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Grammatical Accuracy of Narratives Produced by Typically Developing Children Ages 4-7 in Two Story Contexts

Sierra Browning, Amanda Miller, Natalie Johnson, & Cortney Hoffman.
Communicative Disorders and Deaf Education
Utah State University
Logan, Utah 84322 USA

Faculty Advisor: Sandra Gillam

Abstract

The purpose of the current study was to analyze the narrative samples of 248 typically developing children within the ages of four and seven to determine typical scores for percent of grammatical c-units (PGCU) in two story contexts (sequenced pictures, single scene). This knowledge may provide more information on the performance of typical children and how to accurately identify students with language impairments (LI). This study extends the literature by testing whether the findings remain the same with additional data from children aged six to seven and whether the findings extend to children aged four and five years. PGCU scores of the children steadily increased with the ages of the children with only a slight difference in PGCU for five and six-year-olds. It initially appeared that tense errors were the most common error among all four ages; however, the difference between them was not statistically significant. Children were somewhat less grammatically accurate when they were asked to create a spontaneous story than when asked to create a story using sequenced pictures; however, the results were not statistically significant. PGCU for the single scene story was moderately correlated to the total raw score for oral narrative proficiency and this correlation for PGCU in the sequenced pictures story context was small but significant.

Keywords: Grammatical, Accuracy, Children

1. Introduction

Guo and Schneider[1] explored different approaches to identify grammatical impairments in 128 typically-developing (TL) children and those with language impairments (LI) between the ages of six and eight years. Their participants were 61 six-year-olds (50 TL, 11 LI), and 67 eight-year-olds (50 TL, 17 LI). Measures included the calculation of the finite verb morphology composite (FVMC)[2], the number of errors per C-unit (Errors/CU), and the percent of grammatical C-units (PGCUs) in narrative samples. Each outcome measure was evaluated for its sensitivity and specificity. They found that all three outcome measures provided acceptable diagnostic accuracy when applied to six-year-olds, but PGCUs were found to be the most accurate tool with eight-year-olds. PGCUs provide significant data on how many grammatical errors were made by a child compared to how many utterances they made. This information helps to determine how severe the child is struggling grammatically and provides a prediction of whether he/she has a Language Impairment or not. For this reason, calculating the PGCUs was a main focus for the study. Grammaticality is the percentage of grammatically correct utterances in a single story sample.

In this study, 248 children were tested using the Test of Narrative Language: Second Edition (TNL-2). [3] The sequenced picture story is referred to as Late for School (LFS) and the single scene narrative is titled Aliens.

The research questions were as follows:

1. Does grammaticality differ across ages four to seven?
2. Does grammaticality differ as a function of story context?
3. Is grammaticality related to overall narrative production proficiency?
4. Is there a particular type of grammatical error that is more common than other types?
5. If differences exist in the types of errors that are made, do they differ by story context?

2. Methodology

2.1. Participants

The participants in this study included 36 four-year-olds, 54 five-year-olds, 67 six-year-olds and 91 seven-year-olds. The participants were selected as part of the normative sample for the TNL-2.[3]

2.2. Procedures

Children were asked to produce stories in three varying contexts. The data from the LFS (sequenced pictures) and Aliens (spontaneous story generation) subtests were used in the current study.

The stories were transcribed using Systematic Analysis of Language Transcripts (SALT)[4]. The transcriptions were double coded for grammaticality by two separate research assistants. Each assistant was assigned a group of stories to code for grammaticality. Each story would then be reviewed by a different assistant to make sure there were no mistakes. If any mistakes were found, they were corrected. The utterances were designated as grammatical or ungrammatical based upon how comprehensible the utterance was to the individual coding it. Ungrammatical is defined as "not conforming to grammatical rules."[5] Opinions may vary upon what is deemed grammatical or ungrammatical. For this purpose, there were multiple assistants coding the same story.

