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ASSESSMENT OF MORPHOSYNTACTIC DEVELOPMENT OF PRESCHOOL CHILDREN WITH HEARING LOSS USING THE CLINICAL EVALUATION OF LANGUAGE FUNDAMENTALS – PRESCHOOL SECOND EDITION

by

Angela Anderson

A thesis in partial fulfillment of the
requirements for the degree

of

Master of Science

in

Speech-Language Pathology

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2014

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ABSTRACT

Assessment of Morphosyntactic Development of Preschool Children with Hearing Loss Using the Clinical Evaluation of Language Fundamentals – Preschool Second Edition

by

Angela Anderson, Master of Science

Utah State University, 2014

Major Professor: Dr. Kristina M. Blaiser
Department: Speech Language Pathology

It is recommended that children with hearing loss (HL) are assessed using standardized assessments normed on hearing peers (Houston & Caraway, 2009; Joint Commission on Infant Hearing (JCIH), 2007). However, as these assessments are more commonly administered to children with HL and used as qualifying criteria for special education and speech-language services (Spencer, 2004) there is reason to further investigate the sensitivity of these assessments particularly in their ability to identify weaknesses specific to hearing loss.

The Clinical Evaluation of Fundamental Language Preschool Edition (CELF-P) was administered to 47 preschool age children using hearing aids or cochlear implants. An itemized analysis was performed on subtests *Word Structure* and *Sentence Structure* to determine whether children with HL made similar error patterns and the nature of these errors

. Results indicated children with HL performed within the standard range on the CELF-P; however, there were error patterns noted in this population that require a closer look.

Public Abstract

Assessment of Morphosyntactic Development of Preschool Children with Hearing Loss Using the Clinical Evaluation of Language Fundamentals – Preschool Second Edition

Angela Anderson

It is recommended that children with HL are assessed using standardized assessments normed on hearing peers (Houston & Caraway, 2009; Joint Commission on Infant Hearing (JCIH), 2007). However, as these assessments are more commonly administered to children with HL there is reason to further investigate the sensitivity of these assessments particularly in their ability to identify weaknesses specific to HL. The CELF-Preschool 2 (Clinical Evaluation of Language Fundamentals – Preschool (Wiig, Secord & Semel, 2004)) has been found to be a valid tool for diagnosing language impairment in normal hearing children (Spaulding, Plante, & Farinella, 2006). However, this assessment has not been normed on children with HL and the standardized assessment may not successfully identify areas of acoustic weakness that may exist in children with HL, particularly as it relates to the form of language (such as syntax and morphology) (Spencer, 2004). Standard and/or scaled scores alone may not provide the information needed to understand a child's ability to hear across frequencies and to learn and accurately use morphosyntactic structures/information.

This preliminary study will 1) provide results examining the performance of 47 preschool children with HL on the CELF-P2; 2) describe findings from an item analysis that show children with HL have ongoing challenges with morphosyntactic development; and 3) discuss implications for educational providers (i.e., speech-language pathologists, deaf educators,) for interpretation of assessment results and intervention strategies.

The results indicated that compared to standardized norms, children with HL are performing within the average range on the CELF. An itemized analysis of subtests of the CELF revealed a pattern of errors were made as a collective group. These errors involved the following morphemes: a) using the phoneme /*s*/ (plurals, possessives, verb tense third person singular), b) regular past tense *–ed,* c) irregular past tense, and d) uncontractible copula "be". The results suggest there may be other factors beyond language abilities affecting the performance of children with HL, and a standardized test score overall may not reflect these deficits. These findings merit further investigation into the frequency of sound factors that may be preventing acquisition of morphosyntactic parts of language in this population.

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Angie Anderson

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INTRODUCTION

Background

Changes of decreasing age of identification of hearing loss (HL) and advances in hearing technology have led to the decrease use of American Sign Language (ASL) and an increase in listening and spoken language (LSL) development of children with HL. With these changes come challenges in the assessment practices of language development and the interpretation of assessment results as a function of educational placement and service provision. The purpose of this paper is to describe the current recommendations of best practices for assessing the language development of children with HL, to discuss the challenges that accompany these recommendations for educational service providers, and, finally, to offer suggestions for interpretation of standardized assessments when applied to service delivery in educational settings.

In the past, it was less common to use standardized assessments normed on hearing children to evaluate the language of a child with HL. In part, children with HL did not have the oral language skills that made administration of these assessments possible. Because more children with HL relied on communication modalities that included some components of sign language, many assessments lost validity due to the way the evaluations were administered. For example, an item from the Preschool Language Scale- 4 (Zimmerman, Steiner, and Pond, 2002) that assesses understanding of pronouns, “he, she, hers, his” becomes unusable when supplemented with sign language because the use of sign would indicate the correct answer. Another example is the

Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn, 2007). The vocabulary word "tortoise" would be signed with the sign "turtle". One modification would be to fingerspell the word "tortoise"; however, this task would be calling into play more than receptive vocabulary knowledge.

New Expectations for Language Acquisition

With more children using listening and spoken language from early ages (Brown, 2006), the use of standardized assessments becomes not only more plausible but expected from a best practices perspective. For example, The Joint Committee of Infant Hearing recommends:

> Early-intervention programs must assess the language, cognitive skills, auditory skills, speech, vocabulary, and social-emotional development of all children with hearing loss at 6-month intervals during the first 3 years of life, using assessment tools standardized on children with normal hearing and norm-referenced assessment tools that are appropriate to measure progress in verbal and visual language (JCIH, 2007, p. 19).

Houston and Carraway also state, "If the child with hearing loss is acquiring spoken language, the SLP[Speech-Language Pathologist] should use assessments that compare the child's performance to what is considered to be typical development" (Houston & Carraway, 2010, p, 52).

The majority of recent research includes standardized assessments when examining form (Spencer, 2004), content (Hayes, Geers, Trieman, & Moog, 2009) and use (DeLuzio & Girolametto, 2011) of language. For example, Spencer (2004) examines

the performance on the Clinical Evaluation of Language Fundamentals [(CELF), (Semel, Wiig & Secord, 2003)] of 12 children with cochlear implants, ranging in age from 3 years 11 months to 7 years 11 months. While children with cochlear implants demonstrated commensurate skills as their normal hearing peers on basic concepts and word order in sentences, their performance was poorer on understanding and production of grammatical morphemes especially pronouns, possessive markers, and verb tense. Similarly, Geers et al., (2009) examined receptive vocabulary in children with cochlear implants on the Peabody Picture Vocabulary Test (Dunn & Dunn, 2007). Findings suggested that, over time, children who were implanted early developed receptive vocabulary skills within normal limits compared to their normal hearing peers. Geers noted children implanted by one and a half year of age reached expected mean average scores for 5- to 6- years of age children.

Taken together, there is increasing reason for speech-language pathologists to use standardized assessments to measure language development in children with HL learning listening and spoken language. However, because a child's educational placement and services received depend largely on performance on these measures, it is critical to further understand how to interpret the information obtained through the evaluation and the limitations of these measures.

Educational Requirements

As the use of standardized assessments becomes the norm rather than the exception in the practice of evaluating language development in children with HL, it is important to understand what information these evaluations provide, as well as to note

what information they omit. Some of the challenges of using standardized assessments come from the norming population as well as the testing protocols. The federal act, Individuals with Disabilities Education Act (IDEA, 1997, P.L. 105-17) states the necessity of norm referenced testing, requiring that assessments and evaluation measures be "used for purposes for which [they] are valid and reliable" (118 Stat. 2705). This concept was retained in the subsequent version of this law, Individuals with Disabilities Education Improvement Act of 2004 (IDEIA, 2004; P.L., 108-446, Stat. 2705).

In addition, it is common practice for educational systems to use standardized assessments as guides for qualifying young children with HL for speech and language services. Because of the social, academic, monetary, and ethical consequences of a language impairment diagnosis, it is critical to ensure that the tests designed to determine the presence or absence of a language impairment are indeed valid for that purpose (Greenslade, Plante & Vance, 2009; Spaulding, Plante & Farinella, 2006; Tomblin & Zhang, 2000). Age-appropriate language scores on standardized tests for children with HL may be considered an important prerequisite to determine success in a mainstream classroom (Nicholas & Geers, 2008). Yet, these assessments fail to describe the common gaps of children with HL or to inform service providers unfamiliar with HL of potential needs for hearing technology modifications. For example, morphosyntactic structures may be particularly vulnerable in children with HL populations due to challenges accessing high frequency information, such as phoneme */s/* and past tense *–ed*, which are produced in the 4000 Hz frequency range of speech.(Stelmachowicz, Pittman, & Hoover et al., 2004; McGuckian & Henry, 2007; Moeller, Putman, Arbataitis, & Bohnenkamp et al., 2007; Moeller, Hoover, & Putman et al., 2007).

