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An exploration of the role of narrative skills in higher-level reading comprehension of teenagers with hearing loss

Anita New

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**AN EXPLORATION OF THE ROLE OF NARRATIVE SKILLS IN
HIGHER-LEVEL READING COMPREHENSION OF TEENAGERS
WITH HEARING LOSS**

by

Anita New

**An Independent Study Submitted in partial
fulfillment of the requirements for the degree of:**

Master of Science in Deaf Education

**Washington University School of Medicine
Program in Audiology and Communication Sciences**

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Abstract: This Study examines the relationship between scores on adolescents' self-generated narratives and standardized reading-comprehension scores. This relationship is also compared with the more simple language metrics: vocabulary and syntax.

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I would like to thank my advisor Dr. Johanna Nicholas for her help, support, and proofreading of this study. I would also like to thank Dr. Ann Geers, Julia Biedenstein, and Chris Brenner

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INTRODUCTION & BACKGROUND

Attributes of a narrative–

The ability to tell a story, whether spoken or written, is a common and often complex form of communication. This form of communication is usually referred to as a *narrative*. A narrative is comprehensive, in that it involves the application of both linguistic and cognitive abilities (Abbeduto, Benson, Short, & Dolish, 1995; MacLachlan & Chapman, 1988). An oral narrative is a continuous spoken production that holds the listener's attention. It is self-generated and carries a predictable organizational structure. Examples of narratives might be: telling a familiar story, retelling the plot of a movie or television show, or relaying personal experiences (Wiley, Rose, Burger, & Miller, 1998).

Narratives are a de-contextualized form of language - meaning that the language does not focus on an experience within the immediate context (Owens, 2001). For example: a child might be sitting at a kitchen table describing a scene in which a fish is swimming in a lake - a scene which is completely outside of the child's current physical context.

There is a set of linguistic rules in a well-produced narrative that helps to express a sequence of events. This set of rules is referred to as *story-grammar*. In order to communicate a narrative, the child must state the topic of the narrative and be able to link events to one another in a prescribed manner. In addition, to facilitate the understanding of sequencing, story-grammar demonstrates parts of a story and the interconnection of separate ideas (Gunning, 2008). The components of story-grammar include: the setting, characters, and plot.

Some basic cognitive skills are prerequisites of narrative ability. When children begin learning narrative skills, they build a scheme and/or script that is organized within the child's mind. For example, a child may not have been exposed to all possible events that could occur on a beach, but he or she may have stored background knowledge acquired from a different setting about, for instance, the sound of waves or the feel of sand under their feet. These experiences can be gathered incidentally (TV, movies, books, or listening to others' experiences) or by personal, but still non-contextual, experience (how the sand feels in the playground). These experiences help the child develop and store background knowledge in their internal "filing system" (Rumelhart, 1984). The child can draw upon these experiences to produce a narrative. According to Mandler (1979), "a schema is formed on the basis of past experiences with objects which consist of (usually unconscious) expectations about what things look like and 'what goes with what'" (p. 263). Likewise, children need a schema, or prior knowledge about narrative structure, to be able to comprehend text that is being read or being produced orally. Gunning (2008) states, "A schema thus provides a framework of comprehending a story and making inferences that flesh it out. A schema also aids retention, as students use it to organize their reconstruction of events" (p. 272). In addition, prior knowledge or a scheme already developed allows the child to be able to pick out important information (main ideas) from what is heard or read. These main ideas are referred to as *propositions* and are statements of information that give ideas or details (Gunning, 2008). The main ideas are referred to as *macrostructure* and the smaller details are *microstructures*. In producing or comprehending a narrative, it is important to be able to get the main ideas or "the gist" of things.

Development of narratives–

There are several kinds of experiences that children may have which are thought to facilitate the development of narrative abilities: (a) interaction with a parent or teacher who reads or tells stories directly to the child, (b) opportunities to overhear narratives that are not directed at them and (c) opportunities to practice narratives.

Through both direct exposure and overhearing narratives, children are able to get a sense of story grammar. Dickinson and Smith (1994) conducted a study regarding the positive effects of reading to children. The study found that when children are read to on a regular basis, their reading comprehension scores were better than those children who were not read to as frequently. By listening to stories, children are subconsciously learning the structure and organizational pattern of stories, in general, and gain skills to eventually begin producing their own narratives. Children with normal development have many opportunities to produce and practice narratives (Westby, 1984). For example, a mother and child experience going to a zoo. The mother might later prompt her child by saying, “We had a great day at the zoo. Johnny, tell Dad what we saw at the zoo.” This prompt gives the child an opportunity to talk about his experience. The parent may function as an “expert” narrative model, guiding their child and therefore teaching the child how to produce a narrative. In a child’s early development, parents guide their children by telling stories and eventually, as the children mature, their narrative ability improves to the point where they can do it on their own. Peterson, Jesso, and McCabe (1999) found that when mothers used open-ended questions (usually the “five-W’s”) and elaborated on topics during a conversation with their preschooler, the

narrative language of the child tended to be more complex in comparison to mothers that used close-ended , *yes* or *no*, questions when engaging their preschoolers in conversation.

Typically-developing children often overhear others that have well developed narrative ability at home, school, or other venues (Crais & Lorch, 1994). Through the auditory channel, these children learn oral narrative structure through *incidental learning* (Berman, 1995; Milosky, 1987; Snow & Dickinson, 1990). Incidental learning is the ability to pick-up information that is not presented directly or formally (Warren & Kaiser, 1986).

Children who are deaf or hard-of-hearing tend to have difficulty learning language incidentally. This can be attributed primarily to four factors. The first factor is simply insufficient language input due to late diagnosis of hearing loss. Children who are diagnosed late have later initiation of audiological services and therefore little or no access to sound at the all-important early stages of language development. Second, deaf and hard-of-hearing children have a reduced quantity of auditory input. The children, for various reasons, often do not receive an entire message. Third, the quality of the message received, as a whole, is poor due to various reasons. Finally, children with hearing loss may have fewer conversational interactions. This is perhaps due to intentional or unintentional exclusion resulting from failed attempts to interact with others. Over time a child may be less and less inclined to pursue future social interactions (Easterbrooks and Baker, 2002). These factors (or combination of factors) often cause hearing impaired children to miss critical information presented in narratives (if not the whole narrative). Therefore, these children fill-in the missing information by making inferences which may or may not be correct. The child may remember the incomplete story because their

memory stored the information the wrong way in the first place (Owens, 2001). Additionally, because children who are deaf and hard-of-hearing have difficulty understanding and producing narratives they also have fewer opportunities to attain language-based knowledge (Yoshinaga-Itano & Downey, 1986).

