

# **The efficacy of story grammar training on narrative skills of children with specific language impairment**

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## Introduction

Children with Specific language impairment (SLI) form the largest group of patients within Dutch speech therapy centres<sup>1</sup>. SLI is a form of developmental language impairment which cannot be attributed to other disorders such as hearing impairment, general developmental difficulties, behavioural difficulties, emotional difficulties, or neurological impairment<sup>2,3</sup>. Children with SLI demonstrate varying difficulties – in form as well as severity – with expressive and/or receptive language<sup>2</sup> and the acquisition of spoken language<sup>2,4,5</sup>. The estimated overall prevalence rate of SLI is 7.4%<sup>4</sup> and is more prevalent among boys than girls (3:1)<sup>6</sup>. A consequently found weak language domain in children with SLI is the development of narrative skills<sup>7</sup>.

The ability to comprehend and tell a narrative plays a major role in human communication<sup>8</sup>. By using narratives, children are able to learn inner logical, temporal and causal relationships between events<sup>8</sup>. Furthermore, the ability to narrate experiences is essential for creating their own identity and is of great importance for a proper development of social-emotional and cognitive skills<sup>9</sup>. Narrative skills are also a predictor of later reading outcomes<sup>10,11</sup> and reading comprehension<sup>12,13</sup>. All these skills are crucial to successfully participate in school activities and in society as a whole<sup>14</sup>.

Children with normal language development are able to comprehend and (re)tell narratives on a basic level at the age of six<sup>15,16</sup>. At the age of nine they produce primary components of story grammar<sup>17</sup>, which is necessary to produce temporal, logical and causally coherent narratives<sup>18</sup>. The top of the story grammar hierarchy consists of the setting, theme, characters, plot, and resolution<sup>19-24</sup>. Story grammar as a whole therefore functions as the construct set of rules that enables the generation of a well-structured story<sup>19,25</sup>.

Correctly generated story grammar is not the only prerequisite to be able to tell a coherent narrative, because narration also needs age-appropriate executive functions like (verbal) working memory, (auditory) attention, inhibition and story structure<sup>5,8,26</sup>. The latter can be divided into two structures: microstructure and macrostructure, both of which are essential skills in telling narratives<sup>27,28</sup>.

The level of microstructure defines the local design of a story at sentence level and refers to causal and temporal subordinating conjunctions, coordinating conjunctions, adverbs, cognitive and linguistic verbs, and mean length of utterance<sup>29-31</sup>.

The level of macrostructure refers to the global content of a story and consists of the number of story utterances and the various plotting elements, which form the basis of a coherent narrative<sup>28</sup>.

By the age of nine, children with SLI often show limitations in their narrative skills and story grammar knowledge<sup>32-34</sup>. Children with SLI produce shorter narratives with fewer plot elements compared to typically developing children<sup>7,21</sup>, and they construct less complex syntactic utterances such as sentences containing subordinate, infinitival and reduced clauses and conjunction reduction<sup>8,35-38</sup>. Many studies have indicated that children with SLI have problems with organisation of narratives at the level of microstructure and macrostructure<sup>7,17,39,40</sup>.

Given the aforementioned importance of narrative skills Petersen<sup>40</sup> created an overview of narrative interventions for improving the narrative skills of children with SLI. This overview<sup>40</sup> included nine foreign studies and showed significant improvement in understanding and production of narratives. However, it must be noted that these interventions are often not clearly described, consist of small research populations, and display limited overlap between narrative intervention materials and procedures<sup>41-46</sup>. Petersen<sup>40</sup> stated that story retelling and a focus on narrative macrostructure might significantly improve narrative macrostructure and some aspects of narrative microstructure after a minimum intervention period of 320 minutes. However, there was no clear connection between the different intervention procedures, duration of the intervention period and the extent of improved narrative skills. Petersen<sup>40</sup> furthermore reported that intensive exposure to narratives may lead to possible incidental improvement of the usage of microstructural features in the narration of children with SLI.

