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An analysis of grammatical errors by children with cochlear implants

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AN ANALYSIS OF GRAMMATICAL ERRORS BY CHILDREN WITH COCHLEAR IMPLANTS

by

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Abstract: Spontaneous writing samples of deaf children with cochlear implants were analyzed for syntactic errors and other descriptive characteristics. These results were compared to a small sample of writings from hearing children.

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Epigraph

“In the context of today’s “information revolution”, society grows increasingly dependent on literacy skills. Without writing, all those activities that depend on a degree of permanence and displacement-such as religion, law, philosophy, grade, and education-are severely limited. Given its critical role, deficiency in written language limits education, employment, and recreational opportunities” (Musselman & Szanto, 1998).

Introduction

Writing is one of the most complicated and complex skills for students to master. The task of writing is difficult for a number of reasons. Students are required to produce letters, words, and sentences that can be comprehended by an audience. This means that children must know how to spell and use punctuation, as well as choose vocabulary and utilize syntactical structures. As the writing level increases, students must be able to effectively select topics, plan, and organize ideas (Anita, Reed, & Kreimeyer, 2005). Not only is writing difficult for hearing children, it also imposes difficulties for children who are deaf and hard of hearing (Powers & Wilgus, 1983).

Although writing can be difficult, its importance should not be overlooked, especially within the deaf population. A survey of college graduates who were deaf from National Technological Institute for the Deaf (NTID) was conducted in order to examine how much the alumni relied on writing in their employment (Biser, Rubel, & Toscano, 2007). The results indicated that writing was a critical component of the vast majority of jobs that college graduates who were deaf accepted. In addition, their employers reported that good writing skills are required for a promotion, thus signifying that writing is extremely important, even outside of academic environments.

In order to help describe written language of children with cochlear implants, I will first describe general findings of spoken language skills for children who are deaf. Studies have shown that school-aged deaf children have poorer syntax skills in spoken English than their hearing peers. (Schorr, Roth, & Fox, 2008; Young & Killen, 2002). It stands to reason that if children who are deaf struggle with syntax in their spoken language, then they would also

struggle with syntax in written language. Children with a hearing impairment have also been found to have a narrower range of receptive (e.g., Hayes, Geers, Treiman, & Moog, 2009) and expressive spoken vocabulary (e.g., Johnson & Goswami, 2010) than hearing peers. Thus it would not be surprising to see limited vocabulary use in written language.

How do children who are deaf compare to hearing peers in written language? Studies have shown that writing skills of children who are deaf are below that of hearing peers (deVilliers, 1991). One study that examined expository writing of children with cochlear implants documented that 17 to 18-year-old students' written language resembles the writing of hearing children between the ages of 9 and10 years of age (Paul 2001). Also, students who were deaf produce shorter writings with fewer complex sentences than hearing children (Marschark, Mouradian, & Halas, 1994). However, another study found that children who were deaf have been found to write more complex written language when required to produce an argument when compared to writing a narrative, description, or expository essay (Schick, 1997). Another study found that, if written material consisted of less formal matter such as stories of personal narratives, the writing of students who were deaf closely resembled that of hearing peers (Marschark et al., 1994).

In addition to writing shorter and fewer complex sentences, children who are deaf also have been reported to have difficulty with cohesion, or logic interconnection, of ideas in writing. Yoshinaga-Itano and Downey (1996) found that some children who were deaf could communicate main ideas, but they failed to elaborate and provide supporting details. Maxwell and Falick (1992) examined written essays of children who were deaf and hard of hearing

between fourth and eighth grade and found that their use of lexical cohesions consisted mainly of word repetitions.

One other major area that children who are deaf have difficulty with has been the syntactical structures of sentences in written language. Yoshinaga-Itano and Downey (1996) found that the frequency of production of several syntactical structures differed significantly between children who were deaf and hearing children. Research has reported that deaf and hard of hearing children make positive growth in the use of syntactical structure with increasing age (Heefner & Shaw, 1996). However, children who are deaf continue to lag behind hearing peers in syntactic constructions into adolescence (Anita et al., 2005).