The CELF-P Standardized Language Assessment

The CELF- Preschool [CELF-P (Wiig, Secord & Semel, 2004)] is a standardized language assessment commonly used for diagnosing language impairment in children ages 3-to-6 years of age The norms on the CELF-P for children with HL are unknown since the standardized population was children with normal hearing. The standardization population included 1150 children in 47 states, which was representative of the 2000 US Census. The children were divided into eight, 6 month age groups, with 100 subjects in each group. All children who took the test in standardized manner were able to use spoken language and communicate and none were diagnosed with a behavioral or emotional disorder. English was the primary language of all subjects, and 13% of the sample received special services.

The CELF emphasizes English syntax knowledge and skills; it assesses processing of utterances containing varied amounts of information, understanding and producing basic sentence structures, understanding and producing bound and unbound English grammatical morphemes (e.g., markers for verb tense, plurals, possessive; prepositions; articles) as well as conceptual receptive and expressive vocabulary (e.g., *many, slow, full*) (see figure 1A). The CELF-P measures general aspects of receptive and expressive language and evaluates the oral language skills of children under the age of 6. The CELF-P provides separate receptive and expressive standard scores. The CELF includes four receptive language subtests (Concepts & Following Directions, Sentence Structure, Basic Concepts, and Word Classes). These subtests use closed-set tasks involving questions with pointing responses. The receptive subtests require skills such as

understanding modifiers and spatial concepts (e.g., *first*, *bottom*, *full*), understanding oral commands of increasing length and complexity (e.g., *Point to the giraffe after you point to the turtle*), understanding semantic relationships between words (e.g., *table*, *a watch*, *and a chair*), and understanding spoken sentences that increase in length and complexity (e.g., *The teacher was followed by the students*).

The CELF-P also has three expressive language subtests (Recalling Sentences, Expressive Vocabulary, Word Structure, and Word Classes) requiring a verbal response following a pictorial and verbal prompt. The expressive subtests involve skills such as repeating increasingly complex sentences modeled by the examiner (*The big brown bunny ate all of the kid's carrots*), labeling pictures that illustrate nouns and present progressive verbs (e.g., *running, buttons*), using morphological rules and forms (e.g., *Here is a boy standing, Here is a girl ___* [*sitting*]) and formulating word associations (*How do the words ____ and ____ go together?*).

Performance of children with HL on the CELF

Moeller, McCleary, Putman, Tyler-Krings, Hoover, and Stelmachowicz, (2010) discussed the factors that may influence development of language in children with HL. These include: a) access/audibility issues (HA bandwidth, noise, reverberation, distance); b) position in sentence (*He want +s two bike +s*); c) frequency in the input (/s/ phoneme audibility); and d) phonological production (fricatives, blends –***bows*** vs. *pa**rks***). The study indicated the reason verb tense markers may be missing is due to the position that often occurs in phrase-medial position of sentences, which reflects the reduced amplitude of final consonants. This results in children missing information, particularly in noise and

reverberation. Children with HL may not receive consistent input about obligatory contexts for using morphological markers, which complicates the process of learning the rules of English grammar (Moeller et al., 2010).

In a study examining 13 prelingually deaf children with cochlear implants, 6 boys and 7 girls, who ranged in age from 3 years 11 months to 7 years 11 months, Spencer (2004) investigated their language skills after an average duration of implantation of 49 months. At the time data was collected, seven of the children were in education programs using an oral approach to language (without use of any sign language), and six of the children were in educational programs using some form of sign language. The findings of the study reported the sample of children generally showed strengths on the CELF in the areas of use and understanding of word order in sentences and basic concept vocabulary. The areas of consistent weakness were in understanding and production of grammatical morphemes, especially pronouns, possessive markers, and verb tense. No significant difference was found between children's performance on the receptive subscales and expressive subscales. The mean percentage-of-age score on the CELF was 50.3% (*SD* = 12.96), with none of the children performing at a level higher than 75% of age expectations. These scores noted for the children with HL postimplant language skills ranged from severely delayed to age appropriate. Spencer reports age of implantation (range 14 to 27 months) associated significantly and inversely with CELF-P scores (*r*= -*.68)*. This means the children who were implanted early had better performances on the CELF-P.

Remmel & Peters (2009) used the CELF as a measure of expressive language for some of their test subjects. There were 30 children with cochlear implants (CIs; 15 boys

and 15 girls) from 3-12 years of age, and 30 children with normal hearing (NH; 15 boys and 15 girls) from 4-6 years of age in the study. All of the children with CIs were recruited from aural rehabilitation clinics, and the children with NH were recruited from child care centers in the Pacific Northwest United States. All children used spoken English as their primary mode of communication. The CI children were preimplant hearing levels in the profoundly deaf range and prelinguistically deafened. Only one child was implanted with bilateral CIs, the rest of the children with CIs were implanted unilaterally and used amplification for the other ear. The authors reported the CELF mean standard scores for oral expression were very close to 100, with 48% of the children with CIs performing at or above hearing norms on oral expression. Only four CI children (three younger and one older) had standard scores below 70 on oral expression. The authors state their findings are consistent with the hypothesis that cochlear implantation can enhance acquisition of spoken language, which then increases exposure to mental state references, which then enhances the importance of social cognition. Remmel reports children who had cochlear implants, who use primary oral communication rather than Total Communication, develop better spoken language skills, which lead to better mental state development due to greater access to parental language.

Geers, Moog, Biedenstein, Brenner, & Hayes, (2009) assessed 125 children who had cochlear implants using the CELF. The selection criteria to be a subject in the study included: a) age at onset of profound HL 20 months or younger, b) 5-6 years and 11 months of age at testing, c) age at CI activation before 5 years, d) duration of CI use 12 months or greater, and e) nonverbal IQ $\geq$ 70. All participants were enrolled in auditory approach to spoken language early intervention programs that provided additional

support to parents. The following subtest scaled scores (*M = 10; SD = 2*) from the CELF-P were provided: 1) Concepts and directions (*M= 6.10; SD = 3.54*), 2) Sentence structure (*M= 6.53; SD = 3.17*), 3) Recalling sentences (*M = 5.72; SD = 3.33*), 4) Expressive vocabulary (*M = 7.85; SD = 3.89*), and 5) Word structure (*M= 5.76; SD = 3.87*). Geers reported that, on average, children with CIs performed better on a vocabulary task (Expressive Vocabulary) with 57% achieving age-appropriate scores, than compared to a connected language or a syntax task. Children with CIs received lower scores on aspects of connected language (Recalling Sentences) and syntax (Word Structure), where 33% and 29% respectively, achieved scores within 1 SD of hearing age peers or higher. The authors surmise the lower scores in syntax may reflect deficiencies in aspects of language that are difficult to hear and produce, such as, bound morphemes (e.i., –ed in *cried).* Correlation coefficients were calculated among the total standard scores of expressive and receptive vocabulary measures (*r = .82*), and Geers concluded these correlations indicate that children tended to retain their relative position across language domains. For instance, children who scored high in vocabulary also scored high in syntax-related tasks. There was also a strong correlation between early age of implantation and achieved expected mean average scores for 5- and 6-year-old children. For example, for receptive language, children who were implanted by one and a half years of age reached expected mean average scores for 5- and 6-year-old children. For expressive language, children implanted by 12 months received age expected mean average scores for 5- and 6-year-old children.

Blamey, et al., (2001) investigated 87 children with HL over a 3-year period. The CELF was administered, and the children were tested on whether they could hear and

lipread words and sentences in context, respond verbally (in some subtests), and carry out a linguistic process on the stimulus. The children were reported as learning language at about half to two-thirds the normal rate on average. They improved at a rate that was steady; however, there was a delay in acquiring language at the same rate as hearing peers. Blamey states if this delay continues there will be about a 4 or 5 year difference in language skills by 12 years of age between children with HL and hearing peers (Blamey et al., 2001).