Other research reported an improvement in story retells and narrative comprehension when children with SLI received an intervention focused on story grammar and structure, accompanied with visual support<sup>19,47,48</sup>.

However there are no effective narrative interventions available for improving the narrative skills of children with SLI in the Netherlands<sup>1</sup>. Therefore, the Speech and Language Centre of Royal Dutch Kentalis (RDK) in Utrecht and Eindhoven<sup>49</sup> is developing a narrative intervention for children with SLI: the Story Grammar Training (SGT)<sup>50</sup>. This intervention is derived from the American Story Grammar Marker training<sup>51</sup> and aims at stimulating the narrative skills of children with SLI on microstructure and macrostructure.

An important part of the SGT is the addition of the story-braid<sup>50,51</sup>, which forms the basis of narrative structures and is fitted with several 3D-symbols pointing out different story elements. These story elements display all plotting elements of a story<sup>50,51</sup>. These 3D-symbols help to focus more on the specific structure of a story (character, themes and plot) instead of solely focussing at general structural elements (beginning, middle and ending)<sup>19</sup>. During SGT, children with SLI are trained to concentratedly study the content and plot structures of a story<sup>19,50,51</sup>. The story-braid clearly visualises story grammar and therefor helps children with SLI to improve their story comprehension and story (re)telling<sup>19</sup>. This might lead to an improvement in their narrative skills at the levels of microstructure and macrostructure, which could lead to a coherent, well-structured story.

To find out more about the efficacy of SGT, Duijf<sup>18</sup> executed a study on this training and found promising results on the plotting scores of macrostructure and all microstructure variables. However, so far, these results were not significant, the main reason for which might be the inclusion of several age ranges (7;0-11;0 years). As a consequence, several outcomes remain questionable and less suited for implementation in practice.

However, Duijf<sup>18</sup> does recommend a more limited age range as well as systematic treatment protocols with a fixed eight-week intervention period for all participants. The lack of significant outcome in Duijf<sup>18</sup> and the overall remaining urge for research in the field of SLI and narrative skills are the reason for this research.

## **Aim**

Based on the results of Duijf<sup>18</sup> and previous findings, the following research question and hypotheses are formulated:

### *Research question*

To what extent do the narrative skills of children with a SLI diagnosis improve by using SGT looking at narrative comprehension and the level of microstructure and macrostructure of a story?

H1: SGT has a positive effect on the comprehension of plotting elements in children with SLI.

H2: SGT positively influences the grammaticality of narrative utterances (level of microstructure) in children with SLI.

H3: SGT positively influences the number of correctly used plotting elements (level of macrostructure) in children with SLI.

## Methodology

### *Participants*

A total of seven participants diagnosed with SLI were selected from the RDK<sup>49</sup> Eindhoven and Utrecht. Two of these participants were added from previous research by Duijf<sup>18</sup> and included because of their age, in order to create a greater sample. The children were aged 9;02 to 11;02, they were native Dutch speakers, had an average non-verbal intelligence (IQ>80), normal hearing and vision, and no neurological comorbidity. However, the participants often did have problems with auditory attention, (working) memory and/or executive functions (Table 1). All participants had trouble with the acquisition of grammatical syntactic structures and/or telling a structured and coherent narrative. All parents gave their informed written consent and the participating children had not received SGT before.