MOTIVATION

The link between the ability to produce a narrative and academic and reading-comprehension success–

There has been a particular interest in researching oral narrative ability and linking this to reading comprehension (and to academics in general) for students who are developing language normally and for those with language impairment. The focus of this independent study is to examine relations between narrative ability and higher levels of reading comprehension in children with severe to profound hearing loss who use cochlear implants. To date, there is little research regarding narrative ability in adolescents with hearing loss. Most research to date has been done with normally-developing children as well as children with non-hearing related language impairments.

A study performed by Feagans and Applebaum (1986) found a correlation between narrative ability and reading comprehension. This study was conducted over a three year period with children who were language disabled (LD) with ages ranging from six to seven years old. The study looked at three areas of language: syntax, semantics, and narrative ability. The purpose of the study was to investigate a possible correlation between narrative skills and achievement for LD children. This correlation was then compared to the correlations between other language skills and achievement. For this study, researchers hypothesized that children with deficits in narrative ability (and

language skills) would have difficulty with reading comprehension and academics in general. The study concluded that narrative ability may in fact help predict academic and reading success.

A study related to hearing-loss performed by Crosson and Geers (2001) investigated the importance of the oral narrative to reading comprehension for children eight to nine years old. In this study, normal hearing children were compared to deaf children who wore cochlear implants. The researchers had participants tell a story based on a sequence of eight pictures. The participants viewed the pictures and the pictures were then taken away. The children were expected to tell a story based on the pictures. Researchers analyzed narrative structures (setting/time, characters, events, and problem/solution) and cohesive syntactical devices from the narratives told by the children and looked for reading comprehension scores (taken from reading subsets of the Peabody Individual Achievement Test-Revised). They concluded that narrative ability is a predictor of reading comprehension ability in deaf children above and beyond IQ and syntactic competence.

Rationale for the present study–

The purpose of this present study is to examine the relationship between hearing impaired adolescents' scores on self-generated narratives and their scores on standardized reading-comprehension tests. We are also comparing narrative ability with simple-language metrics such as vocabulary and syntax. We hypothesize a correlation exists between narrative production and reading comprehension. We hypothesize this because both skills require the use of internal structural-organization on the part of the successful student. Therefore, if an individual is unsuccessful in producing a cohesive narrative

(missing important details or unable to give the main ideas to communicate a message), it is assumed that there will be a noticeable deficiency in reading comprehension (inability to identify main ideas in a written narrative).

METHODOLOGY

Participants-

The participants in this independent study were taken from a longitudinal cross-sectional study of the achievement of deaf students previously conducted by Geers, Tobey, Moog, & Brenner (2008). The population used for this research comprises 29 male and 31 female adolescents with cochlear implants. The adolescents were first tested when they were eight to nine years old in the areas of speech perception, speech production, language, and reading. The participants came from 28 different U.S. states and four Canadian provinces. The educational placement of participants varied from full-time regular education classes to partial mainstream integration to full-time special education. In addition, the participants' modes of communication varied; some relied primarily on speech while others communicated using speech and sign.

Experimental procedure-

Adolescents were asked to produce a narrative by looking at a sequence of six pictures that resembles a cartoon comic-strip. We refer to the particular comic-strip used in this research as the *balloon cartoon*, because the theme centers around a boy and his balloon. The *balloon cartoon* is illustrated below in Figure 1. The narratives produced by the participants were video-taped and then transcribed by researchers from Geers' comprehensive deaf-student achievement study (Geers *et al.*, 2008). The *balloon cartoon*

was designed specifically to have three male characters. This prevents participants from using male and female pronouns to distinguish between the possible referents; requiring the participants to use proper names, adjectives, prepositional phrases, and relative clauses (De Villers, 1991). The main character of the cartoon appears in every sequence to test for proper use of pronominal or nominal expressions and to show referent carry-over or change. In addition, the six-sequence cartoon was designed to elicit temporal links between propositions/events or episodes. An example of this might be an adverbial phrase (i.e. “The next day” or “In the morning”).

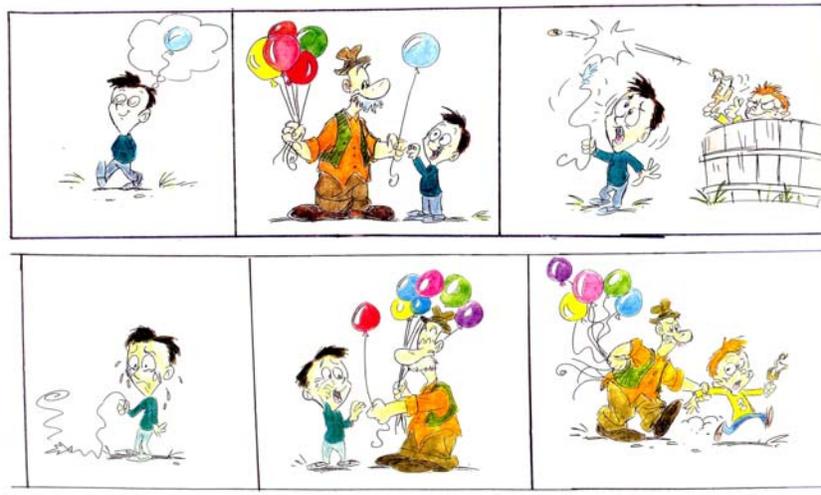


Figure 1. *The Balloon Narrative.* This comic-strip-like sequenced illustration was the basis for the student's self-generated oral narrative.