The conclusion from these studies is children with HL are acquiring language at a steady rate, yet, not at the same rate as hearing peers. Some of the factors affecting rate of language acquisition may be acoustic access to sounds, the age of implantation, and/or type of early intervention, all of which could interplay to contribute to the trends reported for children with HL. Blamey (2001) concludes there is a need for language-based habilitation for children with HL that will enable these children to understand the subject matter that will be presented to them in secondary school.

Is a Standardized Test Enough?

For many years, the primary challenge of parents with children with HL was to have educational providers raise expectations in terms of what the capabilities of children with HL were. Today, expectations are high, yet we must understand the needs of children who, on the surface, look to have no issues based on standardized test scores. Service providers in educational settings are faced with the challenge of rationalizing the continuation of services to children with HL when standardized scores do not qualify them for services. Educators are mandated by federal law to provide a free appropriate

public education (FAPE) in the least restrictive environment (LRE), which entails providing sufficient supplementary aids and services and sufficient program modifications in the regular education setting (IDEA, 2004; P.L., 601-619, Stat. 2705). Children with HL are most likely being placed in the mainstream classroom, yet may not qualify for the language habilitation needed to succeed because of their performance on standardized tests. For instance, mainstream teachers may not be aware of the factors influencing language development (e.g., acoustic access to grammatical morphemes). The CELF is given more commonly to children with HL, but the standard scores alone may not provide us with the key information needed to understand a child's ability to hear across frequencies and acquire morphosyntactic information (See Brown's Morphemes, Table 1; Cole & Flexer, 2011, Table 2). There is reason to further investigate the CELF's effectiveness at identifying acoustic weaknesses as they may be contributing deficits in children's language development, particularly as it relates to language form (syntax/morphology).

Objectives:

The main objective of this preliminary research is to determine whether standardized testing is enough to determine eligibility for services for children with HL, and to further understand the relationship between language acquisition and hearing related factors. For this purpose the following research questions were posed:

1) Does the Core Language score on the CELF accurately reflect morphosyntactic performance?

2) What is the nature of errors that children with HL make and are there patterns in these errors?

METHODS

Participants

This study used a retrospective file analysis design. The results of 47 children with HL (20 males, 19 females, 8 nonspecified) were included in this study. These results were identified and submitted from three oral communication preschool programs in St. Louis, MO; Roseville, MN and Logan, UT. Assessments were administered between 2010 and 2013. All children included in the analysis were between 3 and 6 years of age and enrolled in early intervention programs that used auditory approaches to teach spoken language. The children had mild-to-profound conductive/mixed/sensorineural HL and subjects with bilateral and unilateral hearing loss were included. The CELF-P (Wiig, Secord, & Semel, 2004) was administered by a licensed speech-language pathologist. During the administration of the test, the children wore their personal hearing aids/cochlear implants/BAHAs (bone anchored hearing aids).

Data Analysis

An itemized analysis on the CELF-P subtests, Sentence Structure and Word Structure, was performed using SPSS version 22. Each item was coded as correct, incorrect or not administered. Individual performances on each subtest are illustrated in Figure 3 and Figure 4.

RESULTS

Question 1: Does the Core Language score on the CELF accurately reflect morphosyntactic performance as measured by the Core Language Standard Scores?

Core Language Standard Scores

None of the children with HL had standard scores > 2 SDs above normal; however, ten children had standard scores < 2 SDs below average on the CELF-P (see Table 3 for results of children with HL on the CELF-P). Figure 1 illustrates the mean results of the CELF-P test, with the children ranging from lowest to highest performers (left to right). The range of Core Language standard scores on the CELF were from 45 to 112. Table 4 shows the mean results of the CELF-P broken out by age group of children. On average, children with HL demonstrated skills that were within normal limits (*M = 86.79, SD = 17.98)* when compared to norms provided on the CELF-P (see Table 4). As shown in Figure 1, 27 children were within normal limits (i.e., a standard score of 85-115), none were above normal limits (i.e., a standard score over 115), and 20 were below normal limits (i.e., a standard score below 85), ten of which were 2 SD below normal limits (i.e., a standard score below 70).

Language Structure Index Standard Scores

On average, children with HL demonstrated skills that were below normal limits (*M = 83.30, SD = 18.34*) when compared to norms provided on the CELF-P. As shown in Table 3, 16 children were within normal limits (i.e., score of 85-115), and 31 children were below normal limits (i.e., a standard score below 85).

A paired-sample t-test was used to compare scores on the Core Language composite score (*M= 86.79; SD= 17.98*) and the Language Structure composite score (*M= 83.30; SD=18.34*). There was a statistically significant difference between these scores *t(46)=5.254 (p=.000)*. Figure 2 illustrates the performance of the age group of children on the CELF Core Language compared to Language Structure.

Sentence Structure Scaled Score

Results of the item analysis were analyzed in terms of overall percentage of children who incorrectly answered each item and the language structure tested. (see Table 7). The mean scaled score results for each subtest is shown in Table 5 and 6. Figure 3 illustrates The Sentence Structure subtest results by number of items correct, incorrect and not answered by each child; children's scores are displayed in same order as in Figure 1, based on lowest to highest scores. The children's scaled scores range from 1-13 with normal limits being between 8 and 12. On average, children with HL were within normal limits (*M = 8.47, SD = 3.19*) when compared to the norms provided on the Sentence Structure subtest of the CELF-P (*M = 10, SD = 2*). As shown in Figure 6, 24 children were within normal limits (i.e., a scaled score of 8-12*)*, five were above normal limits (i.e., a scaled score above 12), and 18 were below normal limits (i.e., a scaled score below 8). Additional information about individual performance is shown in Figure 3.

Word Structure Scaled Score

Results of the item analysis were analyzed in terms of overall percentage of children who incorrectly answered each item and the language category tested (see Table

8). The children's scaled scores range from 1-13 with normal limits being between 8 and 12. On average, children with HL were below normal limits (*M = 6.70, SD = 3.7*) when compared to the norms provided on the Word Structure subtest of the CELF-P *(M = 10, SD = 2*). As shown in Figure 7, 21 of the children were within normal limits (i.e., a scaled score of 8-12), one child was above normal limits (i.e., a scaled score above 12), and 25 children were below normal limits (i.e., a scaled score below 8). Additional information about individual performance is shown in Figure 4.

Preliminary t-test indicated there was no significant difference between the performances of early intervention programs except on four items (SS18, SS21, SS4, and WS8). SS18 structure of copula (*is ready*), and SS21 structure of subordinate clause (*although she doesn't need it*) were insignificant when age difference was accounted for, leaving only two items that differed. These were test items SS4 structure of modifications (*big, spotted, black, white*), and WS8 category of objective pronoun (*him*).

Intercorrelations between the Core Language Standard Score and norm-referenced subtests, Sentence Structure and Word Structure, were provided by the authors of the CELF-P (Wiig, Semel, & Secord, 2004).The correlation between Core Language Standard Score and Sentence Structure (*r= .62)* and Word Structure *(r= .5)* were moderate-to-high association between the composite score and the norm-referenced subtests based on the performance of children with normal hearing. The intercorrelation between the Core Language Standard Score and the Word Structure subtest for children with HL indicated a high positive association (*r = .9)*.

Summary

On average, children with HL scored within the low normal limits on the Core Language CELF-P; however, individual performance on each subtest varied between subjects. On average, the subjects were within the lower normal limits for subtest Sentence Structure (*M = 8.47*), which determines correct syntax structure, and below normal limits on the subtest Word Structure (*M = 6.70*), which determines morphological skills. As shown in Figure 5, age does not appear to be a factor in morphosyntactic acquisition since both younger and older groups of children were below normal limits on both subtests. The statistical significant difference between Core Language and Language Structure standard scores (*p=.000*) indicates that children with HL's language difficulties may be based in inadequate acquisition of linguistic rules and structures (language structure). Therefore, it may be assumed the CELF-P does not accurately reflect morphosyntactic skills of children with HL as measured by the Core Language standard scores alone.

Question 2: What is the nature of errors that children with HL make and are there patterns in these errors?

Sentence Structure

Table 7 summarizes the item analysis for the CELF-P subtest Sentence Structure, the percentage of children who answered incorrectly is listed from lowest to highest (top to bottom). The test item number, percentage of children who missed the item, category target and example, and number of children who answered the item are listed in columns

(left to right). Results of the item analysis show more than 50% of the children answered the following structures correctly: copula (*is sleepy*), verb condition (*is*, *can*, *will*), prepositional phrase (*in the wagon*), modification (*big, white*), negation (*not*), infinitive (*to bake, to go*), compound sentences (*and, but*), relative clause (*who is*), and indirect object (*the dog*). More than 50% of the subjects answered the following structures incorrectly: indirect request (*shouldn't you*), subordinate clause (*although, before*), prepositional phrase (*toward*), and passive (*is being followed, is being pushed*).

