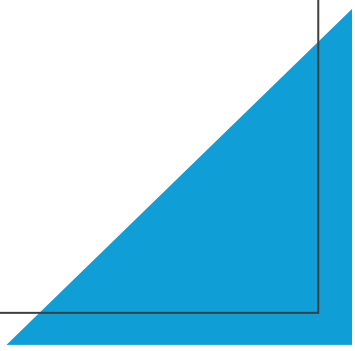
Content



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Comprehension built in the language of the child

- Build complex language
  - Receptive
  - Expressive

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Vocabulary

- Pre- and post-teaching vocabulary
- Considering visual support
- Supporting complex vocabulary learning
- Explicit teaching of word associations

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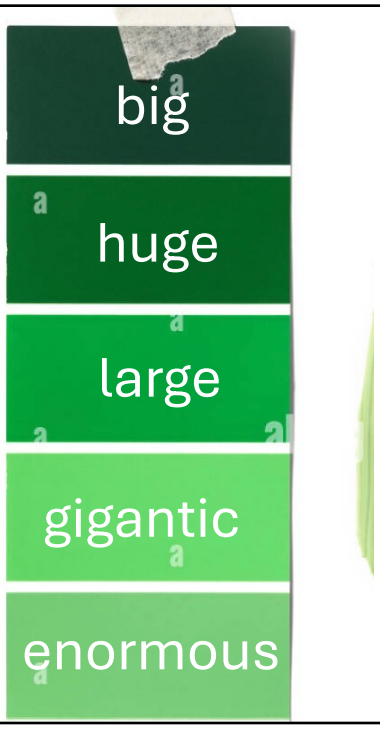

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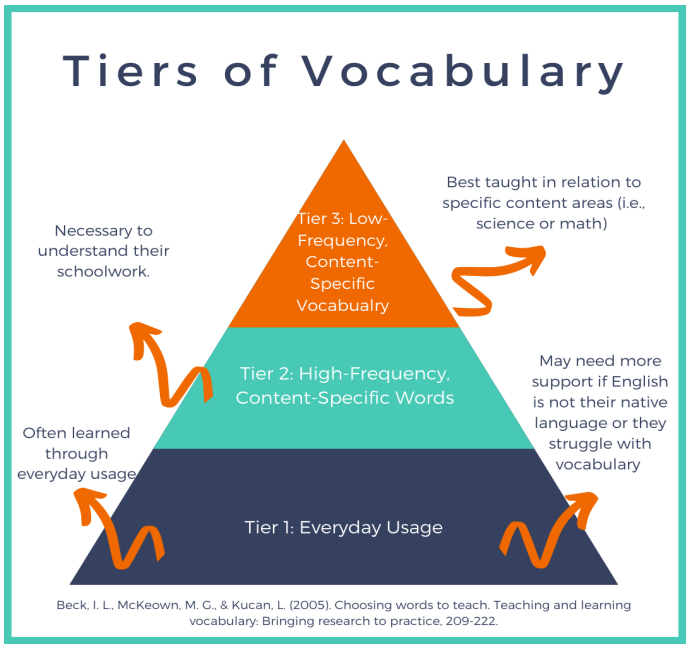