### *Assessments*

During the pre-test and the post-test, the expressive narrative skills were measured via two narrative tests: a retelling task, the Bus story (Retelling)<sup>52</sup>, and a story generation telling task, the Frog story (Telling)<sup>53,54</sup>. The Bus story is a standardised element of the Dutch version of the Renfrew Language Scales<sup>55</sup> and is closely related to verbal working memory<sup>8</sup>. The Frog story<sup>53,54</sup> is predominantly used in international research and closely related to sustained auditory attention<sup>8</sup>. Both narrative tests consist of complex narratives with multiple episodes and contain longer sequences of images. With these tests, complex narrative utterances were elicited by a picture-based story. The narrative transcriptions were analysed at the level of microstructure and macrostructure by using spontaneous language analysis (STAP)<sup>56</sup>. This instrument is a standardised language analysis for children aged four to eight. Standardised analyses for older children do not exist. Therefore, the STAP<sup>56</sup> was used as a guideline. Linguists of RDK, together with the researcher, performed the assessments. The Cohen's Kappa<sup>57</sup> was used for the inter-rater reliability (Appendix 1). Discrepancies were solved in discussion until a consensus was reached.

At the level of macrostructure, plotting elements (PE)<sup>9,55</sup> and story length (SL)<sup>5</sup> – consisting of the total t-units and use of subordinating clauses in a story – were evaluated (Table 2). A t-unit is a main clause with the related adjunct subordinate clauses. Linguistic complexity and grammaticality were examined at the level of microstructure.

An analysis on linguistic variables was made, focusing on verb-related errors (VRE)<sup>5</sup>, non-verb related errors (N-VRE)<sup>5</sup>, and grammatical complexity (GC)<sup>18</sup>. These GC consist of the mean length of utterance (MLU)<sup>58</sup>, mean length of utterance of the five longest utterances (MLU5)<sup>59</sup>, and the number of coordinate conjunctions (CC)<sup>18</sup> and subordinate conjunctions (SC)<sup>18</sup>. The MLU was calculated based on the total use of t-units<sup>60</sup>. The utterances of the participants were transcribed and segmented into t-units, also according to STAP<sup>56</sup>.

Receptive narrative skills were evaluated after measuring expressive skills during pre-tests and post-tests. The evaluation was carried out via comprehension questions (CQ). CQ were composed based on the ten main PE from the Bus story<sup>55</sup> and eight from the Frog story<sup>9</sup>.

### *Experimental design*

This study is a one-group pre-/post-test design with seven participants, conducted according to the principles of the Declaration of Helsinki (version 64, October 2013)<sup>61</sup> and in accordance with the Medical Research Involving Human Subjects Act of the Dutch Law Medical-Scientific Research (WMO)<sup>62</sup>. Each participant passed three phases: the pre-test, the intervention period, and the post-test. The intervention period varied between four and eight weeks, with an average of seven. The duration depended on specific narrative-related treatment goals. The post-test takes place after the last intervention session and on that same day. The efficacy of the therapy sessions was measured by comparing the pre-test and post-test results.

### *Therapy*

The participants received individual SGT by trained therapists once a week for 45 minutes, enduring four to eight weeks.

Story elements at the level of macrostructure were trained within the SGT by means of a story-braid<sup>50</sup>. This tactile-kinaesthetic instrument<sup>50,51</sup> consists of visual and tactile 3D-symbols pointing out different story elements: main character, setting, kick-off, feelings, plan, action/event, direct consequence, and resolution of the macrostructure (Appendix 2). The story-braid enables insight in story elements via visual and tactile support, instead of support presented exclusively orally.

The story elements were trained via a treatment protocol (Appendix 3) by means of picture books<sup>50</sup>. Through stimulating the usage of different verbs and function words (prepositions, adverbs, conjunctions) with specific symbols, the microstructural aspects were trained.

### *Statistical procedure*

The non-parametric Shapiro-Wilk normality<sup>63</sup> test was used to test each variable on normality. Since most variables proved to lack normality, the group averages for each linguistic variable were analysed through the non-parametric Wilcoxon Signed Ranks Test<sup>63</sup> in pre-test and post-test condition. To determine increase or decrease between various variables, different correlation analyses were carried out using the non-parametric Spearman's rho<sup>63</sup>. The significance level was set at 0.05 (2-tailed). Missing values were not included.

The effect of the number of treatments (four to eight) is established with different statistical group analyses and turned out to be minimal.