Word Structure

Table 8 summarizes the item analysis for CELF-P subtest Word Structure. The percentage of children who answered incorrectly is listed from lowest to highest (top to bottom). The test item number, percentage of children who missed the item, category target and example, and number of children who answered the item are listed in columns (left to right). Results of the item analysis show more than 50% of the children with HL answered the following categories correctly: progressive *–ing* (*walking, sleeping*); preposition (*in/inside*); contractible copula (*it is*), objective and subjective pronoun (*her, he* and *she*); uncontractible/auxiliary copula (*she is*); superlative derivational form (*fastest*); and future tense (*will slide*). More than 50% of the subjects answered the following categories incorrectly: objective and reflexive pronoun (*him, herself*); regular plural (*horses*); possessive noun (*king's*); comparative derivational form (*faster*); third person singular (*flies*); possessive pronoun (*hers*); noun derivation (*singer*); irregular past tense (*blew, flew*); regular past tense (*climbed*); and uncontractible/auxiliary copula (*they are*).

Error patterns

Children with HL commonly missed the phoneme /s/ in the following morphemes: plurals, possessives, and third person singular. Regular past tense *–ed* and irregular past tense were also morphemes missed frequently by children with HL.

Conclusion

As shown in Table 2, phoneme */s/* is a high frequency sound that may not be as salient to children with HL. The position of past tense *–ed* in the middle of the sentence also diminishes the emphasis placed on the phoneme */d/* (Moeller, 2010). The error patterns noted on the CELF-P indicate a need for intervention to help children with HL to recognize and use morphosyntactic structures in language.

DISCUSSION

In summary, the goal of this paper was to determine whether the CELF assessment is sensitive to the language needs of children with HL population. Results showed that the average performance of children with HL on the CELF-P were within normal limits; however, when investigated further, key language markers were not demonstrated. The error patterns noted from the performance of children with HL on the CELF-P do not follow patterns of typical developmental language acquisition (see Table 1). Therefore, educators must go beyond developmental milestones and consider the acoustic influences of language development of children who do not recognize plurals, possessives, past tenses, and verb tenses. Blamey suggests ongoing intervention is needed

to ensure the success of children with HL in secondary schools (Blamey et al., 2001). This study confirms Blamey's findings and suggests key information that may be explicitly targeted in intervention. Suggestions for intervention should include morphemes that contain the phoneme */s/* and past tense */d/* because these are not as acoustically salient (e.g., these phonemes are produced in higher speech frequencies and their placement at the end of words is less emphasized in speech). Thus, these phonemes are often not recognized in connected speech by children with HL. Item analysis on the CELF helps professionals to better identify patterns as well as explicitly address them in intervention.

Assessments are commonly used to assess progress and development of children with HL in the schools. In fact, they are also commonly the basis of qualifying criteria. Although it is recommended that children with HL should take these tests which provide information on language performance compared to age matched hearing peers; the composite scores (such as the Core Language score) alone may not provide enough information about the errors made. If services are dependent solely on standardized scores then intervention may not be provided to address deficits in language that may be unique to this population. Based on the criteria children who score >2 SD below the mean qualify for intervention, only 10 children from this study qualified for services. However, the results showed 28 children missed crucial language markers. It is therefore imperative to obtain criteria-based information on the language performance of children with HL to ensure they receive the targeted intervention they need. Based on the information found in this study, the Word Structure subtest may be much more sensitive in identifying how a child is performing on morphological development, an area of potential weakness in

children with HL. The following are suggestions that may be taken into consideration along with the CELF to qualify a child with HL for services:

Item analysis: To better understand specific gaps that a child might have, examine the items missed on the standardized language assessments. Note trends and determine if there is a pattern in the errors. For example, a child who is missing plurals, possessives and first person singular verbs may not have full access to high frequency sounds. This type of information may be very useful for an audiologist because a child may have a particular weakness that a specific subtest may show more than the summative scores.

Language Samples: Use language samples and criterion-based assessments to supplement information obtained on standardized assessments. Monthly language samples help to demonstrate what a child is producing in spontaneous interactions. This may reveal that the child is able to produce the morphemes in individual therapy but not in fluent speech. The educational team may want to discuss the use of an FM system to ensure that the child has access to less acoustically salient morphological markers in noisy classroom environments.

Alternative assessments: Use of assessments focused on assessing literacy and narrative skills might provide supplemental information about the child's ability to produce and understand language skills as a prerequisite for later language acquisition. As a child produces more complex language or recruits more cognitive attention to language, it is important to monitor if morphological use is maintained or regresses.

Response to Intervention (RTI): RTI services are becoming more of a possibility for children who are considered borderline but do not qualify for individual services. Working with educational providers to better understand specific targets, creating criteria

and timelines for accomplishment of those targets and implementing action plans if those targets are not met may be a way to continue to closely monitor a child's continuing language and communication development without serving them individually.

Study Limitations

There were several limitations to this study that could affect the clinical implications. First, because this was a "first glance" study to examine broad trends of preschool children with HL, no background information was known for the children who attend oral communication preschool programs in St. Louis, MO and Roseville, MN. Also, gender, type of HL, age of hearing, quality of hearing aid fitting, duration of use, and bandwidth of the hearing aids, were not known for these subjects. Analysis was done to see if there were differences between the Logan, UT preschool program and St, Louis, MO and Roseville, MN programs, resulting in no significant differences in performance between the groups of students on the CELF-P. All of the children at the early intervention preschool were included regardless of their age of identification, device experience, and length of intervention. The purpose of each of the preschools was to provide extensive service and support to families and children. Consequently many families with children who had complicated histories or who had limited progress in other settings chose to come to this preschool. As a result, there was a high variability of skills among the children. Consequently, cognitive deficits may be another contributing factor to be taken into consideration as well.

Clinical Implications

Despite the limitations of the study several implications can be drawn from the results. First, children with HL are performing within standard limits on the assessment CELF-P. Second, the standardized scores are not reflecting the morphosyntactic errors in language children with HL are making. Next, children with HL are not following the early childhood age of language acquisition norms stated by Brown (1973; see Table 1). Finally, further investigation into error patterns made by children with HL is necessary to ensure deficits are not overlooked. Educational providers and parents are met with new challenges as children with HL surpass previous expectations of what was possible. With educational laws such as IDEA 2004 supporting the concept of children leading independent and productive lives to the maximum extent possible.

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Table 1: 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"

Table 2: Speech Information Carried By The Key Speech Frequencies 250 – 4000 Hz. Adapted from Cole & Flexer, 2011.

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

Table 3: Children With HL Performance On The CELF-P.

Children with HL Performance on the CELF-P					
Children age groups in months		**CORE Language Scores**	**Language Structure Index**	**Sentence Structure Subtest (Mean=10)**	**Word Structure Subtest (Mean=10)**
36-48	**Mean**	**83**	**83.33**	**7.50**	**7.00**
	N	**6**	**6**	**6**	**6**
	Std. Deviation	**24.017**	**21.851**	**4.037**	**4.050**
49-60	**Mean**	**88.75**	**85.50**	**8.56**	**7.63**
	N	**16**	**16**	**16**	**16**
	Std. Deviation	**18.687**	**18.687**	**3.366**	**3.998**
61-72	**Mean**	**86.39**	**82.26**	**8.74**	**6.09**
	N	**23**	**23**	**23**	**23**
	Std. Deviation	**17.593**	**18.638**	**3.078**	**3.592**
73-75	**Mean**	**87**	**77.50**	**7.50**	**5.50**
	N	**2**	**2**	**2**	**2**
	Std. Deviation	**1.41**	**6.364**	**.707**	**.707**
All Ages	**Mean**	**86.79**	**83.30**	**8.47**	**6.70**
	N	**47**	**47**	**47**	**47**
	Std. Deviation	**17.98**	**18.343**	**3.195**	**3.706**

Table 3 (From left to right). Column 1 presents subjects broken out into age groups as well as overall combined group performance. The mean and standard deviation are listed as the following: Column 2, Core Language standard scores; Column 3, Language Structure Index standard scores; Column 4, Sentence Structure subtest; and Column 5, Word Structure subtest.