https://www.ascendlearningcenter.com/blog-highlights/how-to-pick-vocab-words

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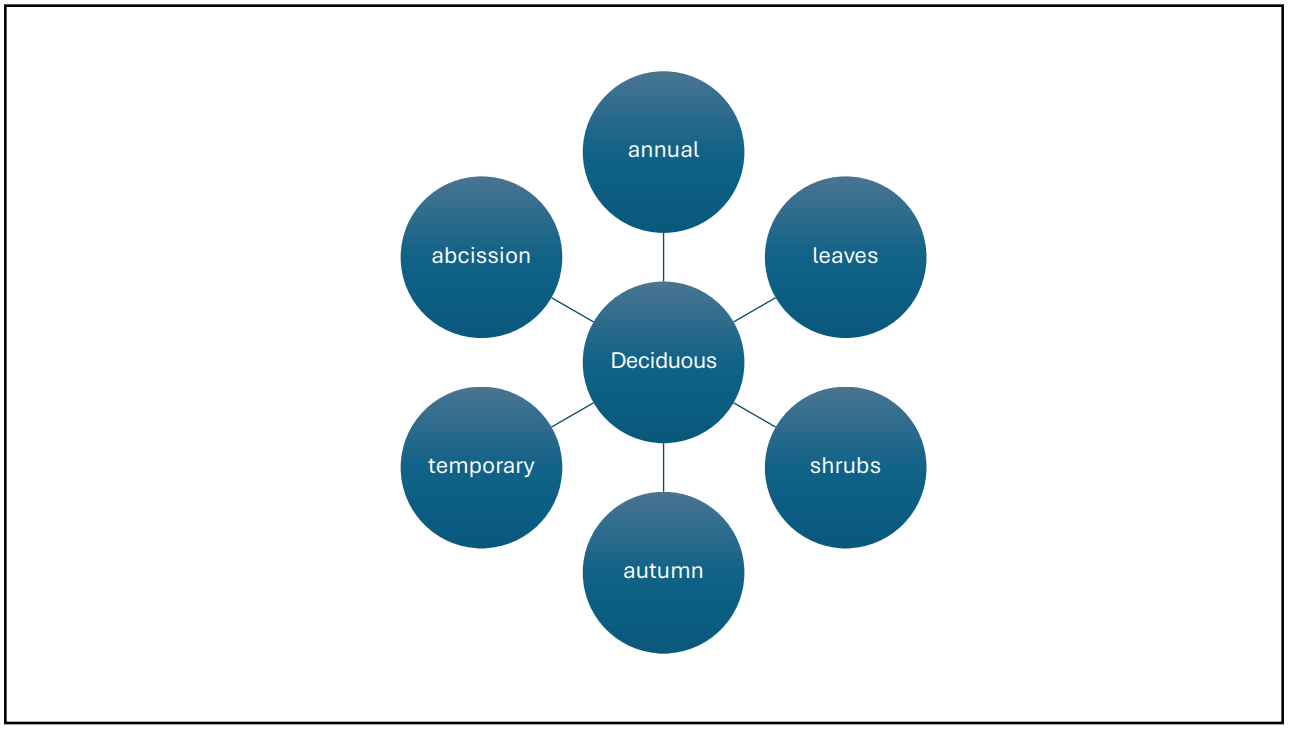

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Chronological Age & Red Flags	Gesture	Use of Words
RED FLAGS 10-12 months	Limited use of gestures.	
RED FLAGS 12 months	Limited use of gestures. Lack of pointing or showing by 12 months.	
RED FLAGS 12-21 months		No words at 18 months
RED FLAGS 18-24 months+		Slow transition to use of 2-word combinations (after 30 months). Produces very few words that are understandable to parents (after 30 months). Predominance of jargon segments for an extended period (> 36 months)

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Pragmatics

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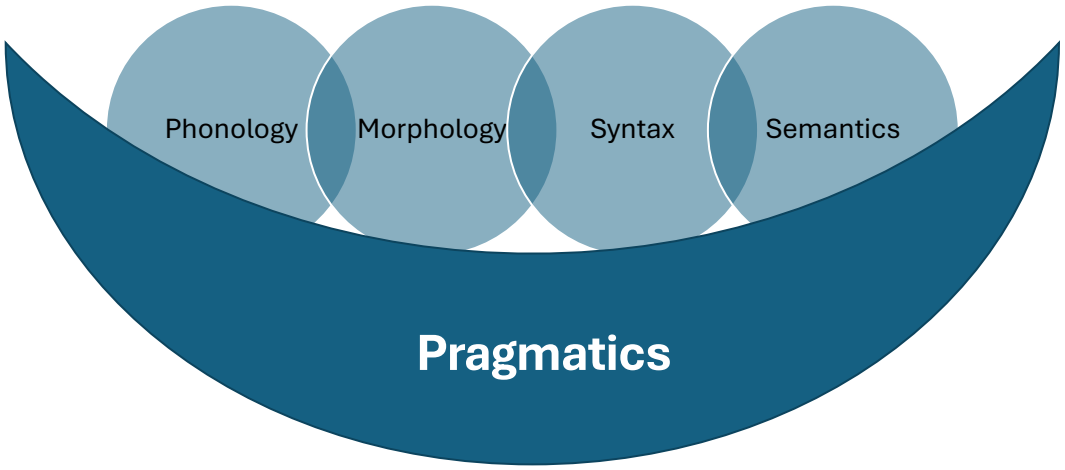
Rethinking Pragmatics



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Importance of **pragmatics**

- Behavior (Keetelars, Cuperus, Jansonius & Verhoeven, 2010)
- Difficulties with peer friendships and psychosocial functioning (Whitehouse, Watt, Line & Bishop, 2009),
- Lower quality of life ratings (Blaskova & Gibson, 2012)

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Pragmatics in children who are DHH

Delays compared to peers in:

- Types of communication (Goberis et al., 2012)
- Variations of interactions (Most et al., 2010)
- Success of initiations (DeLuzio & Giralometto, 2011)

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Assessment → Intervention

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How do we assess pragmatics?