Ungrammatical utterances were also coded for the type of grammatical error present using the Grammatical Utterances Complexity and Coding Instrument (GUCCI), which was designed to code a number of grammatical errors typically produced by children. The categories are briefly described in Table 1. The GUCCI was modified from a study performed by Guo and Schneider[1]. Guo and Schneider looked for tense marking errors, pronoun errors, grammatical morpheme errors, argument structure errors, and other syntactic errors. They also analyzed their samples for FVMC errors such as "third person singular *-s*, regular past tense *-ed*, and copula and auxiliary *be* (i.e., *am, are, is, was, were*) in obligatory contexts." [1] In their study, they used certain codes to represent different grammatical errors made by the child. The GUCCI was based on these same codes but was modified to the particular needs of this study.

Table 1. Summary of GUCCI categories

Category	Description	Examples
[UG1] Tense Marking Errors	Omissions and incorrect usage of tense markers.	C He play with the alien/s. C She do want ice_cream.
[UG2] Pronoun Errors	Substitution errors and incorrect usage of pronouns and reflexive pronouns.	C They hurt theyselves. C That is the girl (omitted that) went to the store.
[UG3] Grammatical Morpheme Errors	Omissions or incorrect usage of grammatical morphemes other than pronouns and tense markers.	C There are a lot of alien. C He put the milk under the bowl.

[UG4] Argument Structure Errors	Omissions of required constituents (i.e. arguments) before or after the verb.	C Want/ed a hamburger. (Omitted subject) C The girl hug/ed (Omitted direct object)
[UG5] Other Errors	Any other syntactic errors or semantic irregularities.	C The boy was go/ing to pop. C The girl did not know what was the alien/s do/ing.
[G-X] Unintelligible Utterances	Unfinished and unintelligible utterances.	C They play/ed with the> C And they X up in the sky.

2.3. Inter-Rater Reliability

Inter-rater reliability was determined in a similar way to Shriberg, Kwiatkowski, and Hoffman's[6] consensus procedure. This was determined by searching through the coded utterances and counting how many times the participants agreed on the codes assigned and how many times the participants did not agree. A percentage of the total utterances that were agreed upon was calculated. The reliability score for grammaticality coding was 97%. Any discrepancies in coding were corrected by the graduate research assistant.

3. Results

Table 2 shows the means and standard deviations for the percentage of grammatical utterances in both story contexts (sequenced pictures or LFS; single scene or Aliens story) and the narrative production raw scores for the LFS and Aliens stories.

Table 2. Means and standard deviations of percent grammaticality in Late for School (LFS) and Aliens (A) stories by age group

Age	Percent Grammaticality LFS	Percent Grammaticality A
4 (n = 36)	70.39 (25.05)	59.44 (29.53)
5 (n = 54)	79.39 (22.58)	77.08 (23.19)
6 (n = 67)	82.47 (20.47)	77.74 (23.65)
7 (n = 91)	85.73 (16.05)	85.42 (12.61)

A one-way, multivariate analysis of variance (MANOVA) was conducted to determine the effect of age on the measure of grammaticality (PGCU) in LFS and Aliens story contexts. Significant differences were found among the age groups on the dependent measures, Wilks's $\Lambda = .040$, $p < .001$. The multivariate η^2 based on Wilks's Λ was strong, $\eta^2 = .96$. Analyses of variances (ANOVA) on the dependent variables were conducted as follow-up tests to the MANOVA. Using the Tukey method, each ANOVA was tested at the .05 level. The ANOVA on the PGCU in LFS was significant, $F(3, 244) = 5.18$, $p = .002$, $\eta^2 = .060$, as was the ANOVA for PGCU in the Aliens story context, $F(3, 244) = 12.866$, $p = .001$, $\eta^2 = .137$.

Tukey post hoc analyses to the univariate ANOVA for the scores on the LFS subtest revealed that the five (79.39 ± 22.58, $p = > .05$), six (82.47 ± 20.47, $p = > .05$), seven-year-olds (85.73 ± 16.05, $p = > .05$) demonstrated significantly higher PGCU scores than the four-year-olds (70.39 ± 22.05, $p = > .05$). No other differences were significant. Post hoc analyses to the univariate ANOVA for the scores on the Aliens subtest revealed that the five, six and seven-year-olds demonstrated significantly higher PGCU scores than four-year-olds. The seven-year-olds demonstrated higher PGCUs than the five and six-year-olds. There was no significant difference in PGCU for five and six-year-olds ($p = > .05$).