A score sheet was developed by Geers to assess the adolescents' competence in producing a narrative. See Appendix for scoring sheet. There are three cohesive devices that are analyzed in the narrative which include: Reference Cohesion, Reference Specification, and Temporal Links. Also, "mental states" were examined to see if participants expressed desire or cognition in their self-generated narrative. A point system was assigned to each category. The category, *Reference Cohesion*, examines the

appropriate use of definite and indefinite references as well as the use of nominals versus pronouns. The maximum number of total points a student could possibly attain is six. The reference specification point system used in this study is based on the increasingly sophisticated use of linguistic device for specification. This point system is also calibrated to the developmental sequence and reference specification analyzed from narratives orated by normal-developing hearing students (De Villers, 1991). Temporal links examined how well a participant expressed time between propositions/events. The adolescents' self-generated narrative was scored based on the highest level of temporal link present. Scores in each category were then summed to produce the total narrative score, which could be a maximum of fifteen points.

Inter-rater reliability–

To ensure that there was minimal influence caused by the unintentional bias of a single narrative score rater, scores were averaged from two separate raters. Narratives were scored based on criteria designed for objectivity, but because of the possibility of subjectivity in scoring, we examined the initial scoring by the two raters. We are including a statistical analysis of the two sets of ratings to examine inter-rater reliability. The two scorers met after scoring 20 narratives, not only to compare ratings, but also to discuss some challenges that were encountered while scoring specific narratives. The scorers then came to an agreement on scores based on discussion. During the course of these discussions it was determined that one element (Reference Cohesion) was not able to be scored reliably and was omitted from the analyses that follows. Figure 2(a) illustrates the agreement in paired scores for the various narrative cohesion linguistic devices between the two scorers. Figure 2(b) shows side-by-side box plots for all the

scores in each category for each grader. The box plots show consistent overall agreement for each category (fig. 2(b)), but the ~47% agreement for paired scores in fig. 2(a) is troubling. This data suggests that there inter-scorer reliability could pose a problem for paired data correlation, but should not be an issue correlation of the means of the categories.

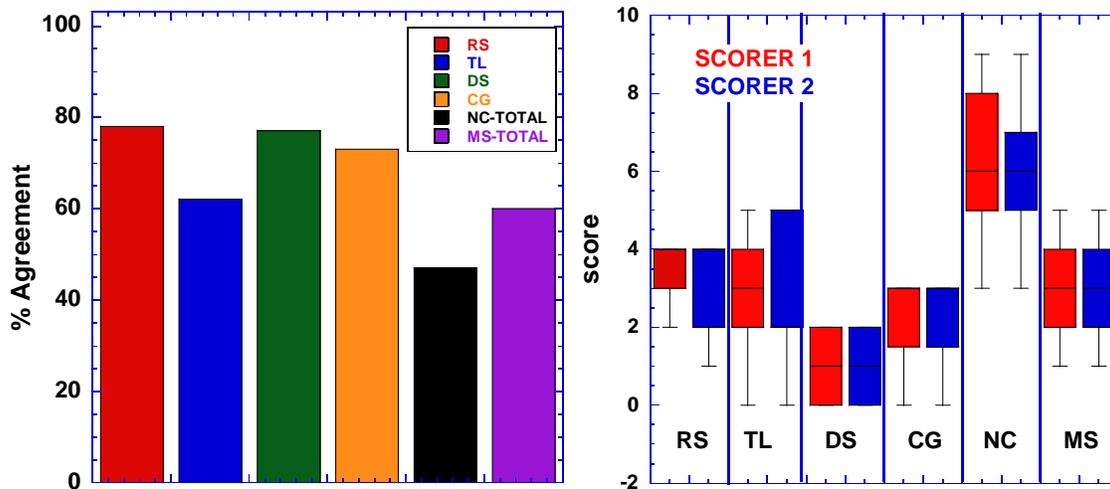


Figure 2. (a) The percent of scores in agreement between the two scores for each category of linguistic device and (b) side-by-side box plots of the actual scores for each grader for each category. RS (Reference Specification), TL (Temporal Links), DS (Desire), CG (Cognition), NC (Narrative Cohesion), MS (Mental State).

RESULTS AND STATISTICAL ANALYSIS

Before we discuss the results and statistical analysis, we would like to note that box plots were used to explain the results and statistical analysis. We would like to explain what a box plot is, a box plot is a convenient way of graphically depicting groups of numerical data through their five summaries the smallest (observation (sample minimum), lower quintile (Q1), median (Q2), upper quintile (Q3), and largest observation (sample maximum). A box plot may also indicate which observations, if any,

might be considered outliers. The spacing between the different parts of the box helps indicate the degree of spread and skewness in the data, and identify outliers. This section will detail the data obtained for the various tests taken by the students and their statistical analyses. We will leave interpretation of the significance of this data for the *Conclusion* section. First, it is helpful to discuss the different data sets and the format in which we will present them. Simply put, we are analyzing test scores for each student and comparing the scores of the various tests to make inferences on inter-test correlation. It should be noted that for the simplicity of comparing the test scores on equivalent scales, we have chosen to report test scores as the ratio of the student's score to the maximum score for that test in the entire population, or:

$$\text{normalized test score} = \frac{\text{individual's test score}}{\text{maximum test score}}.$$

Therefore, the maximum normalized test-score possible is one and the minimum possible score is zero.

Statistics summary–

We will first analyze the statistics of the population as a whole for each test. Table I below outlines the statistics for the various tests for the entire population. Figure 3 displays side-by-side box plots for the normalized scores for four of the tests of interest.

	COMP-STD	NC-TOTAL	AGE EQ/AGE	MS-TOTAL	CELF	EOWss
Minimum	0.401	0.333	0.444	0.200	0.077	0.553
Maximum	1.000	1.000	1.180	1.000	1.000	1.000
Mean	0.644	0.685	0.788	0.600	0.628	0.728
Median	0.599	0.667	0.681	0.600	0.692	0.715
Std Dev (σ)	0.144	0.196	0.249	0.241	0.288	0.096
Skewness	0.549	0.209	0.439	0.058	-0.411	0.280

Table I. Summary of statistics for the normalized scores for the standardized tests and reading comprehension equivalent age for the entire population. AGE EQ/AGE is the reading comprehension

equivalent age of an individual divided by the actual age of the individual thus it is a normalized metric of their reading comprehension level for their particular age.