Observation

Checklists

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Challenges with assessment

Challenge observing all of the behaviors

Lack of standardization

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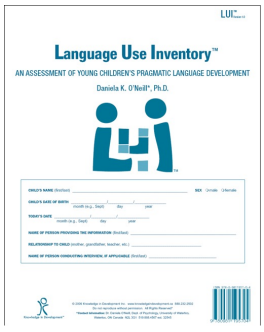
Assessing Pragmatics in Toddlers



- Language Use Inventory (LUI, O'Neill, 2009), a standardized parent-report measure for 18 to 47 month old children.
- Via the LUI, families can provide a uniquely broad overview of young children's social communicative functioning.
- The LUI has high sensitivity and specificity and scores correlate with later language measures (e.g., CELF-P2, CCC-2).

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Assessing Early Pragmatics

- Normed on over 3500 Canadian children. Percentile score norms are monthly from 18 to 47 months.
- Parents can reply "yes" or "no" to items regardless of language used by the child and can confer with multiple interactants.
- Can be administered in hardcopy form or online form via secure online platform that provides automated scoring and report generation.

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LUI Subscales Comprising the LUI Total Score

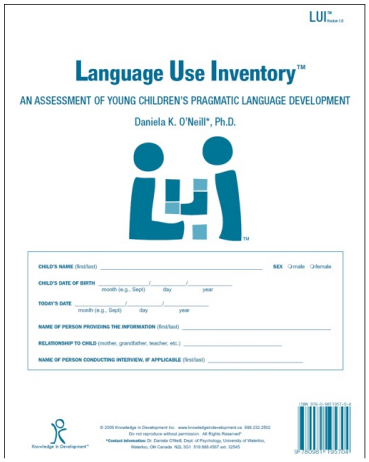
Part 2: Communication with Words

- Types of words used
- Requests for help

Part 3: Longer Sentences

- Use of words to get you to notice something
- Questions and comments about things
- Question and comments about self & others
- Use of words in activities with others
- Teasing and sense of humour
- Interest in words and language
- Adapting communication to other people
- Building sentences and stories

Total LUI Score = 161 items of Parts 2 & 3



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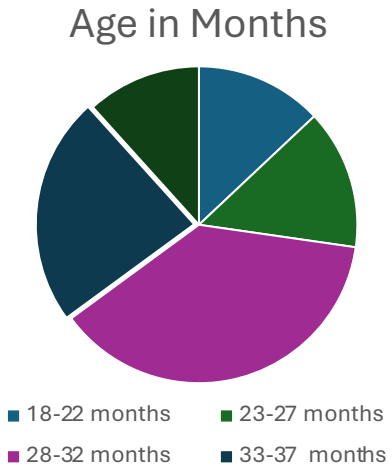
Participants (LUI specific)

N=85 (Females= 46; Males=39)

Age Range: 18-48 months (*M*=30.8 months)



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LUI Percentile Scores

	Part 1 (Gestures)	Part 2 (Words)	Part 3 (Sentences)	Total
M	77	35.3	12.3	12.6
SD	29.7	38.8	20.5	21
Range	98	98.5	98.5	98.5