## Results

In order to answer the research question, three levels are analysed: the level of story comprehension, the level of microstructure, and the level of macrostructure of story (Re)telling.

### *Story comprehension*

A total of five participants completed the CQ. Table 3 shows the results of the score of the story CQ. Children scored higher on both narrative tasks. However, the differences between pre-test and post-test are insignificant.

Figure 1 and 2 show the correct answers to the CQ and the related correct achieved PE. It is striking that in both tasks the comprehension of the PE is higher than the production: four out of five participants scored higher on the Retelling and all participants scored higher on PE for Telling. No correlations were found between CQ comprehension level and production level.

### *Microstructure*

All seven participants completed the (Re)telling tasks. Table 4 displays the average usage of the microstructure measures for each task. No significant differences were found between pre-test and post-test on the total usage of CC and SC. When the conjunctions are more closely examined, there is only a significant increase in the usage of the Additive CC: 'en' during the Retelling (pre-test  $M=23.5$ ,  $SE=0.04$ ; post-test  $M=34.6$ ,  $SE=0.05$ ,  $z(7)=-2.028$ ,  $p=0.043$ ). There were no significant differences found in the usage of SC.

The results in Table 4 show a lack of significant differences between pre-test and post-test concerning total N-VRE and VRE. However significant differences were found in subcategories of the (N)VRE. A significant decline in deletion of the adverb 'er' in Retelling (pre-test  $M=0.007$ ,  $SE=0.002$ ; post-test  $M=0.002$ ,  $SE=0.001$ ,  $z(7)=-2.21$ ,  $p=0.027$ ). Telling showed a significant increase of deletion of nouns (pre-test  $M=0.0007$ ,  $SE=0.0005$ ; post-test  $M=0.003$ ,  $SE=0.0008$ ,  $z(7)=-2.032$ ,  $p=0.042$ ). Furthermore, there was a significant increase in argument structure deletion (pre-test  $M=0.009$ ,  $SE=0.004$ ; post-test  $M=0.026$ ,  $SE=0.004$ ,  $z(7)=-2.201$ ,  $p=0.028$ ) and congruency errors in VRE (pre-test  $M=0.016$ ,  $SE=0.006$ ; post-test  $M=0.04$ ,  $SE=0.013$ ,

$z(7)=-2.197, p=0.028$ ). No significant differences were found on the MLU and MLU5 for (Re)telling.

There were no correlations found for Retelling. A significant correlation for Telling can be observed between deletion of nouns and deletion of argument structures ( $\rho=0.908, p=0.005$ ).

### *Macrostructure*

In Table 5 the average usage of the macrostructure measures is displayed for (Re)telling. The achieved PE in Retelling improved for four out of seven, and remained unchanged for one of the participants (Figure 3). Participant #3 showed a substantial improvement from 12 per cent to 76 per cent of achieved PE. However, the previous differences were not significant. In Telling, the number of realised PE increased significantly (Table 5, Figure 4).

Table 5 shows the differences in SL. The significant rise in the usage of subordinate clauses in Retelling is noteworthy, as this difference is not found for Telling. No significant correlations were found in Retelling. In Telling, there is a correlation between PE and subordinate clauses ( $\rho=0.935, p=0.002$ ) as well as for PE and VRE ( $\rho=0.901, p=0.006$ ). Another significant correlation can be observed between t-units and VRE ( $\rho=0.893, p=0.007$ ).

## Discussion

The purpose of this study was to examine the efficacy of SGT on narrative skills of children with SLI. The results of this research suggest limited significant evidence for improvement for the grammaticality of narrative utterances (level of microstructure) and plot structures (level of macrostructure) after receiving SGT. Based on the results of this research SGT does not significantly improve PE comprehension levels for (Re)telling, this despite the fact that PE comprehension levels do seem to progress over the training period.