Table 4: CELF-P Standard Score (Mean=100) By Age Group For Sample Of Children With HL (N=47).

Age Group (months)	CELF-P CORE LANGUAGE Standard Score			
	N	Standard Score	Standard Deviation	Range
36-48	6	83.00	24.017	45-104
49-60	16	88.75	18.303	57-112
61-72	23	86.39	17.593	50-112
73-74	2	87.00	1.414	86-88
TOTAL	47	86.79	17.981	45-112

Table 5: CELF-P Sentence Structure Subtest Scaled Score (Mean =10) By Age Group For Sample Of Children With HL (N=47).

Age Group (months)	CELF-P Sentence Structure Subtest Score			
	N	Scaled Score	Standard Deviation	Range
36-48	6	7.5	2	1-11
49-60	16	8.1	2	3-13
61-72	23	9.2	2	3-19
73-74	2	7.5	2	7-8

Table 6: CELF-P Word Structure Subtest Score (Mean=10) By Age Group For Sample Of Children With HL (N=47).

Age Group (months)	CELF-P Sentence Structure Subtest Score			
	N	Scaled Score	Standard Deviation	Range
36-48	6	7	2	1-11
49-60	16	7.1	2	1-12
61-72	23	6.1	2	1-13
73-74	2	5.5	2	5-6

Table 7: Sentence Structure Item Analysis

Item Number	Percentage missed (# missed/N)	Item Testing (example)	N = number of subjects answered
SS1	**2**	**Copula** *(is sleepy)*	**47**
SS3	**2**	**Verb Condition** *(is running)*	**47**
SS2	**4**	**Prepositional Phrase** *(in the wagon)*	**47**
SS4	**17**	**Modification** *(big, spotted, black, white)*	**47**
SS6	**17**	**Negation** *(not)*	**47**
SS8	**19**	**Verb Condition** *(will find)*	**47**
SS11	**23**	**Verb Condition** *(can get)*	**47**
SS5	**28**	**Infinitive** *(to bake)*	**47**
SS7	**28**	**Prepositional Phrase** *(in the box)*	**47**
SS13	**30**	**Compound Sentences** *(She is climbing and he is swinging)*	**47**
SS10	**34**	**Relative Clause** *(who is sitting under the big tree)*	**47**
SS14	**34**	**Relative Clause** *(who is holding the baby)*	**47**
SS18	**42**	**Infinitive** *(to go)*	**45**
SS16	**43**	**Indirect Objective** *(the dog)*	**46**
SS12	**47**	**Relative Clause** *(Who is standing in front of the line)*	**47**
SS19	**52**	**Indirect Request** *(Shouldn't you wear your jacket?)*	**44**
SS21	**53**	**Subordinate Clause** *(although she doesn't need it)*	**43**
SS15	**55**	**Prepositional Phrase** *(toward the girl)*	**47**
SS20	**57**	**Compound Sentence** *(The first two children are in line, but the third child is still playing)*	**44**
SS17	**60**	**Passive** *(is being pushed)*	**45**
SS9	**62**	**Passive** *(is being followed)*	**47**

Table 8. Word Structure Item Analysis

Item Number	Percentage missed (# missed/N)	Item Testing (example)	N=number of subjects answered
WS1	**4**	**Progressive *-ing*** *(sleeping)*	**47**
WS3	**9**	**Preposition** *(in/inside the box)*	**47**
WS2	**13**	**Progressive *–ing*** *(walking)*	**47**
WS5	**21**	**Preposition** *(on the chair)*	**47**
WS7	**30**	**Copula –Contractible** *(It is big)*	**47**
WS6	**36**	**Pronoun –Objective** *(her)*	**47**
WS20	**39**	**Pronoun –Subjective** *(She does)*	**36**
WS21	**39**	**Copula – Uncontractible/Auxiliary** *(She is)*	**36**
WS19	**47**	**Derivational form – superlative** *(fastest)*	**36**
WS14	**48**	**Pronoun –subjective** *(He is)*	**42**
WS15	**48**	**Future tense** (will slide)	**42**
WS8	**51**	**Pronoun –Objective** *(him)*	**47**
WS16	**53**	**Pronoun –Reflexive** *(herself)*	**38**
WS10	**58**	**Regular Plural** *(horses)*	**45**
WS12	**58**	**Possessive Noun** *(king's)*	**43**
WS18	**58**	**Derivational Form – Comparative** *(faster)*	**36**
WS11	**60**	**Third Person Singular** *(flies)*	**45**
WS4	**60**	**Pronoun –Possessive** *(hers)*	**47**
WS13	**63**	**Noun Derivation** *(singer)*	**43**
WS23	**64**	**Irregular Past** *(blew)*	**36**
WS9	**68**	**Third Person Singular** *(sleeps)*	**46**
WS17	**75**	**Regular Past Tense** *(climbed)*	**36**
WS24	**80**	**Irregular Past Tense** *(fell)*	**35**
WS22	**83**	**Copula-Uncont./Auxiliary** *(They are)*	**36**