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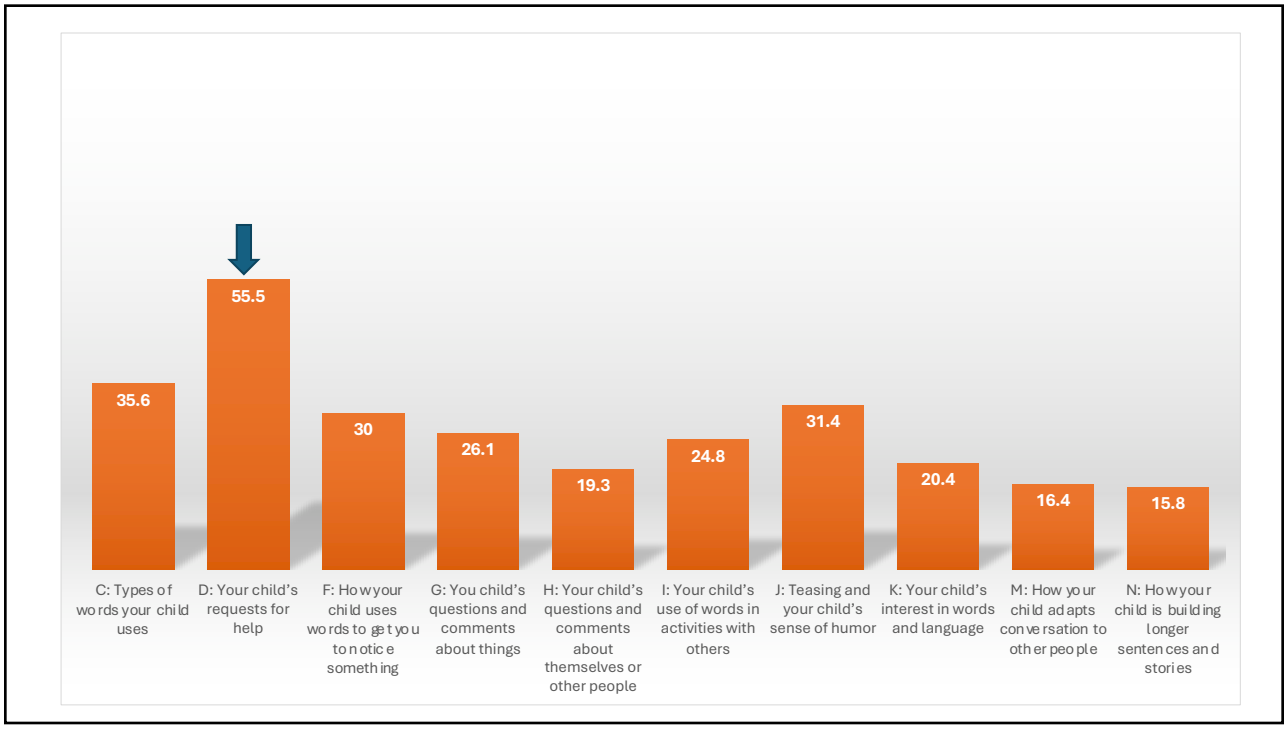
35.6
55.5
30
26.1
19.3
24.8
31.4
20.4
16.4
15.8
C: Types of words your child uses
D: Your child's requests for help
F: How your child uses words to get you to notice something
G: You child's questions and comments about things
H: Your child's questions and comments about themselves or other people
I: Your child's use of words in activities with others
J: Teasing and your child's sense of humor
K: Your child's interest in words and language
M: How your child adapts conversation to other people
N: How your child is building longer sentences and stories

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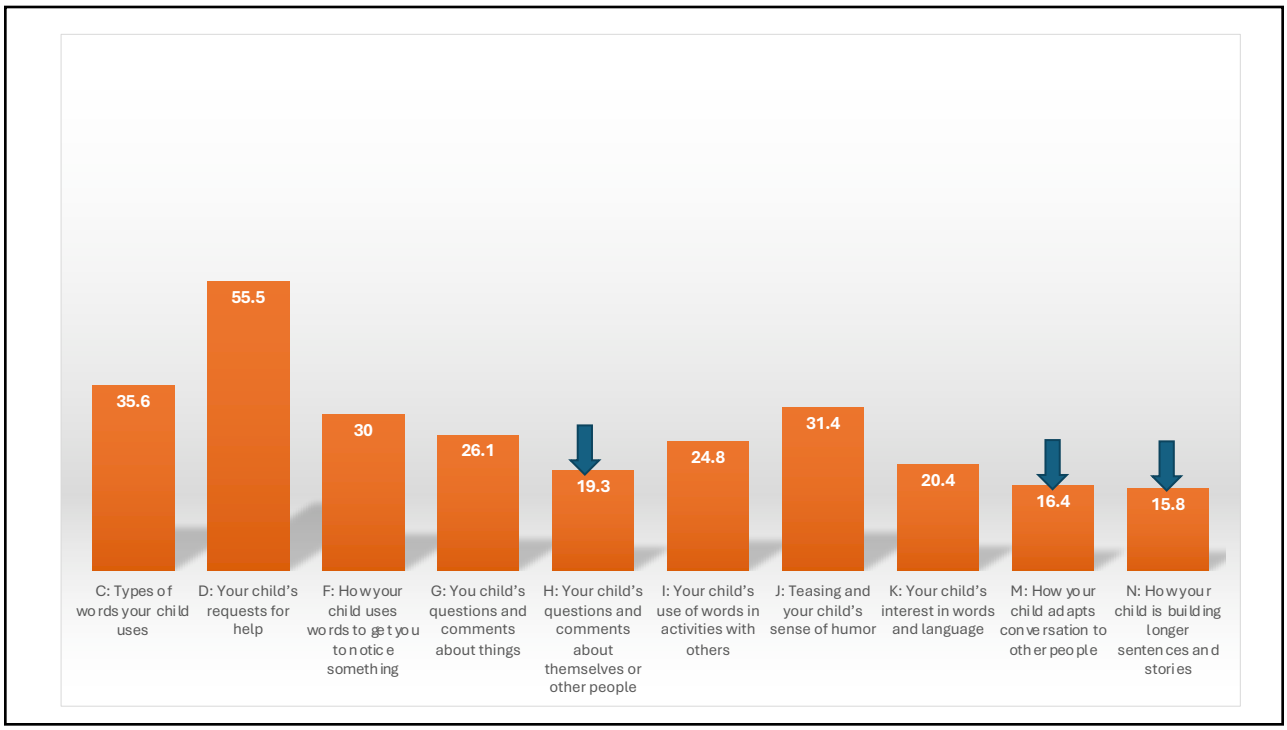
35.6
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K: Your child's interest in words and language
M: How your child adapts conversation to other people
N: How your child is building longer sentences and stories