Few researchers have investigated the variables that affect written language of children who are deaf. Musselman and Santo (1998) found that children who use the auditory-oral mode of communication scored higher than students who used sign language on all subtests on the Test of Written Language. The researchers did note that 14 of the 15 auditory-oral students were in general education classrooms while 37 of the 45 students who used sign language were educated in segregated classrooms, thus acknowledging that placement could potentially be a confounding factor in why the oral children performed better than the signing children. Another study found that there was an increased delay in written language with an increased degree of hearing loss (Yoshinaga-Itano & Downey, 1996). These researchers found that students with mild-moderate hearing losses were delayed in written language compared to hearing peers up to age 13, but showed similar performance by high school. Students with moderate and greater hearing loss made progress with age, but showed delays in written language compared to hearing peers at all ages. This delay became progressively greater as the hearing loss increased. By high school (age

15 to 16 years), the children with severe-profound hearing losses were reported to show writing skills similar to hearing students who were 9 and 10 year olds.

To summarize, research has shown that children who are deaf have poorer writing skills than normal hearing peers: children who are deaf write shorter sentences, fewer complex sentences, have difficulty with cohesion of ideas, and struggle with syntax. However, what specific grammatical structures pose a threat to the performance of children who are deaf and their written language? To my knowledge, this question has not been fully explored.

The objective of this paper is to examine the specific grammatical errors that children with cochlear implants generate in their spontaneous writing. With this information, teachers can focus on specific structures that should be targeted in classroom instruction. It is good to know *that* children who are deaf have trouble with syntax in their writing, but it is more beneficial to know what types of errors they tend to make. The current study has 3 goals: to describe the characteristics of spontaneous writing samples by children who are deaf, to describe the types of errors children with cochlear implants produce, and to measure progress over time.

Participants

The participants in this study initially came from data collected by Treiman and Hayes as a part of a larger study investigating spelling skills in children with cochlear implants (Hayes, Kessler, & Treiman, 2011). Oral schools for the deaf across the United States were asked if their teachers would be willing to give the researchers access to spontaneous writing samples that their students produced as a part of everyday classroom activities. The following schools agreed to participate: The Moog Center for Deaf Education (St. Louis, MO), Central Institute for the Deaf (St. Louis, MO), St. Joseph Institute for the Deaf (St. Louis, MO), Child's Voice (Chicago, IL),

Desert Voices Oral Learning Center (Phoenix, AZ), and Sunshine Cottage School for Deaf Children (San Antonio, TX).

Participants included 52 children with cochlear implants who used oral communication. The children ranged in age from 5 years 11 months to 11 years 8 months. Twenty-six of the subjects were male. Duration of implant use ranged from 11 months to 7 years, with a mean of 5 years implant use.

A small number of hearing children also participated in the study (N = 5). The hearing children were educated within an oral school for the deaf, sometimes referred to as a reverse-mainstream setting. All of the hearing participants attended Sunshine Cottage School for Deaf Children. The hearing children were in third grade and were between the ages of 8 and 9 years. There were three boys and two girls.

Procedure

Each school was sent a packet of information, including postage-paid envelopes. The teachers were asked to send spontaneous writing samples they elicited in the classroom as part of their weekly writing activities, two times per month. Detailed instructions given to the teachers can be found in the Appendix. In essence, the teachers were asked to submit samples that had not been corrected and to not provide help to the children on spelling, syntax, or mechanics. Teachers then asked the children to read their writings aloud and the teachers noted any pronunciation differences between what the child said and what he wrote. The teacher filled out a brief questionnaire form with each batch of samples, providing information about changes in the child's audiological characteristics.

Scoring method

Each participant's sentences were entered into an Excel spreadsheet by research assistants in the Treiman lab. The following describes my approach to error analysis. First, I read each sentence to determine if the sentence was grammatically correct or incorrect. I knew what each child intended to say because the teachers who provided the writing samples wrote down the students' intentions. Spelling errors were not analyzed in this study. If an error was present (i.e., the sentence lacked grammatical unity), then a color coded note was attached to the end of the sentence. I marked what type of error took place (substitution, omission, or addition) and described the nature of the error (e.g., substituted a noun for a verb). After each sentence was analyzed, I reviewed each individual sentence to recheck my judgment as well as to make a tally to measure the proportion of errors. After each sentence was examined twice, the data were compiled into another Excel document. The following results were obtained.

Results

Both groups of participants submitted 455 writing samples containing 2,630 sentences. The children who were deaf submitted 445 writing samples (mean number submitted = 9.25). The five hearing children had two submissions each.