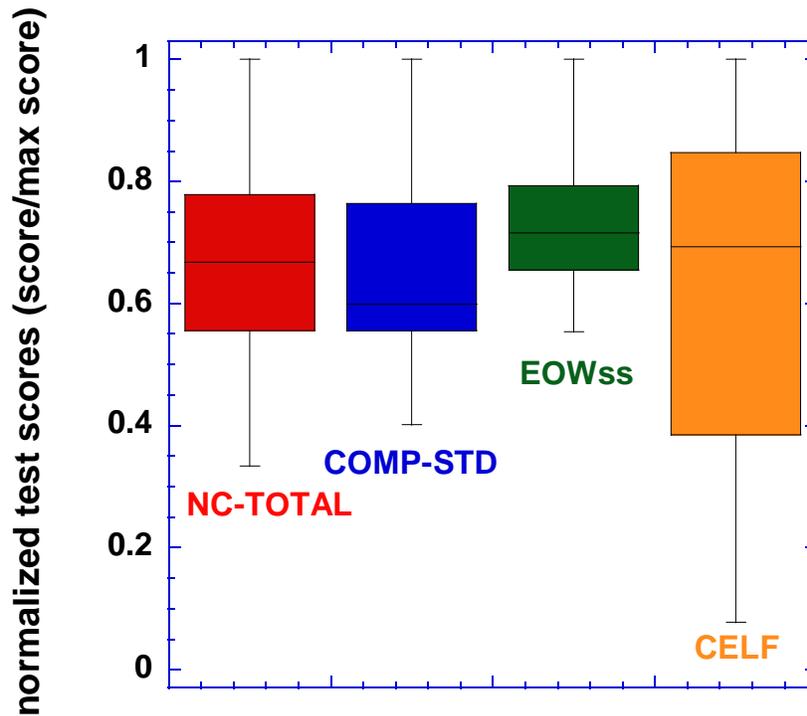


Figure 3. Side-by-side box plots summarizing the normalized scores for the various standardized tests for the entire population. Of particular interest are the plots of NC-TOTAL and COMP-STD, which are statistically similar (i.e. variance, mean, quintile size).

As seen from the box plots in Figure 3, the narrative cohesion total scores and the reading comprehension standard scores have very similar statistics. Perhaps the most fundamental relationship we will be analyzing will be that between the *total narrative cohesion* scores (NC-TOTAL) and the *reading comprehension standard* scores (COMP-STD). These two tests are of particular interest, because they are the most complete representations of the relationships being studied. Because of this, we will include a more complete statistical analysis of these two tests. As seen in figure 4 below, probability plots of NC-TOTAL and COMP-STD data show a high degree of linearity suggesting a normal distribution of the test scores among the population. Further analysis of the histograms of the data (Fig. 5) show slight bimodal tendencies and slight skewness

in both data sets. However, the deviations from normality are and we will assume normally distributed data for further statistical analysis.

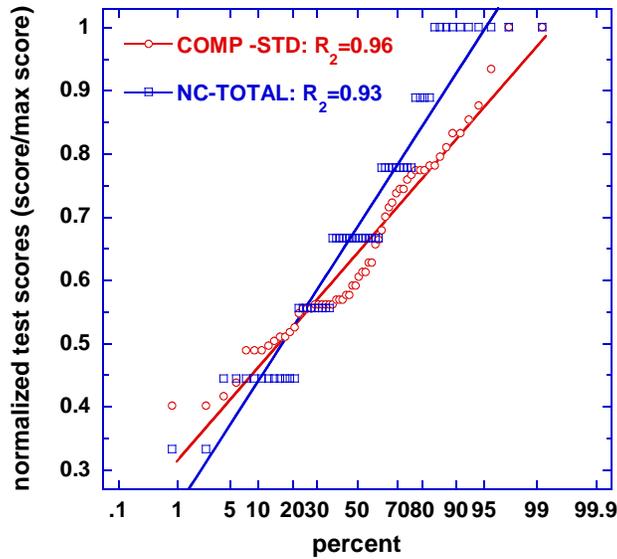


Figure 4. Probability plots for COMP-STD and NC-TOTAL scores show a high degree of linearity and therefore suggest normal distributions of the data.

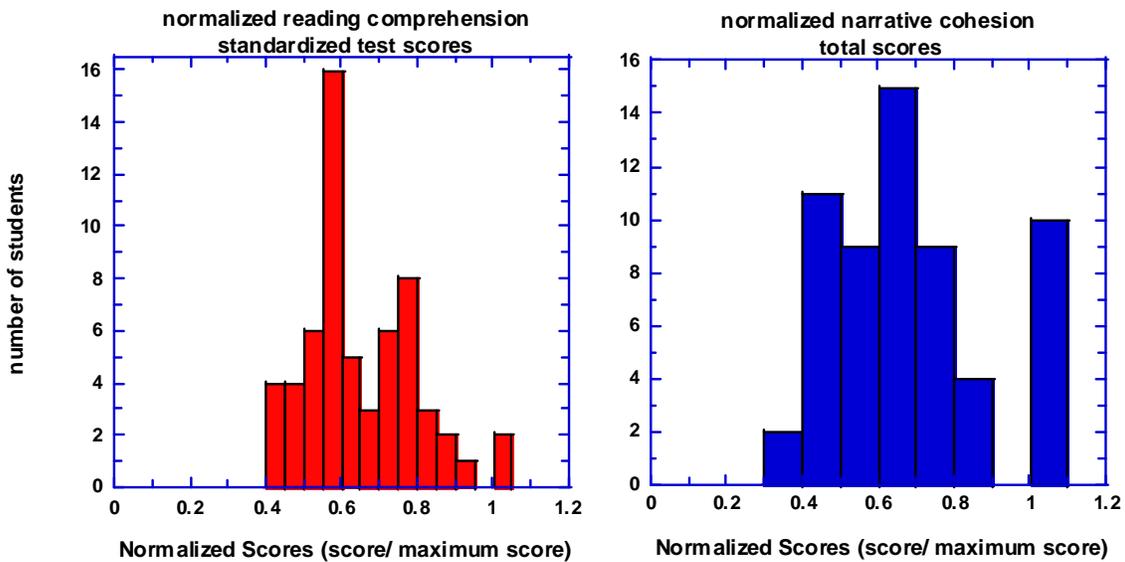


Figure 5. Histograms for COMP-STD and NC-TOTAL scores show slight skewness and nominal bimodal tendencies for the population for both data sets, but not to the extent that we reject normality.