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Language Use Inventory: Heat map

			Child age (months) (bins)								
Part (group)	Section (group)	Question/Section	16	20	24	28	32	36	40	44	Total
Part 1: How your child co..	Part 1 Percentile	Part 1 Percentile	99.0	85.0	91.3	63.2	84.7	77.5	65.0	87.0	80.1
Part 2: Your child's communication with words	Part 2 Percentile	Part 2 Percentile	88.0	40.0	33.0	58.0	40.1	73.0	99.0	71.5	53.6
	Section C: Types of words your child u..	C Percentile	97.0	36.0	25.0	58.8	46.7	70.8	99.0	70.5	55.8
	Section D: Your child's requests for he..	D Percentile	42.0	51.5	60.7	48.3	56.7	99.0	99.0	66.3	62.2
Part 3: Your child's longer sentences	Section F: How your child uses words t..	F Percentile	21.0	42.3	31.7	28.7	38.2	68.4	99.0	35.0	43.6
	Section G: Your child's questions and ..	G Percentile	69.0	63.0	19.0	19.3	31.2	64.2	99.0	23.0	41.5
	Section H: Your child's questions and comments about themselves or other people	H Percentile	49.0	24.2	30.5	22.0	14.8	50.8	12.0	11.5	27.2
		H Self Percentile	34.0	27.6	76.0	36.0	21.5	65.0	33.0	15.0	34.2
		H Other Percentile	57.0	32.8	19.7	6.4	9.8	64.5	5.0	13.5	23.3
	Section I: Your child's use of words in ..	I Percentile	25.0	29.0	17.0	52.5	35.3	56.8	56.0	38.5	37.6
	Section J: Teasing and your child's sen..	J Percentile	47.0	32.3	55.7	17.9	26.2	30.4	14.0	32.0	28.2
	Section K: Your child's interest in wor..	K Percentile	60.0	28.3	26.0	37.3	20.3	38.0	5.0	39.0	28.1
	Section M: How your child adapts con..	M Percentile	28.0	21.5	27.0	18.0	17.4	36.5	19.0	2.0	22.3
	Section N: How your child is building l..	N Percentile	43.0	31.2	19.3	6.1	15.7	15.0	24.0	5.0	17.8
	Part 3 Percentile	Part 3 Percentile	36.0	19.2	11.0	19.0	13.0	24.3	16.0	4.0	17.1
Totals	Total LUI Percentile	Total LUI Percentile	45.0	16.2	16.5	21.5	12.1	25.8	19.0	5.0	17.8

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Level of Pragmatic Difficulty (Percentiles)

	N	%
Pragmatic Difficulties (Percentile ≤ 7)	57	67%
Severe Pragmatic Difficulties (Percentile ≤ 2)	45	53%

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BOTTOM UP

DECIPHERING

LINKING SOUND-LETTERS-MEANING

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Decoding different based on language that is used