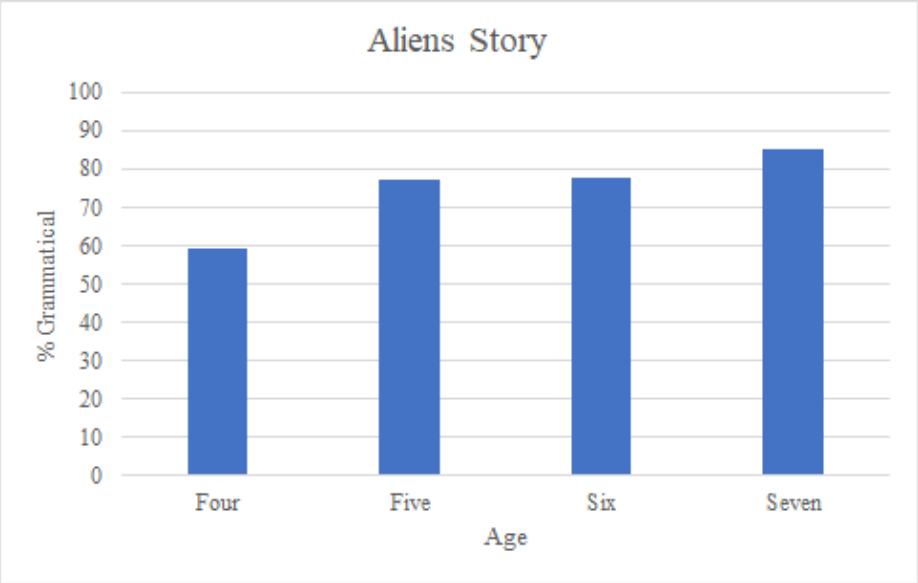

Figure 1. Aliens story mean percent grammatical by age.

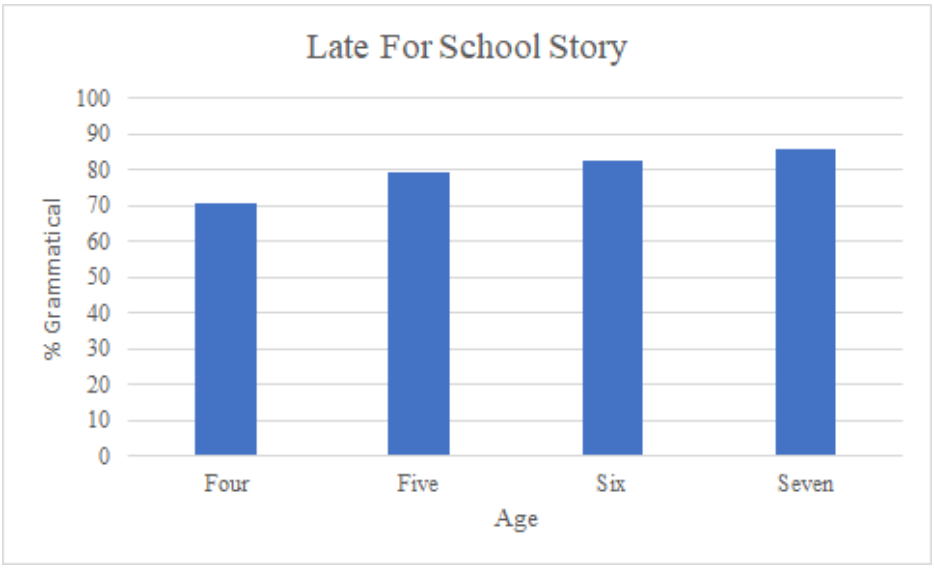

Figure 2. Late For School story mean percent grammatical by age.

A paired samples t-test was conducted (with group collapsed) to determine whether grammaticality differed as a function of story context. The results revealed that children were somewhat less grammatically accurate when they were asked to create a spontaneous story (PGCU= 78%) than when asked to create a story using sequenced pictures (PGCU = 81%); however, the results were not statistically significant (p = .055).