Figure 1A: Areas Of Assessment By The CELF

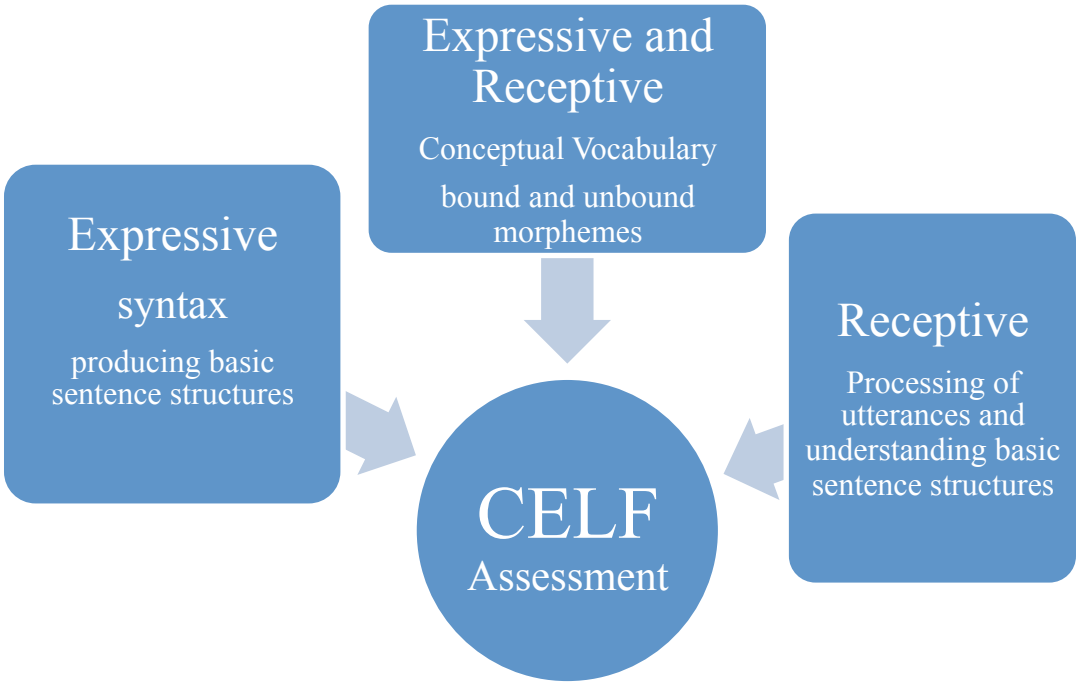
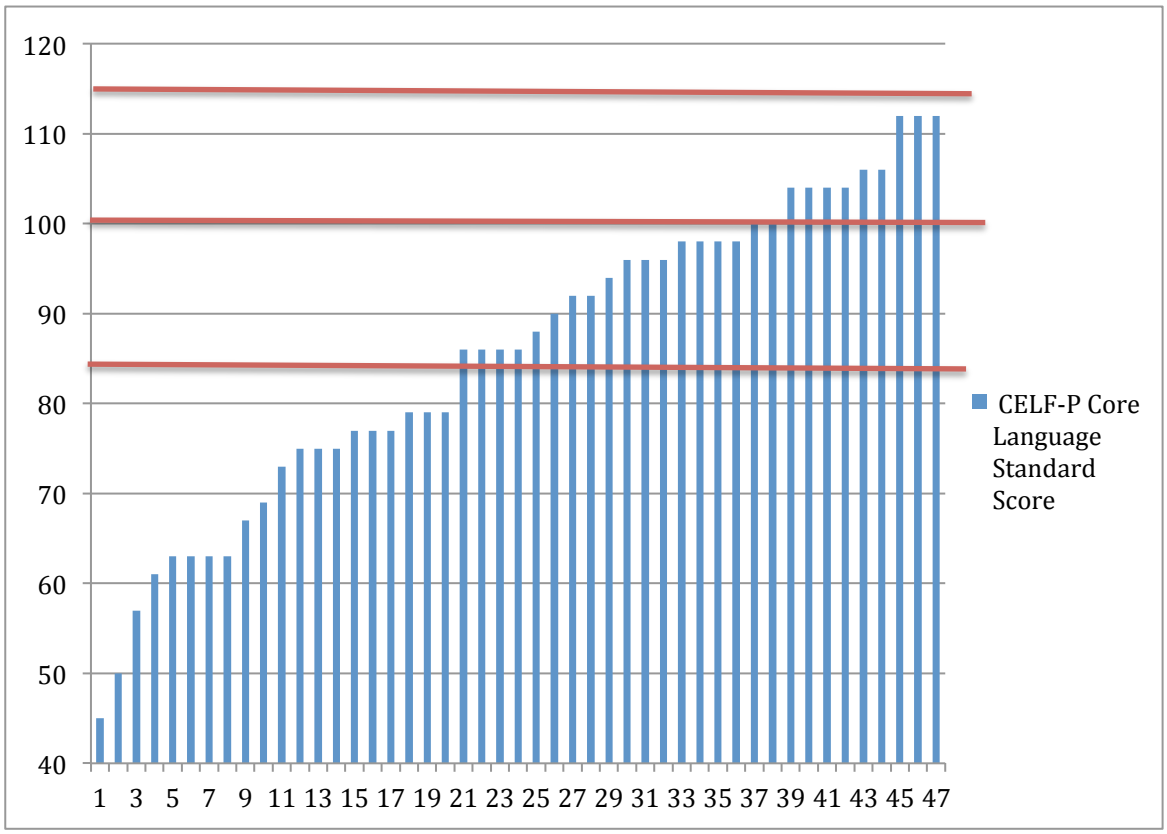
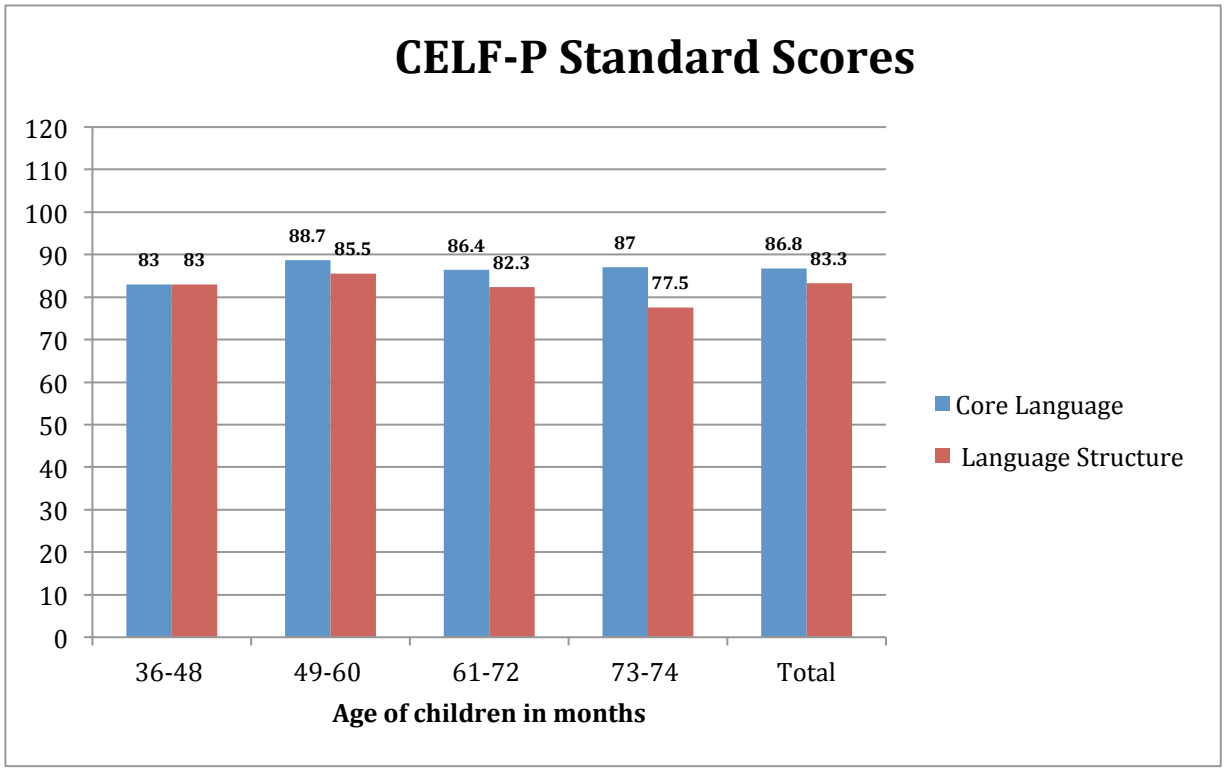


Figure 1: Individual Performances On The Core Language Score Of The CELF-P.



Children's scores are displayed based on lowest to highest scores on CELF-P.

Figure 2: Comparison Of Children With HL Performance On Core Language Vs. Language Structure On The CELF-P



(From left to right) The subject groups are listed in months from youngest to oldest, with the last column representing the entire group's performance on each standard test. The blue bars represent the mean standard scores for Core Language and the red bars represent the mean standard scores for Language Structure. All of the groups, except the youngest, performed slightly better on the Core Language Standard test than compared to the Language Structure Standard test. The youngest group's average scores were the same for both standard tests.

Figure 3: Individual Performance Of Children With HL On The Sentence Structure Subtest Of The CELF-P.