My first objective was to provide a description of the characteristics of the students' writings. As shown in Table 1, children with cochlear implants wrote shorter sentences than the hearing children. Although the participants who were deaf had a lower mean length of sentence compared to the hearing children, the maximum number of words per sentence for each group was similar. Children with cochlear implants had a lower average minimum number of words per sentence than the hearing group (4.5 compared to 6). It should be noted that the hearing

participants were educated in the same setting as the children with cochlear implants, in an oral school for the deaf. With the same overall type of instruction, the hearing children produced more words per sentence on average than the children who were deaf.

To describe the lexical diversity of the children's writing samples, I calculated a type-token ratio for each group. Type-token ratio refers to the number of words written (i.e., type) divided by the number of different words written (i.e., token). Values can range from zero to one, with values closer to zero indicating little lexical diversity. Type-token ratios were calculated on writing samples from five hearing children and six deaf students. Only six students who were deaf were used because they were the same age as the hearing control group and had writing samples that consisted of at least 50 words. Table 1 also shows that the hearing children had greater lexical diversity in their writing samples than the participants who were deaf.

Table 1

Mean Length of Sentence and Type-Token Ratio for Deaf and Hearing Participants

	Deaf	Hearing
Mean Length of Sentence	7.76	8.41
Average Minimum	4.50	6.00
Average Maximum	11.30	11.20
Type-Token Ratio	0.53	0.61

My second objective was to perform an error analysis to examine the pattern of errors produced by children with cochlear implants and the hearing group. Both groups of children

made grammatical errors in their spontaneous written language. Errors were made on verbs, articles, nouns, prepositions, pronouns, conjunctions, plurality, adverbs, adjectives, negatives, and questions. Children in both groups also struggled with word order confusion and produced incomplete sentences.

For the purposes of this paper, I will report only on verb, article, and preposition errors. These three categories accounted for over 65% of the grammatical errors for children with cochlear implants. These three categories accounted for almost 50% of the normal hearing participant's errors.

Verbs

Forty-six percent of total errors for children with cochlear implants were made on verbs as compared with 31% of the hearing children's errors. Verb errors were the most common type of error made by both groups. Verb errors were categorized as tense errors, omissions, substitutions, additions, and subject-verb agreement errors. Table 2 shows the proportion of the different types of verb errors made by participants with cochlear implants and hearing children.

Table 2

Percentage of Verb Errors by Type

	Deaf	Hearing
Tense errors	62%	33%
Omissions	14%	33%
Agreement errors	10%	7%
Substitutions	9%	20%
Additions	5%	7%

Tense Errors: Both groups made tense errors when writing verbs. For the participants who were deaf, tense was the most common type of verb error. Of all tense errors, 86% of errors by children who were deaf were substitutions of the present for the past tense. All of the tense errors made by the hearing students were substitutions of present for past as well. An example was: *The cat like the milk*. In this example, he/she had used verbs in the past tense throughout the sample, but did not on this sentence.

Another verb error produced by the participants who were deaf was using the progressive tense inappropriately. Five percent of the verb errors by participants who were deaf were with using the present progressive tense incorrectly and 3% of the progressive errors were with past progressive. Examples of inappropriately using the progressive tense were: *The boy is sad because it is rain. On Sunday we went sled.*

Students who were also had difficulty with substituting the past for the present tense. Four percent of all verb errors of the children who were deaf fell within this category. An example included: *Shadow liked to be in the rain.* (The student substituted *liked* for *likes*). Other verb tense errors deaf children made included irregular verbs (0.9%), future for past (0.7%), past for future (0.5%), and present for future (0.2%).

Omission Errors: Deaf and hearing children made omission verb errors. Fourteen percent of verb errors for the deaf participants were omissions, compared to 33% of verb errors for hearing children were omissions. An example of an omission error was: *Where the girl?* Omission and tense errors were the top two areas of struggle for both the participants with cochlear implants and the hearing group.

Agreement Errors: Of all students' who were deaf verb errors, 10% of them were subject-verb agreement errors compared to 7% in the hearing group. An example of an agreement error would include: *The girl were fishing.*

Substitution Errors: Only 9% of verb errors for the students with cochlear implants were substitution errors, compared to 20% for the hearing group. The most common type of substitution error for both groups was substituting a wrong verb. Almost all of the children who were deaf (91%) and all of the hearing students produced substitution errors by substituting a wrong verb. An example was: *She had never done this cat before.* (The verb *done* was substituted for the verb *seen*).