Hypothesis testing: equality of means–

Correlations between the narrative cohesion scores and the reading comprehension standardized scores can be made in two ways: 1) by comparing the scores of the populations as a whole (comparing the difference of the means) and 2) by examining the relationship between individual scores (correlation of scores). The comparison of means (and variance) is most useful for testing the effectiveness of the narrative for predicting reading comprehension level for a population overall. Correlation between individual scores (reading comprehension scores as a function of narrative scores) is most useful for predicting the reading comprehension level of an individual student solely from knowledge of their scored oral narrative.

We will first compare the means of the scores of the various standardized tests. To do this we will define a *null hypothesis* (H_o) to be tested. The null hypothesis is that the means of the scores for the population for the various standardized tests (μ_i) are equivalent, or: $H_o : \mu_{COMP-STD} = \mu_{NC-TOT} = \mu_{EOWss} = \mu_{CELF}$. The rejection of the null hypothesis is: $H_a : \mu_{COMP-STD} \neq \mu_{NC-TOT} \neq \mu_{EOWss} \neq \mu_{CELF}$. To test the validity of the null hypothesis, we use the *Student's t-Test for paired data*. The main assumption for this test is that the data fit a normal distribution, which we have proven from the histograms and probability plots (Figs. 2 & 3). However, this test can still be used, even if there is significant non-normality in the data, provided the sample size is greater than 40. The *t*-distribution critical value for *degree-of-freedom* = 59 ($d.f.=N-1$) and a confidence interval of 90% ($\alpha = 0.1$) is 1.296. Table II gives the results of the *t*-tests. Because all of the calculated *t*-values are less than the critical value of *t*, we accept the null hypothesis. In other words, the difference between the means of the tests are not significantly

different from each other. We will discuss the impact of this result in the *Conclusion* section.

COMP-STD vs.	NC-TOTAL	CELF	EOWss
mean difference	-0.042	0.015	-0.084
t-value	-1.436	0.479	-7.034
t-probability	0.156	0.634	< 0.0001
correlation prob.	0.233	< 0.0001	< 0.0001
H_o True? ($\alpha = 0.1$)	YES	YES	YES

Table II. Summary of t-test statistics for paired data shows that the null hypothesis is accepted (that the mean difference between the various tests are equal).

Correlation testing for individuals' scores–

In this section we will try to answer the question: "is there a statistically significant correlation between how students score on an oral narrative compared to their reading comprehension score?". In other words, can we predict an individual's reading comprehension level based on their competence in constructing an oral narrative. To accomplish this, we plot the COMP-STD scores as a function of NC-TOTAL scores on a scatter plot. Conceptually, we hypothesize that if a student is able to perform well on a scored oral narrative, that this same student should have good reading comprehension skills. Thus, we expect to see a linear relationship between the students' scores on the two tests with a positive slope (ideally a slope of 1.0). If the data are well correlated, we would also expect to have an R^2 value (*Pearson correlation squared* or the *coefficient of determination*) that is close to 1.0. Figure 6 shows the raw-data scatter plot of COMP-STD scores as a function of NC-TOTAL scores for the population. There are several aspects of this plot, which are noteworthy. The data has a positive slope as predicted, but the correlation is extremely weak ($R^2 = 0.024$). In this plot, it is apparent that the COMP-

STD values are stratified into only seven possible NC-TOTAL-score categories. This artifact of the data actually makes it easier to identify the spread of COMP-STD scores within each NC-TOTAL strata. Viewing the data this way, one can see that there is a significant spread in the COMP-STD data for all of the NC-TOTAL categories. For example, the COMP-STD values for the individuals that scored 0.67 on the NC-TOTAL range from 0.4 to 0.9 with an even distribution within this range.

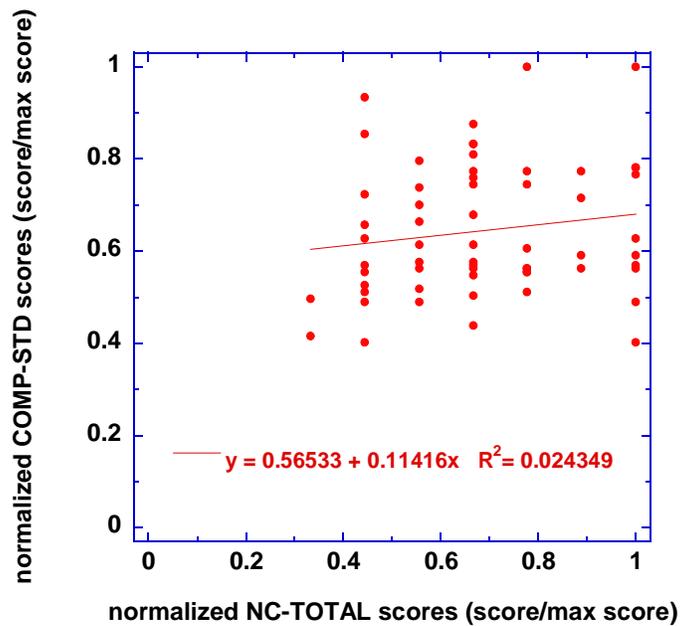


Figure 6. Raw data scatter plot of COMP-STD scores as a function of NC-TOTAL scores for the population

It is perhaps easier to visualize the data if we plot only the mean COMP-STD values for every NC-Total strata as illustrated in figure 7 below. The y-axis error bars represent the standard deviation of the COMP-STD values.

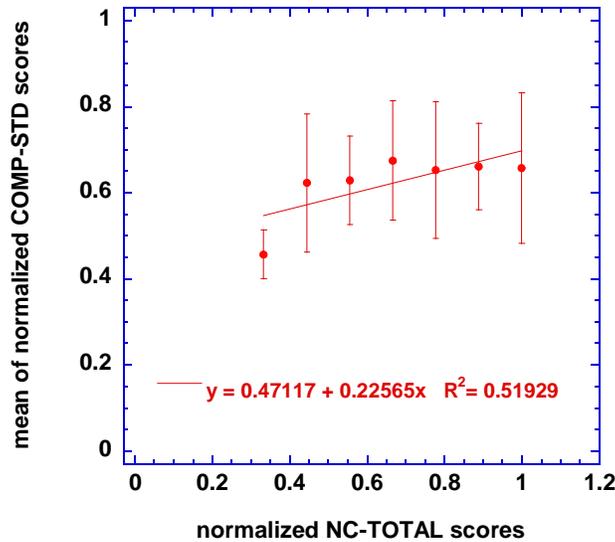


Figure 7. Mean COMP-STD scores as a function of NC-TOTAL scores. The y-axis error bars represent the standard deviation of the COMP-STD values within each NC-TOTAL score strata.