Furthermore, there is limited evidence for SGT positively influencing the narrative skills of children with SLI on the grammaticality of narrative utterances (level of microstructure). For Retelling, partly significant differences were found for CC. The usage of 'en' (Additive CC) displays a significant increase. In addition, there was an improvement in the usage of the adverb 'er'.

Contrarily, Telling displays a significant negative effect on the level of microstructure in SLI. Opposed to expectations, Telling exhibits a significant increase of noun deletion. There is also a significant increase in argument structure related errors and congruency errors in Telling.

Retelling displays a significant improvement in the usage of subordinate clauses on the level of macrostructure. For Telling, there was a significant improvement in the number of realised PE after SGT.

The fact that few significant results are found in this research is likely due to the small sample size, the short intervention period, and the limited frequency with which the training was given. A strength of this study, compared to the study of Duijff<sup>18</sup>, is the homogeneity within the age range (9;2-11;2) and the average intervention period of seven weeks. The specification of N-VRE and VRE variables at the level of microstructure also contributes to new provided insights in narrative skills of children with SLI.

Only a limited sample size was available for the analysis, plausibly negatively affecting the chances of finding significant effects on story comprehension. Dymock<sup>19</sup> and Dungen<sup>48</sup> claim improvement on story comprehension when training children with SLI with story grammar, additional insights regarding story structures, and/or providing visual support.

A positive effect on story comprehension was expected since these elements are used extensively in SGT. As said, slight progression is noticeable, however not significant.

The usage of Additive CC 'en' and the usage of the adverb 'er' improve significantly. The second hypothesis – considering results on the level of microstructure – can therefore be partly supported. However, using this specific Additive CC already comes forward at the age of three in typically developed children<sup>64</sup>. Previous research from Duijf<sup>18</sup> found no significant differences on microstructural level. This is likely due to the small heterogeneous sample containing many different age categories. Other research on the other hand, did find significant effects on the usage of additive, temporal and causal CC after a minimum intervention period of eight weeks with a training of 40 minutes three times a week<sup>40,45</sup>.

The result of the improved usage of the adverb 'er' in narrative utterances in Retelling is not conform literature. This because the usage of the adverb 'er' which is a monosyllabic, short, unstressed, and often contains schwas is difficult to learn and process for children with SLI<sup>5,65</sup>. An explanation for the increased usage of 'er' might be that SGT trained children with SLI, have improved their processing of all type of words, are more aware of their language production and therefore more precise.

The significant increase of noun deletion on the grammaticality of narrative utterances might be caused by the fact that Telling demands more of an independent inquiry of content related words. This argument is backed up by previous research, which states that children with SLI often have more difficulty with content-related word finding<sup>48</sup>. The deletion of arguments does correlate with the deletion of nouns<sup>4</sup>. Explanations for these results are related to the difficulties with retrieving content-related words in telling a complex story.

This often results in deletion of arguments and therefore errors in the subject-verb agreement. A viewpoint in literature is that these weaknesses in argument structures are caused from a possible lack of processing resources. The processing system of children with SLI has a limited capacity and can only deal with a certain amount of information at a moment in time. Restrictions within the system, when complex tasks are encountered, leads to processing trade-offs<sup>66</sup>. This could explain the significant increase of congruency errors in Telling.

Based on the abovementioned hypothesis it was expected that children with SLI after receiving SGT formulate more well-thought-out-narratives. However, after a short intervention period, it seems that they are often not able to express these phrases at the level of microstructure.

At the level of macrostructure research shows a positive correlation between PE scores on verbal working memory and Retelling. The same relation exists for PE scores on auditory attention and Telling<sup>8</sup>.

However, this research shows paradoxical results: the auditory attention scores were under the range of normality but the participants did show significant improvement in the usage of realised PE. The verbal working memory of the participants was within the range of normality at the start of the research but did not lead to significant increased PE scores on Retelling.