Auditory signal

Visual signal

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Children who are using hearing technology

Direct link between perception and production

Child hears "kit" – writes "kit" (instead of *skip*)

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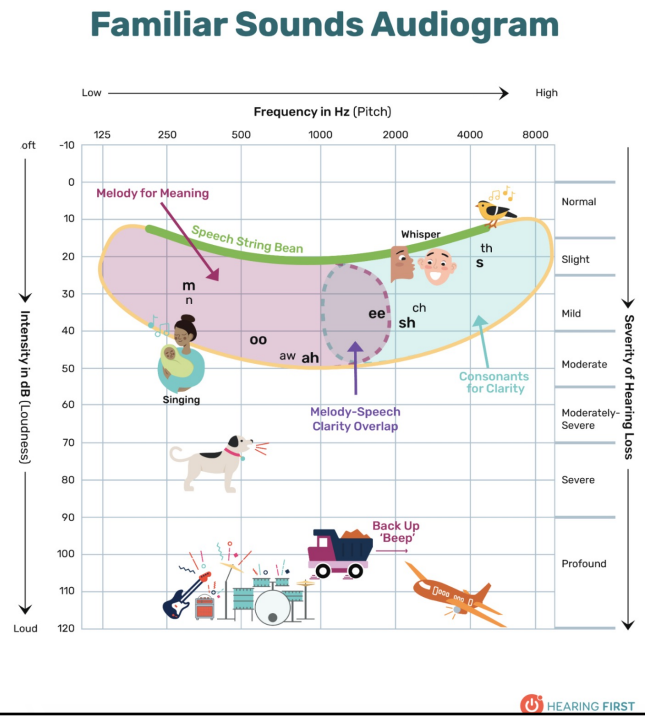
Ensure hearing across all frequencies

- Today's hearing technology should provide access across all frequencies
- However, this means ongoing verification of technology
- Daily Ling sound check
  - M/S/SH/AH/EE/OO



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Highlight key sounds, words and phrases

- Beginning sounds
- Final sounds
- Alliteration
- Rhyming words
- ***Acoustically highlight*** words and phrases

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Full-time use of hearing technology

- Support hearing retention
- Different for different ages
  - Supporting caregivers
  - Supporting child
- Supporting acoustic access in the classroom
  - Distance and noise- challenges
  - Hearing Assistive Technology
    - Elevating the speaker's voice
    - Reducing noise/distractions

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Auditory Skill	Literacy Skill
Detection	Attend to reading
Discrimination	Tell the difference between sounds & words
Self-Monitoring/Auditory Feedback Loop	Reading aloud & ability to correct speech production based on text
Auditory Memory	Understanding text read aloud to include grammatical morphemes
Auditory Comprehension	Ability to recall information from the story short & long term
Auditory Linguistic Processing	Understanding the story

NAN

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What does this look like?

- Making sounds sound different.
- Beginning consonants
- Syllables
- Ending sounds
- Medial short vowels
- Segmenting 3 letter words into sounds
- Blending Sounds into words

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- Make more perceptually salient with changes in
  - Duration
  - Intensity
  - Pitch

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Access to Sound

The key to success is consistent access to sounds!! Support full-time use of hearing technology

Develop routines with books

Book time is the perfect time for listening and talking!

If it's noisy, use a remote microphone

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Audibility is not just for audiologists

While audiologists are the primary providers who are responsible for addressing audibility in the fit of the hearing technology, it's really ***a team effort*** to understand how it is impacting communication access and development

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Questions you need to ask yourself

- What is developmentally appropriate for the child?
- What am I (and our team) doing to support auditory access?
- Are there patterns (auditory) that warrant discussion with an audiologist?

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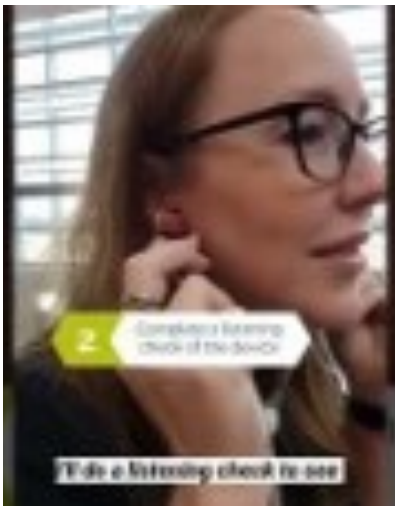
How to monitor/check audibility as an SLP