It is very apparent from Figure 7 that the means of the COMP-STD scores reflect little to no dependence on NC-TOTAL scores, especially within the error of measurement. The slope of the fit to these data and the R^2 value have increased, but these do not represent the data set as a whole, only the means. For instance, the slope has increased in this case only because the COMP-STD values at NC-TOTAL = 0.33 now have a higher statistical weight than in Figure 6 (statistical weight of 1/7 vs. 2/60).

Correlation between narrative cohesion scores and other standardized tests—

We now analyze the data to find possible correlation between the total narrative cohesion scores and those of other standardized language tests - namely the Clinical Evaluation of Language Fundamentals, Sentence Assembly (CELF) and the Expressive One Word Picture Vocabulary Test: Standard Score (EOWss). We are not including a full statistical analysis of these data sets as for COMP-STD, however the box plots

showing the statistics summaries are found in Figure 3. Figure 8 is of the same construction as the previous Figure 7, but displaying mean data for all of the standardized reading tests as a function of NC-TOTAL.

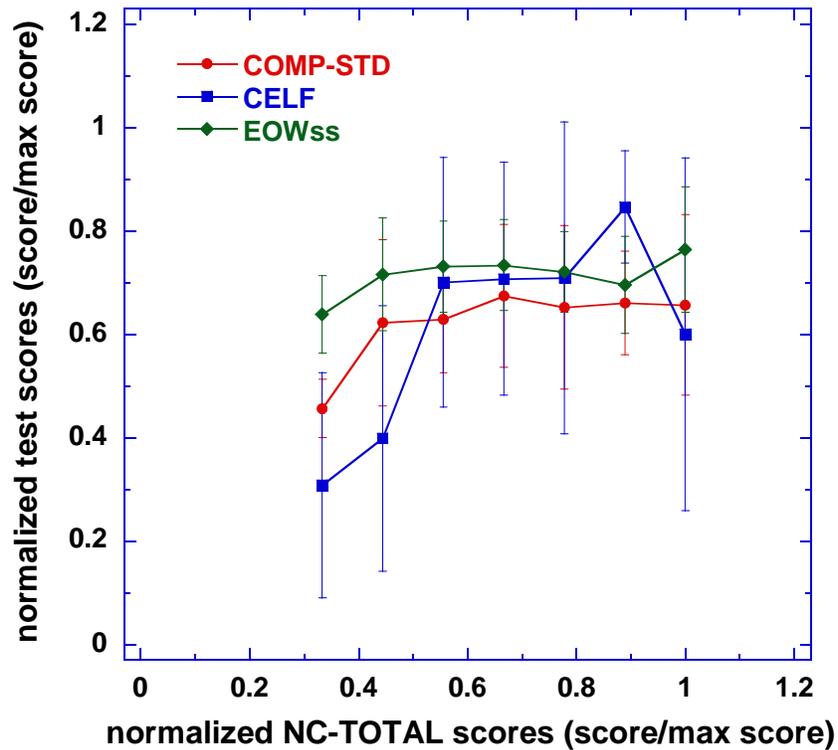


Figure 8. Mean COMP-STD, CELF, and EOWss as a function of NC-TOTAL scores. As in figure 7, the y-axis error bars represent the standard deviation of the COMP-STD values within each NC-TOTAL score strata.

Although the scatter plots of the raw data are not presented, there are similarities between the plots for CELF and EOWss scores compared to that of COMP-STD (Figure 8). A table of the Pearson correlation coefficients from these scatter plots (and for all the variables) is located in the Appendix. The plot of the means of the standardized tests in Figure 8 above shows no correlation between how a student scores on the various standardized tests and on their narrative competence. However, upon examining the data

in Figure 8, it appears that a slight correlation exists for students in the lower two-to-three strata of NC-TOTAL, especially for CELF.

How the students score on NC-TOTAL based on their reading comprehension equivalent age–

We will investigate one final metric to test the relationship between a hearing-impaired student's oral narrative ability and their level of reading comprehension. This metric is *reading comprehension equivalent age*, which is the "age-level" a particular student fits into in terms of their reading comprehension. As with the test scores, we will normalize the student's equivalent age (AGE EQ) to their actual age by taking the ratio:

$$\text{normalized equivalent age} = \frac{\text{individual's AGE EQ}}{\text{individual's actual age}}.$$

Therefore, if a student has reading comprehension commensurate with his or her age-level, $\text{AGE EQ}/\text{AGE} = 1.0$ and if a student in the twelfth grade, has reading comprehension at the sixth-grade level, $\text{AGE EQ} = 0.5$ for this student. This metric is slightly different than the other variables because it is possible for student to have a normalized age equivalent greater than 1.0 if they have above average reading comprehension for their peer-age-group. It seems intuitive that a student who has reading comprehension at the college level (which some of the subjects in the population do) will outperform a student who is at the 3rd grade level in oral narrative abilities. Thus, we hypothesize that there will be a correlation between equivalent age and NC-TOTAL. The scatter plot in Figure 9 shows this relationship.