The hearing children only made one type of substitution error, as noted above. However, the deaf children made six different types of substitution errors. Children with cochlear implants substituted a letter for a verb, as in *In the morning, grandma m breakfast for May.* (The student

wrote *m* instead of *made.*) Students did not always produce the first letter of the word while substituting a letter for a verb. For example, in *The girl b the button on the bear,* the letter *b* was substituted for the verb *sewed*. Children with a hearing impairment also substituted a preposition for a verb (2%), a pronoun for a verb (2%), a noun for a verb (0.8%), and a conjunction for a verb (0.8%).

Addition Errors: Addition errors made up 5% of verb errors for the children who were deaf and 7% of the hearing participants' verb errors. An example of an addition error was: *That is costs a lot of money.*

Overall, the participants with cochlear implants made more verb errors than the participants with normal hearing. Even though these children made a higher proportion of verb errors overall, the hearing children made verb errors too, and made many of the same types of verb errors as deaf children. Interestingly, the hearing children made a higher proportion of errors with omissions, substitutions, and additions than the children with cochlear implants. In contrast, the group with cochlear implants made more errors than hearing children with tense and agreement.

Articles

Article errors were the second most common error for children with cochlear implants. Approximately 12% of their errors were on article usage compared to 10% for the hearing group. Errors with articles included the usage of *a, an,* and *the*. Children committed omission, addition, and substitution errors on articles. Table 3 describes the types of article errors made by the participants with cochlear implants and the hearing participants.

Table 3

Percentage of Article Errors by Type

	Deaf	Hearing
Omissions	67%	60%
Additions	24%	20%
Substitutions	9%	20%

Omission Errors: The most common error type on articles for both groups of children was omission. Of all article errors, 67% of children who were deaf made errors with omissions, as compared to 60% for hearing children. An example of an omission error was: *We saw hummingbird that had red throat.*

Addition Errors: Another common type of article error was addition errors, which comprised 24% of the children with cochlear implants article errors and 20% of the hearing children's article errors. An example of an addition error was: *Pat and Jacob were by a the window.*

Substitution Errors: Substitution errors were the least common type of article error made by the children with cochlear implants. Only 9% of their articles errors were from substitution errors compared to 20% of article errors in the normal hearing children. The normal hearing group had a higher percentage of substitution errors in their written articles than the children who were deaf.

A closer look at the types of substitution errors revealed that 100% of substitution errors made by the hearing children came from substituting a conjunction for an article. An example of this substitution error was: *And house was scary but they rebuilt it*. In contrast, the participants with cochlear implants had four types of substitution errors, none of which included substituting a conjunction for an article. The most common substitution error made by these children was substituting one article for another (66% of the substitution errors). An example was: *I want to make a angel.* Substituting a preposition for an article was also an error made by the children who were deaf (28% of substitution errors) An example was: *The snowman hit by boy.* A small proportion of the substitution errors were made when a student who was deaf substituted a letter for an article (3%). An example was: *I saw b boy.* (The student substituted the letter *b* for the article *a*). In addition, 3% of substitution errors occurred when a child with a cochlear implant substituted a pronoun for an article. This error was not very common and only used by one student.

Overall, children who were deaf made proportionally more article errors than hearing children. Children with cochlear implants made proportionally more omission and addition errors and the normal hearing group made proportionally more substitution errors. Substituting an article for an article was the most common substitution error in the children with cochlear implants.

Prepositions

The third type of error analyzed was the use of prepositions. Approximately eight percent of all grammatical errors in the children who were deaf resulted from incorrect preposition usage compared to 6% of hearing children's errors. The children with cochlear implants made a higher

proportion of preposition errors than the hearing participants. There were three types of preposition errors produced by the group of students who were deaf: omissions, additions, and substitutions. The hearing children did not make any omission errors, but did make additions and substitutions. Table 4 shows the proportion of preposition errors made by the two groups.

Table 4

Percentage of Preposition Errors by Type

	Deaf	Hearing
Omissions	47%	0%
Additions	28%	67%
Substitutions	25%	33%

Omission Errors: Almost half (47%) of the children with cochlear implants preposition errors were omissions. An omission error was: *The girl was walking the store*. Omissions were the most frequent type of preposition error for children with cochlear implants.