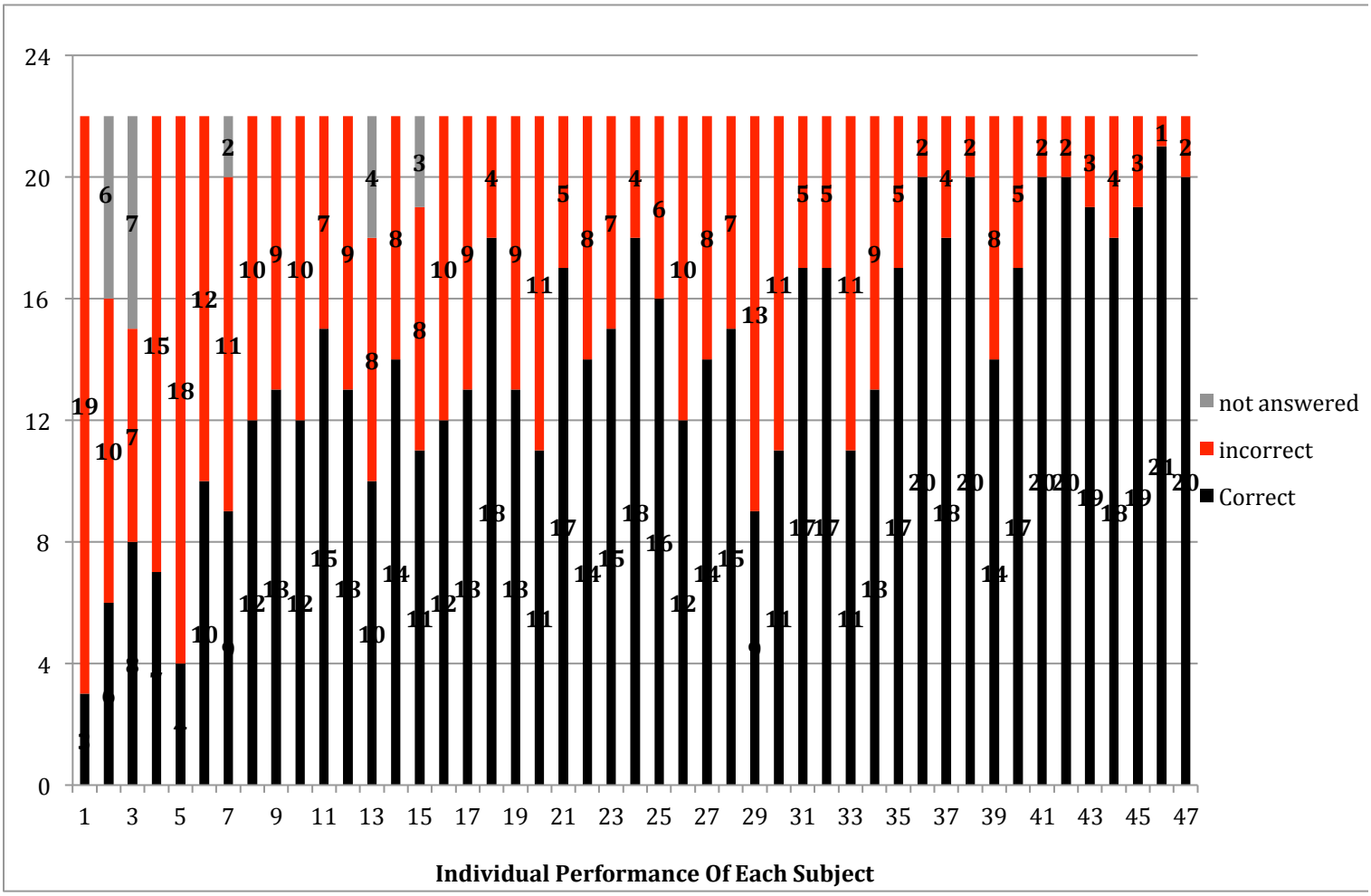


Figure 3 represents raw scores on the Subtest Sentence Structure. Children's scores displayed in same order as Figure 1, based on lowest to highest scores on the CELF-P. Black represents number of correct answers, red are incorrect, and gray are not answered.

Figure 4: Individual Performance Of Children With HL On The Word Structure Subtest Of The CELF-P.

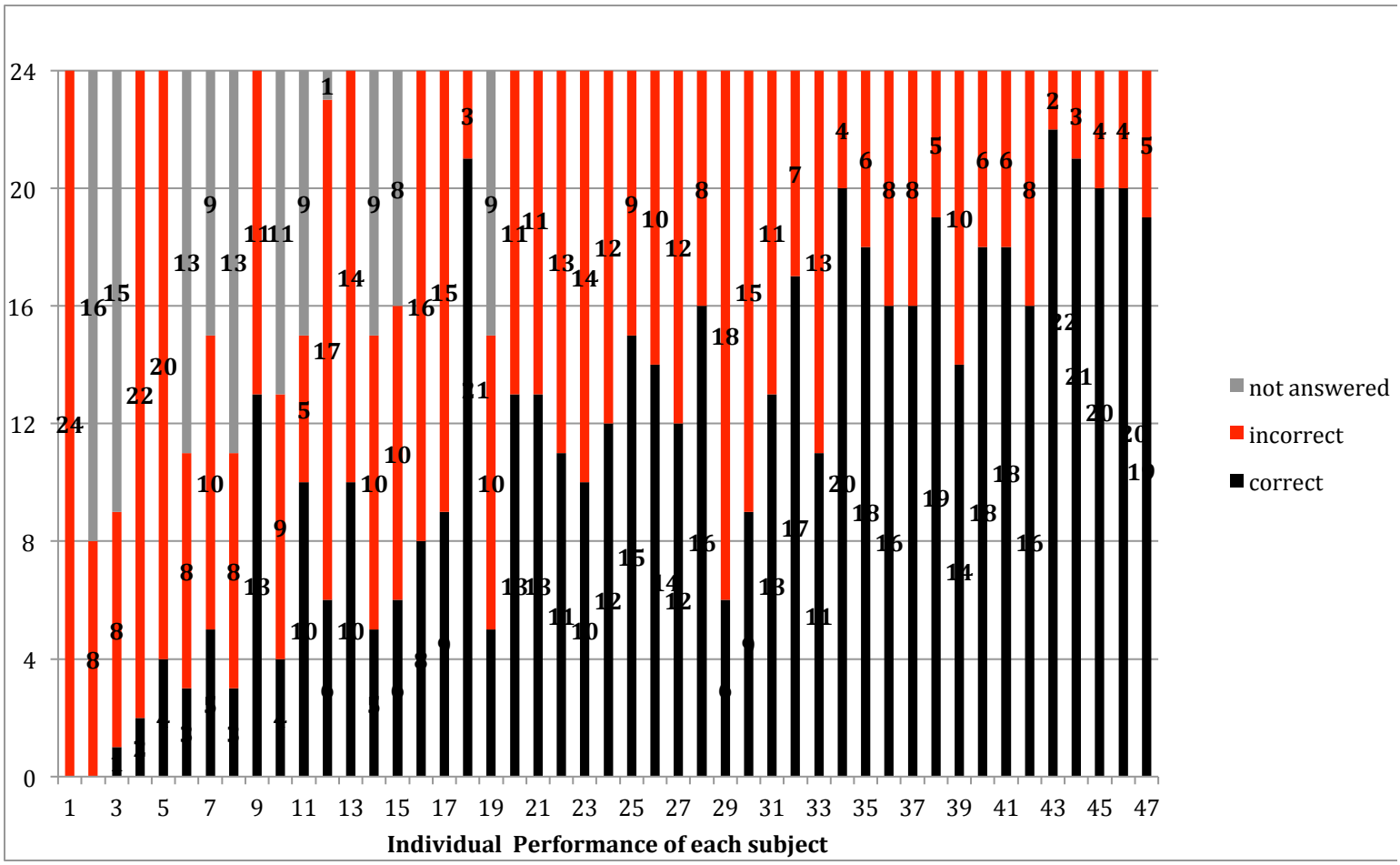
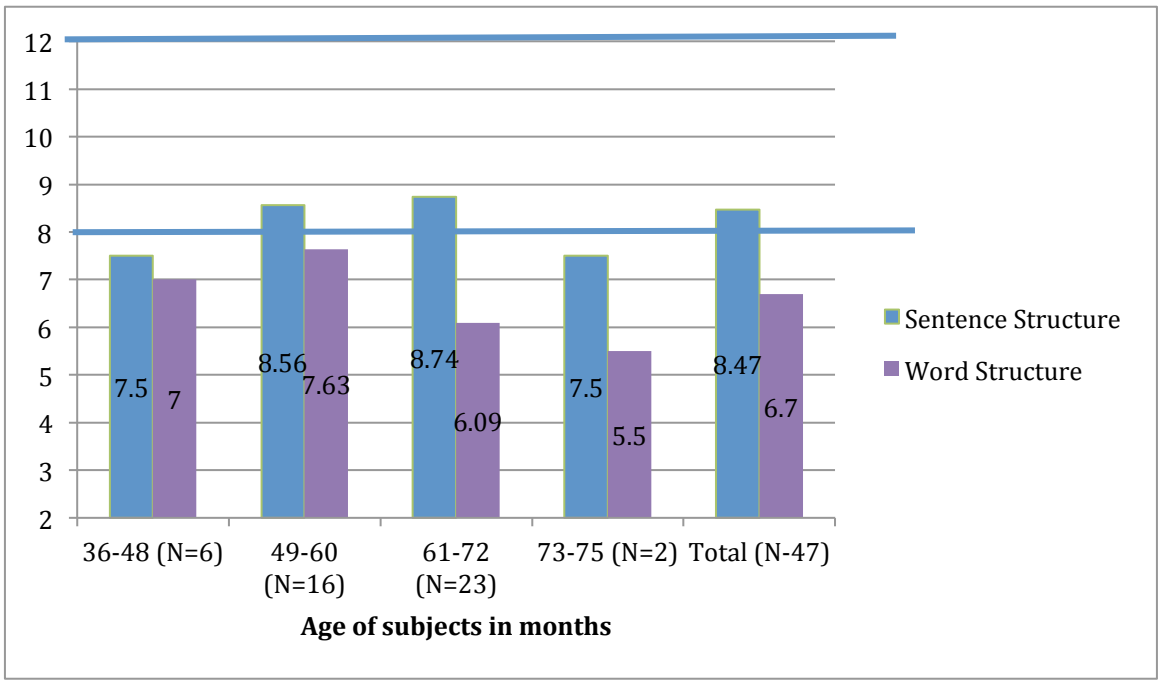