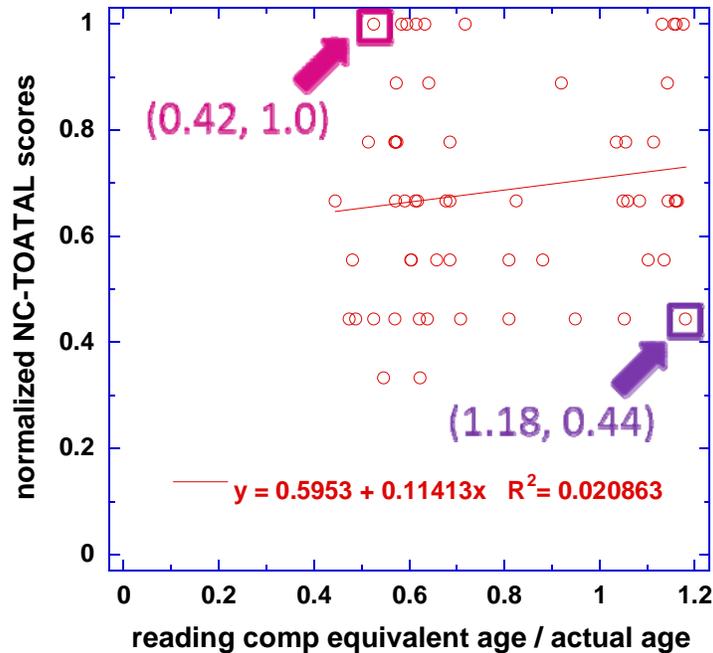


Figure 9. Scatter plot of NC-TOTAL scores as a function of reading comprehension equivalent age. An R^2 value of 0.021 indicates a near-zero positive-slope correlation.

Plotting the NC-TOTAL scores as a function of AGE EQ/AGE shows very little correlation between the two parameters. If we look at a few points in detail, we can get a more qualitative picture of what is going on. For example, one student that lies at point (1.18, 0.44; purple box in Fig. 9) is at a reading comprehension grade equivalent of around a freshman in college, yet has scored a 44% on his or her cohesion narrative. In contrast, the individual at point (0.42, 1.0) has a reading comprehension grade equivalent around the 5th-grade, but has scored a 100% on his or her oral narrative.

Another way of looking at this data is to split the population into six equal groups of ten individuals ranked by their reading comprehension equivalent age. The NC-TOTAL scores are presented as box plots in Figure 10 for the six ranked groups.

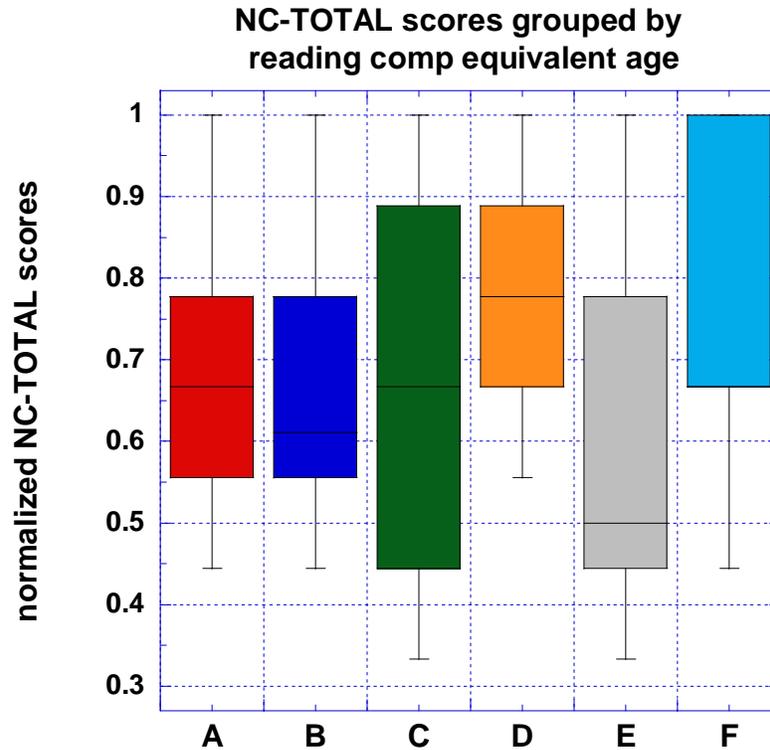


Figure 10. Side-by-side box plots of six equal-population groups (N=10) ranked in terms of their reading comprehension age equivalent, i.e. Group A consists of the ten highest scorers from the entire population whereas Group F comprises the ten lowest scorers from the entire population of 60.

Due to wide variability in scores in each groups no significant difference were found. The last group, F, is of particular interest because it has a higher median score than the three-highest ranked groups (A, B, and C).

CONCLUSION

The hypothesis for this research project is: a hearing-impaired student's ability to produce a cohesive oral narrative is a predictor for that particular student's reading comprehension level. In other words, we predicted that there would be a correlation between self-generated oral narrative ability and reading comprehension. In addition, it was of interest to know if simpler language metrics, such as vocabulary and syntax,

correlated with oral narrative ability. In order to test this hypothesis, we performed a thorough statistical analysis of the scores of the various standardized tests and narratives - both to test the difference between the population means as a whole for the different tests and to test the correlation between individual scores within the population.

Analysis of the difference of means of the various tests indicates that there is sufficient statistical significance (with a 90% confidence interval) to conclude that the means of the various tests are indeed the same. This suggests that, as a whole, the experiment (i.e. the narrative scoring criteria) was well constructed in order for the variation and means of the COMP-STD and the NC-TOTAL to be the same. What does this tell us qualitatively? We can now say with confidence that we can predict the mean reading comprehension level (and variance) for a population with knowledge of that population's mean narrative cohesion total score (provided the population is of a statistically significant size).

Analysis of the correlation between individual COMP-STD and NC-TOTAL scores, however, suggests that no relationship exists. Simply put, there is not a strong enough correlation to predict an individual student's reading comprehension level based on their narrative cohesion total score (or any of the narrative sub-categories). Therefore, we must dutifully but regrettably reject the hypothesis of this project given the data at hand.

The conclusion of this project is most certainly counterintuitive; as cited in the previous section, it does not make sense that a student with 5th-grade reading comprehension skills scores 227% higher on the narrative than a student with college-

level reading comprehension. This leads us to question the validity of the experimental design and not necessarily reject the hypothesis outright.

If we find it difficult to reject the hypothesis based on intuition, we must introspectively evaluate the research design to see if the problem lay there. In this spirit, we propose some possible causes for the observed lack of correlation. Because the data is so completely random, one logical scenario would be a clerical error that unpaired the data. A simple shift of one list relative to another would most certainly cause catastrophic effect. Some other possible reasons for the results of the data is the type of stimulus chosen to elicit the oral narrative from the adolescents in a consistent manner. To recall, participants were asked to tell a story based on a comic-strip which was placed in front of them. This method might have limited participants ability to truly produce a cohesive narrative, in that the participant only told about what was in front of them in each sequence rather than telling a story. In other words, there could be a miscommunication in the objective of the narrative. It would also make sense that this score would be strongly dependent on the student's personality type. Expressive personality types would use their imagination and elaborate, giving themselves more opportunity to receive a score for a specific criteria than say a analytical or amiable personality type who would keep to the facts. A test for this hypothesis would be to gather personality type data (there exist simple test schema), or perhaps even correlate the narrative score to the overall length of the narrative (normalize total narrative score to total narrative length).