Addition Errors: Children who were deaf made addition errors on prepositions 28% of the time as compared to 67% of hearing children's preposition errors. Addition errors were the most common type of error for the hearing students. An example of an addition error was: *It was pretty, but there was by a scary ride that came every night.*

Substitution Errors: Twenty-five percent of preposition errors in the children with cochlear implants were from making substitution errors while 33% of the hearing children's preposition errors were substitutions. A substitution error was generated when a student used a

word which should have been a preposition. Several types of substitution errors were made by the students who were deaf. The substitution errors included substituting one preposition for another, an article for a preposition, a conjunction for a preposition, or a noun for a preposition. The hearing group made only one type of substitution error, which was substituting one preposition for another.

The majority (92%) of the children who were deaf and all of the hearing children substituted one preposition for another. An example was: *His uncle jumped in a cliff.* Another error the children with cochlear implants made was substituting an article for a preposition. This error only occurred 2% of the time and only one student made this type of error. Substituting a conjunction for a preposition was also an error made, which took place 2% of the time in preposition usage. Again, only one student made this type of error one time. The fourth type of preposition error generated by the children who were deaf was substituting a noun for a preposition. This took place 5% of the time.

Overall, children who were deaf made proportionally more errors on prepositions as compared to hearing children. The participants with cochlear implants made more errors of omission and the hearing group produced more errors with additions and substitutions. However, the children who were deaf made a greater variety of substitution errors than the hearing group.

The third and final objective of this study was to measure the progress of children with cochlear implants over time. I examined the participants with cochlear implants spontaneous written language samples to determine whether the students wrote longer sentences on later samples than on earlier ones. My expectation was that the children's average length of sentence would increase over time. I computed the average length of sentence for the first submission and

subtracted that from the average length of sentence in the last submission. Children who were deaf increased their sentence length by an average of 0.84 words in a school calendar year (the average amount of time between first and last submission was nine months). Overall, the students did increase their average sentence length over time.

Discussion

The purpose of this study was to analyze grammatical errors in spontaneous writing samples by children with cochlear implants. The first goal of this study was to describe the characteristics of the writings of children with cochlear implants and hearing participants. I wanted to find out if the children who were deaf wrote shorter sentences compared to hearing children to support previous findings (Marschark et al., 1994). The participants with cochlear implants, on average, wrote fewer words per sentence than the hearing participants. The participants who were deaf had an average length of sentence of 7.76 words and the normal hearing group had an average length of sentence of 8.41 words per sentence. Although the average length of sentence was greater for the normal hearing participants, the values between the two groups were extremely close.

I also wanted to determine the lexical diversity of the children's writing samples using a type-token ratio. The children who were deaf wrote samples containing less lexical diversity than the hearing participants. This finding indicates that the hearing group was using a broader range of vocabulary than the children with cochlear implants. The children who were deaf tended to use the same vocabulary repeatedly in their spontaneous writing samples.

The second objective of this study was to complete an error analysis on the spontaneous writing samples of both groups. The goal of doing an error analysis was to look at the patterns of

errors generated. Overall, I noted 13 different types of syntax errors produced within both groups. These categories included errors with: verbs, articles, nouns, prepositions, pronouns, conjunctions, singular versus plural, adverbs, word order, incomplete sentences, adjectives, negatives, and questions. The children who were deaf did produce more errors than the normal hearing participants in eight categories; however the normal hearing group made more errors in five different categories. This serves as a reminder that not only do children with cochlear implants make syntax errors in their written language, but normal hearing children make mistakes as well. For the purposes of this paper, I focused on three categories of errors; verbs, articles, and prepositions. All three of these areas provided difficulty for both groups.

Both groups struggled most with verbs. Almost half (46%) of the children with cochlear implants total errors were due to verbs, compared to 36% of verb errors for the hearing group. Tense errors were the most common type of verb errors for both groups. The most common type of tense error for both groups was substituting the present for the past tense. Although omissions were common among both groups, the students who were deaf did not make proportionally as many omission errors as did the hearing group. Agreement errors were found in both groups, although the children with cochlear implants demonstrated proportionally more than hearing children. The hearing participants had a higher proportion of substitution errors on verbs than the children with cochlear implants. However, the children who were deaf made different types of substitution errors than the hearing group. Although the children with cochlear implants had more categories of substitution errors, it is important to note that both groups had the most difficulty with the same type of substitution error: substituting a wrong verb. Addition errors were the least common type of verb error for both groups.