Correlation coefficients were computed among PGCU scores and the total raw score for oral narrative proficiency. These correlations and their corresponding p values are shown in Table 3. The results of the correlational analyses show that PGCU for the Aliens story was moderately correlated to the total raw score for oral narrative proficiency and this correlation for PGCU in the LFS story context was small but significant (p = 005).

A one-way, MANOVA was conducted to determine the effect of age on the types of grammatical errors (Types 1, 2, 3, 4, 5) made in the Aliens story context. Significant differences were found among the age groups on the dependent measures, Wilks's L = .826, p <.001. The multivariate η^2 based on Wilks's Λ was strong, η^2 = .091.

A one-way, MANOVA was conducted to determine the effect of age on the types of grammatical errors (Types 1, 2, 3, 4, 5) made in the LFS story context. No significant differences were found among the age groups on the dependent measures, Wilks's $\Lambda = .931$, $p = .297$. The multivariate η^2 based on Wilks's Λ was, $\eta^2 = .023$.

Table 3. Correlation coefficients between Aliens (A) and Late for School (LFS)

		% Gram. A	% Gram. LFS	TNL-2 Raw - Prod
% Gram. A	Pearson Corr.	1	.144*	.385**
	Sig. (2-tailed)	-	.023	.000
	N	248	248	243
% Gram. LFS	Pearson Corr.	.144*	1	.180**
	Sig. (2-tailed)	.023	-	.005
	N	248	250	244
TNL-2 Raw - Prod	Pearson Corr.	.385**	.180**	1
	Sig. (2-tailed)	.000	.005	-
	N	243	244	244

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
% Gram A = Percent Grammatical in Aliens Story.
% Gram. LFS = Percent Grammatical in Late For School Story.

The PGCU scores for the six & seven-year-olds in the current study were significantly lower (i.e., 78% & 85%, respectively) than those reported for six-year-olds by Guo & Schneider[1] (i.e., 91%).

Table 4. PGCU in story generation task

6-year-olds		8-year-olds	
TL	LI	TL	LI
91	64	95	78

*Guo & Schneider, 2016

4. Discussion

With respect to the first research question, grammaticality differs across the age groups studied. For both story contexts, five, six, and seven-year-olds were more grammatically accurate than the four-year-olds. For the Aliens subtest, the seven-year-olds also demonstrated higher PGCUs than the five and six-year-olds.

To answer the second research question, grammaticality did not differ as a function of story context. Although the children's overall PGCU scores were slightly lower in the Aliens story than the LFS story, the difference was not significant. The difference in scores may be due to the varying amount of stimuli provided to the children to elicit the stories. The LFS story was elicited with five images, and the Aliens story was elicited with one.

In connection to the third research question, grammaticality was highly associated with narrative proficiency in the Aliens story context more than the LFS context, although both were significantly correlated.

Relative to the fourth and fifth research questions, there was no particular error type that was more common that the others, although children tended to make slightly more errors that fell in the Type 1 category than other category types.

Guo and Schneider[1] used the Edmonton Narrative Norms Instrument[7], which includes picture sequences with varying lengths (e.g., five, eight, and thirteen images). Before administering the test to the children, the researchers gave the participants a training story of five pictures that was not included in the study. This was to help the child practice telling a story from pictures and understand what they were being asked to do. If the child struggled to understand during the training story, the examiner was permitted to help the child with explicit prompts.

The participants in the current study had a picture sequence with five images and a single scene. Each child was presented with simple and short instructions prior to each story. These instructions were very similar to each other and required children to look at the pictures and tell the story that corresponds with them for as long and as detailed as they could. The children involved in the study were not primed to tell the stories in a certain way. The lack of background and how the pictures were presented may account for the difference in PGCU scores between these two studies.

5. Future Directions

The next step in this research is to code the McDonald's retell story from the TNL-2 test. The plan is to compare its grammaticality data to the other two stories to see if there is a significant difference in grammaticality between them. This might give clues that will improve diagnosis of language disorders early in a child's development.

6. Acknowledgements

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