1. Check phoneme on speechmap (HA) or aided audiogram (CI)
2. Complete a listening check of the device
3. Ask the child to listen & respond–head turn, point to picture, or repeat after me
4. If a child can detect/discrim–proceed with intervention as planned
5. If a child cannot detect/discrim–contact audiologist to see if device can be adjusted to improve audibility



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https://www.edaud.org/infographic--a-team-approach-to-hat

Save

a team approach to

HEARING ASSISTIVE TECHNOLOGY*

*Also referred to as *Assistive Listening Devices (ALDs)*

This document was developed by an interprofessional workgroup of educational audiologists, speech-language pathologists, (SLP) and teachers of the Deaf/Hard of hearing (TODHH) with specific input from Kristina Blaiser, Kameron Carden, Kym Meyer, and Dana Kan to support educational teams' decision-making and compliance in serving children who are Deaf/Hard-of-Hearing in schools. A special thanks to the Educational Audiology Association (EAA), the Division of Communication, Language, and Deaf/Hard of Hearing (DCD) for the Council for Exceptional Children (CEC) and the American Speech-Language Hearing Association (ASHA) for assistance and support. EAA, DCD of CEC, and ASHA support the National Association of State Directors of Special Education (NASDSE, 2018) guidance regarding providers' approach to HAT.

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TEAM ROLES

TEAM

- **Self-determination:** Teach and empower self-advocacy in educational and social settings.
- **Validation:** Collaborate to ensure optimal device use and access in different environments; Provide feedback when red flags* occur.
- **Accessibility Tools**: Monitor accessibility technologies (i.e., captioning and alerting systems) and accommodations
- **Daily Listening Checks:** Assign team member to perform and track daily listening checks.
- **Personnel Support:** Provide in-services to extended and general education team

AUDIOLOGIST

Assessment: Identify hearing type and degree, evaluate functional listening
Device Selection: Recommend appropriate HAT
Fitting and Configuration: Select, fit, evaluate, and verify devices for optimal performance
Training: Teach individuals how to use HAT effectively across settings

SLP

Audibility: Assess and provide feedback when access impacts understanding/production across communication domains

TODHH

Integration: Ensure child has access to general education curriculum, specialized instruction, and social engagement throughout the school day

Families and students should be included as part of the team and team members should all have experience working with children who are DHH.

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Class schedule

- Welcome (large group)
- Book
- Centers
- Art
- Snack
- Music
- Good-bye

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Team Planning Sheet

Class Schedule	Quiet/Noise	Structure	Communication Partner	Goal

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Team Planning Sheet

Class Schedule	Quiet/Noise	Structure	Communication Partner	Goal
Welcome	Quiet	Structure	Teacher/other children	Routine, Vocabulary, Simple Directions, Name

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Summary

- For children who use technology, it is important that educational teams understand how to optimize it
- Systematic discussion and evaluation of communication settings, partners, and listening environments
- Collaborative approach is integral to success

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Key Resources/References

Communication Domain	Why Audibility Matters	Mechanism	Key Evidence
Phonology / Speech Sound Development	Speech perception requires access to fine acoustic cues (e.g., place, voicing, fricatives). Reduced audibility limits the development of phonological representations.	Access to acoustic speech cues → phonological representations → speech production and phonological awareness.	Farquharson et al., 2022; McCreery et al., 2020
Morphology / Syntax / Morphosyntax	Grammatical markers are often brief and low intensity (e.g., plural /s/, past tense /ed/). These cues are easily missed with reduced audibility.	Reduced perception of grammatical morphemes → weaker morphosyntactic learning.	Tomblin et al., 2015; Walker et al., 2015
Semantics / Vocabulary	Vocabulary growth depends on consistent access to spoken language input and exposure to word meanings.	Access to spoken input → lexical mapping → vocabulary growth.	Walker et al., 2015; Lund, 2020
Pragmatics / Social Communication	Pragmatic development relies on conversational exposure and access to spoken interactions.	Access to conversational language → social cognition → pragmatic language skills.	Walker et al., 2017
Literacy	Reading depends on phonological awareness, vocabulary, and grammar knowledge developed through spoken language input.	Audibility → oral language foundations → reading development.	Werfel, 2017; Lund, 2020

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Thank you!

Kristina Blaiser, PhD, CCC-SLP

KristinaBlaiser@isu.edu

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