Thus, it is apparent that verbs are difficult for both children with cochlear implants and hearing children. The children who were deaf did make proportionally more verb errors than the hearing participants, but it is important not to overlook the fact that the hearing children struggled with producing verbs too.

The second most common syntax error for both groups was with the usage of articles. The participants who were deaf did have a higher proportion of article errors than the normal hearing participants. However, all participants made omission, addition, and substitution errors on articles. Omissions were the most common type of error for both groups, although the children who were deaf made a slightly higher proportion of omission errors than the hearing group. Additions were also common in both groups however, the children with cochlear implants made a slightly higher proportion of these types of errors than the hearing participants. Interestingly, the hearing group made a higher proportion of substitution errors than the participants who were deaf. Again, like the verbs, the hearing children made only one type of substitution error: substituting one article for another. This type of substitution error was also very common among the children with cochlear implants. Overall, it is evident that both groups had difficulty using articles.

Another area of writing that was difficult for both groups was prepositions. The proportion of preposition errors was similar within both groups. The participants who were deaf made a slightly higher proportion of preposition errors (8%) than did the normal hearing group (6%). The highest proportion of preposition errors in the group with cochlear implants resulted from omissions. Conversely, the hearing children made no omission errors. Children who were deaf also made addition errors, as did the hearing group, which comprised the highest proportion

of their preposition errors. Substitutions generated the lowest proportion of errors for each group. The hearing group made only one type of substitution error: substituting one preposition for another. Although the children who were deaf did have more types of substitution errors, substituting one preposition for another was the most frequent type. Thus, substituting one preposition for another was difficult for both groups in this study.

To conclude the error analysis, although children who were deaf did have a higher proportion of verb, article, and preposition errors the hearing children made errors in all three categories as well. Sometimes the children with cochlear implants made higher proportions of errors within a category, but at other times the hearing participants generated a higher proportion of errors. In addition, when it came to substitution errors, the hearing group only made one type of substitution error in each category (verbs, articles, and prepositions). The important thing to realize is that for each area of substitution errors, the children who were deaf had the most difficulty with the same substitution error as the hearing children produced. For example, with verbs, normal hearing children only substituted the wrong verb. Even though the group with cochlear implants made other types of substitution errors, substituting the wrong verb was the area which had the highest proportion of errors. There does seem to be a pattern that the children with cochlear implants in this study struggled with the same type of errors as did the normal hearing group.

My final objective was to do a measure of progress over time. I wanted to look longitudinally at the data and determine if the participants who were deaf increased their written sentence length. I did not do a measure of progress on the hearing children due to a lack of longitudinal data. I did find, however that over nine months, or the length of a traditional school

year, the children with cochlear implants added an average of 0.84 words to their sentence length. I was eager to see an increase of words over time; however, I was hoping I would have found a greater increase. This means that after nine months, the children with cochlear implants were not adding even one full word to their sentences. It should be noted that some students had writing samples analyzed for a time length of only month whereas other students' writing samples were analyzed for 45 months. Also, some students happened to produce longer sentences on their first submission than their last submission. I am not sure of the reasoning behind this. There could be multiple reasons. Some may include, time of day, topic of interest, background knowledge of what the student was writing about, or a student's mental state. There are many factors that could have influenced the students' writings on a particular day.

There were several limitations of this study. One limitation of this study was determining if an error was a grammatical error or a spelling error. Because I was provided with information that told me what the participants had intended to write, I was able to use my best judgment to decide if a syntax error or a spelling error took place. As mentioned in the Results section, sometimes a student substituted a single letter for a verb. I feel as if this could have been a teaching strategy the teacher taught the students. Perhaps she told them to just take a guess if they did not know how to spell the verb. It was difficult to determine if substituting a letter for a verb was a verb error or a spelling error. In the example, *In the morning grandma m breakfast for May*, I included this as a substitution error because the student did not attempt to write the whole word. She might have guessed the word started with the letter *m*, but she made no other attempt to write the word. If she would have written other letters, such as *mad*, I would not have counted it as a syntax error.