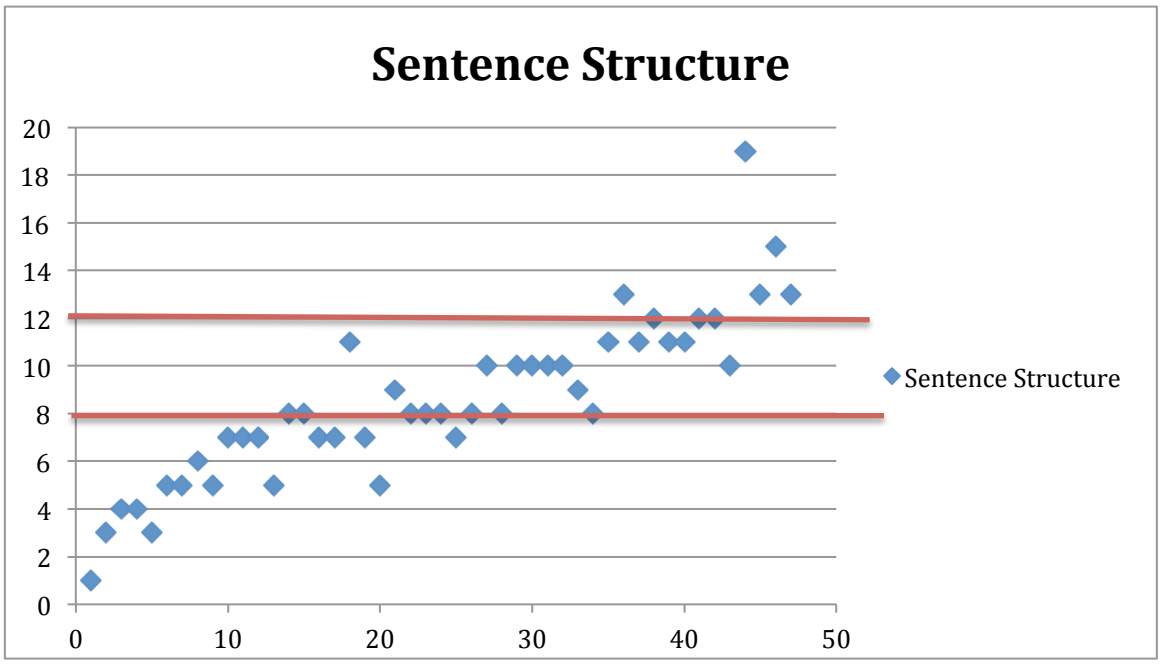
Figure 4 represents raw scores on the Subtest Word Structure. Children's scores displayed in same order as Figure 1, based on lowest to highest scores on the CELF-P. Black represents number of correct answers, red are incorrect, and gray are not answered.

Figure 5: Average Scaled Scores Of Age Groups On Subtests Sentence Structure And Word Structure (*M = 10).*



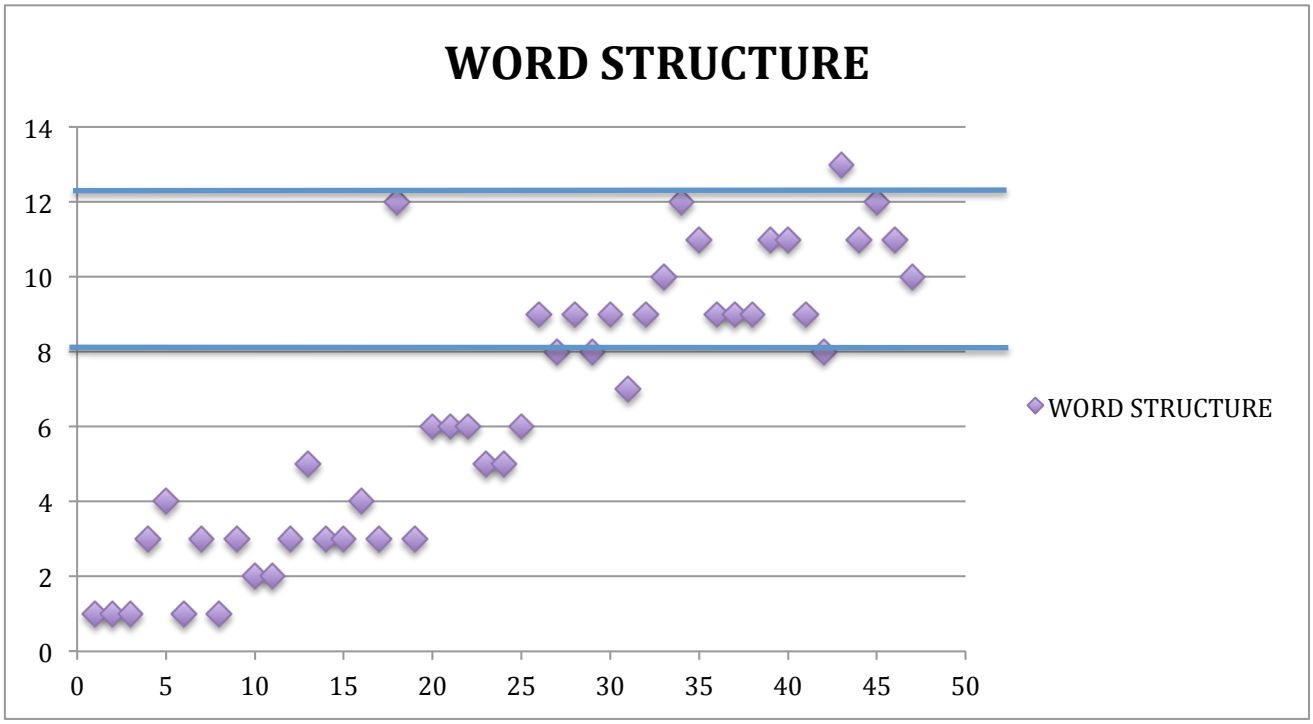
(From left to right) The subject groups are listed in months from youngest to oldest, with the last column representing the entire group's performance on each subtest. The blue bars represent the mean scaled scores for Sentence Structure and the purple bars represent the mean scaled scores for Word Structure. All of the groups performed better on Sentence Structure subtest than compared to the Word Structure subtest. The mean scale score of all subjects' performance on the subtest Sentence Structure is in the low average range. However, only the age groups 49-60 and 61-72 performed in the low average range (8-12), the other groups were below average (8 <) in performance for both subtests Sentence Structure and Word Structure. The mean scale scores of all groups were below average performance on the Word Structure subtest.

Figure 6: Sentence Structure Scaled Scores For Each Participant.



Sentence Structure scaled scores are plotted for 47 preschool children between the ages of 3 and 6 years old. Children's scores are displayed in same order as in Figure 1, based on lowest to highest scores on CELF Core Language. The red lines indicate the point at which the expected scaled score is within age-appropriate range.

Figure 7: Word Structure Scaled Scores For Each Participant.



Word Structure scaled scores are plotted for 47 preschool children between the ages of 3 and 6 years old. Children's scores are displayed in same order as in Figure 1, based on lowest to highest scores on CELF Core Language. The blue lines indicate the point at which the expected scaled score is within age-appropriate range.

VITAE

Angela Anderson

CAREER OBJECTIVE

To obtain a position as a Speech-Language Pathologist

EDUCATION:

B.S. in Communicative Disorders and Deaf Education , Utah State University, Logan, Utah (May 2012) GPA: 3.67. M.S. in Speech-Language Pathology, Utah State University, Logan, Utah (expected May 2014). Current Graduate GPA: 3.89.

CLINICAL EXPERIENCE:

Pediatric practicum: articulation, language, hearing screenings, outpatient evaluations: Estimated clock hours: 520 hours. Adult practicum: dysarthria, TBI, CVA, aphasia, and severe communication impairment: Estimated clock hours: 170 hours.

RESEARCH AND LEADERSHIP EXPERIENCE

Member of the National Student Speech Language Hearing Association. Completed over 450 observation and participation hours in didactic, clinical, and research. Second author of poster presentation for 2012 Undergraduate Research on Capitol Hill: Early Identification and Literacy Performance in Preschool Children with Hearing Loss. Expected presenter of Poster Presentation, Early Hearing Detection and Intervention (EHDI) Conference, April 2014. Will present on Assessment of Morphosyntactic Development of Preschool Children with Hearing Loss Using the CELF-P measure.