For future independent studies it would be suggested to use a different method to elicit an oral narrative. Such possibilities include: having a participant retell a story (read

to them), or perhaps the use of a picture, but instead take away the picture while the participant is producing the narrative. In addition, the scoring sheet and the inter-rater reliability may have led to deleterious effects. The scoring sheet seemed loose in terms of possible interpretation; there is perhaps a need for "hard-and-fast" rules or examples of particular criteria. As stated previously, the box plots show consistent overall agreement for each category (Fig. 2(b)), but the ~47% agreement for paired NC-TOTAL scores in fig. 2(a) is troubling. These data suggest that inter-scoring reliability could pose a problem for paired data correlation, but it has not proven to be an issue for the correlation of the means of the various categories.

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APPENDIX

TABLE A-I. Outcomes on standardized test

Outcome variables	Mean	S.D.	Range
Reading Comprehension Standard score	88.17	19.68	55-137
Reading Comprehension Grade Equivalent	7.61	3.82	2.8-13
EOW Standard Score	89.48	11.79	68-123
CELF-Sentence Analysis Subtest Standard score	8.17	3.74	1-13

TABLE A-II. Outcomes on narrative scoring

Outcome variables	Mean	S.D.	Range
Reference Specification	3.21	0.97	1-4
Temporal Link	2.95	1.47	0-5
Narrative Cohesion Total	6.16	1.77	3-9
Desire	0.92	0.77	1-2
Cognitive	2.08	0.77	0-3
Mental State Total	3	1.2	1-5

TABLE A-III. Relationship between narrative outcome variables and test scores

Narrative Cohesion Total	and	Read Comprehension SS	=	.11
Narrative Cohesion Total	and	EOW ss	=	.15
Narrative Cohesion Total	and	CELF SAss	=	.26

Mental State Total	and	Read Comprehension SS	=	-.07
Mental State Total	and	EOW ss	=	-.13
Mental State Total	and	CELF SAss	=	.10

Table A-IV. Matrix of Pearson coefficients of correlation.

RS	TL	NC - total	DS	CG	MS- Total	CompRaw	CompStd	EOWss	CELF
*	0.01	0.56	0.05	-0.16	-0.13	-0.01	0.04	0.05	0.07
	*	0.83	0.15	0.01	0.11	0.14	0.16	0.15	0.27
		*	0.15	-0.08	0.02	0.11	0.16	0.15	0.26
			*	-0.31	0.33	0.21	0.16	0.18	0.16
				*	0.80	-0.15	-0.18	-0.24	0.00
					*	-0.01	-0.07	-0.13	0.10
						*	0.95	0.79	0.57
							*	0.77	0.51
								*	0.47
									*

Table A-V. Scoring of Narrative Cohesion devices in the Balloon Popping Picture Sequence

A. Reference Cohesion

appropriate contrastive use of definite and indefinite reference, and nominals vs pronouns

<u>definite and indefinite reference</u> (the versus a/some)	<u>nominals and pronouns</u>
0 no contrast between them (no articles, all <i>the</i> or all <i>a</i>)	0 no contrast between nominal and pronoun use (all nouns or all pronouns)
1 at least one contrast but mostly incorrect uses (>50% of articles incorrect - usually <i>the</i> for <i>a</i>)	1 at least one contrast but mostly incorrect uses (>50% of cases incorrect, redundant nouns or ambiguous pronouns)
2 mostly correct uses but at least one incorrect	2 mostly correct uses but at least one incorrect
3 all correct uses	3 all correct uses

Discourse Cohesion subscore = total /6

B. Reference Specification

(measures use of modifying expressions - names, adjectives, prepositional phrases and/or relative clauses - to identify the referents in the narrative)

Points based on increasing sophistication of linguistic device used for specification, based on normal developmental sequence in prior studies of narrative development and reference specification.

- 0 no contrasting specification of referents (just nouns or pronouns)
- 1 proper names, or "another boy/girl" or "the other boy/girl" (these are the earliest emerging forms)
- 2 adjectives (e.g. "the good girl" vs "the bad girl")
- 3 prepositional phrases (e.g. "the boy with the slingshot")
- 4 relative clauses (e.g. "the boy who popped the balloon")

Reference Specification subscore = the highest level of device used, i.e. score /4

C. Expressed Temporal Links between Propositions/Events (defined as Clauses).

Points based on increasing sophistication of link based on developmental data from hearing children.

- 0 no links expressed

- 1 stringing events (not just linking two nouns) together with "and"
- 2 more specific sequencer or coordinating conjunction such as "and then", "then", "next".
- 3 adverbial phrase (e.g. "The next day", "In the morning" etc.)
- 4 adverbial clause following its main clause (e.g. a "when" or "after" clause such as "The boy cried after his balloon popped")
- 5 adverbial clause preceding its main clause
(e.g. "While the boy wasn't looking, the bad boy popped his balloon " or "When the boy cried, the balloon man offered him another one")

Semantic Link subscore = highest level of device used, i.e. score /5

Total Narrative Cohesion Score = total of A+B+C = score /15

Scoring of Mental State References

Score separately for references to desires (typically with verb "want") and references to cognitions (typically "dream" or "think")

Desires:

0 points = no references to desire

1 point = want + NP

2 points = want + clause

Cognitions (dream, think, remember, know):

0 points = no references to cognitions

1 point = cognition verb alone (e.g. "She dreamed")

2 points = cognition verb + NP or "about NP"

3 points = cognition verb + complement clause.

For each of these measures the score = the highest level used by the child. Total possible = 5.

Table A-VI. Score table

Cohesion	Articles	
	Pronouns	
Reference Specification		
Temporal Links		
Mental State	Desires	
	Cognitions	
TOTAL SCORE		