Another limitation of this study was the inter-rater reliability. I was the only one who analyzed the spontaneous writing samples of all the students. If another person had assisted in analyzing the data, better reliability could have been attained. With two people scoring, they could have compared analyses and decided together what type of error took place. Finally, a third limitation of this study was the limited control group. There were only five hearing students who provided spontaneous writing samples. It would have been beneficial to have a higher number of hearing participants in order to compare the written language of children with cochlear implants and hearing children. Also, there was no longitudinal data for the hearing participants. It would have been interesting to measure the control group's progress over time.

In summary, the children in this study who were deaf produced shorter sentences and had less lexical diversity than the hearing students, they showed similar patterns in syntax errors as hearing children, and the children with cochlear implants added less than one word to their sentences over nine months' time. Hopefully, teachers of the deaf can use this information to help gear instruction to individual student needs. Verbs, articles, and prepositions give children with cochlear implants difficulty so teachers can focus on these skills early to help increase successful writing for their students.

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Appendix

How to Collect Written Language Samples

1. Twice a month, the teacher will provide a short opportunity for the children to create spontaneous written language samples. This should take approximately 10-15 minutes and should be conducted as consistently as possible and at the same time of the day (i.e. every other Friday afternoon or every other Monday morning). *The administration of these written language samples should not interfere with the regular school day or with the typical written language or spelling curriculum already in place in the classroom.*
2. The teacher will ask the children to write a story without any help, "just for fun." The teacher may provide them with a variety of prompts to keep the activity interesting. For example, the teacher may use a picture, a sequence story, a conversational topic, or any other type of story starter that is of high interest to the children.
3. The teacher then allows the children to write stories without help in spelling or syntax. If a child asks how to spell a word, the teacher may encourage the child to give it his or her best attempt and not to worry about making mistakes. It is very important for the teacher to make the activity as stress-free as possible so that the children actually enjoy expressing their ideas without worrying that they will be corrected.
4. After the children are finished, the teacher asks each child to read or sign their story. The teacher should note any words that are misspelled by writing the correct spelling above the misspelled word. This can be done as the child is reading the story and used as a teaching moment. Also, if the child says or signs a sound or word that he didn't write, especially word endings such as *s, ed, ing, es,* etc., the teacher should write what the child said or signed. For example, if the child wrote the word **plaey** and said **played**, the teacher should make the following notes:

   plaey
   play (said "played")

   She may also want to note any unusual pronunciations in parentheses. For example, if the child wrote **fireplast** and said **fireplate**, the teacher should make the following notes:

   fireplast
   fireplace (said "fireplate")

   The teacher should also note any words that would be difficult for an outside reader to understand without explanation (i.e. names of family members, pets, friends, places, etc.). Additionally, the teacher should note if any of the words the child has spelled are displayed somewhere in their immediate environment. For example, if a child has written a story about Halloween, the teacher should note if there is a large sign above the board that reads, "Happy Halloween," so the researcher knows that the child had access to the correct spelling of those words.
5. After the samples have been written, the teacher completes the "Collection Form" and follows the guidelines listed. The teacher will fill out a Collection Form each time she or he collects samples. The teacher will also please note any changes to the child's information throughout the course of the school year (i.e. audiology or educational issues).
6. The teacher copies the samples, keeping the original for his/her files, and puts the Collection Forms and samples in a postage-paid envelope. These should be mailed after each collection, approximately every two weeks.

Written Language Samples Collection Form

Please fill out this form each time you collect samples. You may use one form for each group of students.

Teacher:_____ Date of Samples: _____

Children (first names only): _____

- ☐ Ask the children to write a story "just for fun" with no teacher corrections.
  What prompt did you use? (e.g. sequence story, conversational topic, etc.)
  _____
- ☐ Ask each child to read/sign his or her story to you.
- ☐ Note on each child's sample any misspelled words or words that the child said or signed differently than he/she wrote. Also, note words that may be difficult for a new reader to figure out, such as names of family members, pets, place, etc.
- ☐ Were there any words in the sample that the child may have been able to copy from displays in the room? (e.g. *Happy Halloween, September, Welcome*, etc.)
  _____
- ☐ Write the child's first name on each sample.
- ☐ Write the date on each sample.
- ☐ Make a copy of each sample. Please keep the original for your files.
- ☐ Attach this page to the group of samples and put in the postage paid envelope to be mailed every two weeks, if possible.
- ☐ If applicable, did any child have any audiological issues since the last sample? (e.g. device malfunction, missing equipment, etc.) If so, please note here:
  _____
  _____
  _____
- ☐ Note any additional comments here:
  _____
  _____
  _____