This remarkable result might be explained by the usage of a too heterogeneous sample considering cognitive abilities. Another explanation might be the number of relatively high-realised PE with Retelling at the pre-test condition. Therefore a ceiling effect is reached at the post-test condition. This is most likely the reason for the lack of significant differences in this research. Duijf<sup>18</sup> did not find significant differences on both stories tasks, although six out of eleven participants realised a higher PE after SGT.

Considering the results of this study, (Re)telling tasks show different outcomes at the level of microstructure and macrostructure. In line with previous research, children with SLI showed more grammatical linguistic complex utterances, considering the usage of subordinate clauses as a linguistically complex skill, in a retelling task than in a generation task<sup>8</sup>. In current research Retelling showed progress at the level of microstructure and Telling at the level of macrostructure. An explanation for this result might be that in Retelling, children with SLI recite the example by using their memory-related skills and therefore apply only a few grammar rules. Peterson shares this viewpoint<sup>40</sup>. For Telling, children with SLI need to retrieve the proper content words and grammatical constructions without verbal input in front.

In general, one could conclude that both stories display a decline at the level of microstructure when the levels of macrostructure are increasing and vice versa.

A possible explanation is that children with SLI cannot show proficiency at both levels simultaneously. Another possibility is that (Re)telling is too complex to show significant differences after a short period of SGT.

This research provides more insight in narrative skills of children with SLI and the complexity of it. However, the sample used in this research consists of non-representative participants – five girls and two boys – while boys are overrepresented in SLI populations<sup>6</sup>. In addition participants demonstrate varying difficulties with expressive and/or receptive language and also demonstrate problems with auditory attention, memory and/or executive functions in addition to SLI. These problems and varieties might explain the limited significant differences and increase of narrative skills, but on the other hand does resemble the actual SLI population more closely than homogenous sample groups.

The intervention period used in this research may be too short for significant progress. This because of the substantial learning difficulties children with SLI have regarding storing and using words, and the complexity of comprehending and producing narratives in general<sup>64</sup>. An extended duration and more frequent scheduled SGT may lead to better results. A minimum training period of eight weeks seems to be more effective<sup>2,18</sup>.

Another recommendation for future research is to study a greater sample size containing homogeneity only at two age ranges, enabling the possibility to monitor the effect of age on the efficacy of SGT. More cases could also increase the evidence of the efficacy of SGT training on story comprehension, in grammaticality (level of microstructure) and in plot structure (level of macrostructure) and therefore overall narrative skills.

## **Conclusion**

Narrative abilities are a prerequisite for a healthy development of social-emotional and cognitive skills in children. The clinical setting yearns for evidence by means of scientific research in effective narrative interventions for children with SLI. This research contains limited evidence for the efficacy of SGT. Improvements on microstructure and macrostructure can be noticed, as well as using more Additive CC, use of the adverb 'er', more subordinated clauses, and the usage of more realised PE. Further well-designed research is needed to confirm these findings.

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## Tables

**Table 1.** Characteristics of participants.

Variable	Participants (n=7)
<u>Age</u>	
Age in months (SD)	119 (8.8)
Interval	110.5 – 126.7
<u>Gender</u>	
Male	2
Female	5
<u>Intelligence quotient<sup>a</sup></u>	
IQ <sup>h</sup>	97.0 (15.6)
Interval	82.2 – 111.8
<u>Receptive skills<sup>b</sup></u>	
WBQ <sup>h</sup> (SD)	88.3 (9.7)
Interval	79.3 – 97.3
<u>Receptive skills pct<sup>b</sup></u>	
WBQ pct (SD)	0.26 (0.17)
Interval	0.09 – 0.40
<u>Auditory attention<sup>c</sup></u>	
Ss <sup>i</sup> (SD)	5.86 (3.0)
Interval	3.1 – 8.6
<u>Visual attention<sup>c</sup></u>	
Ss <sup>i</sup> (SD)	9.71 (2.4)
Interval	7.5 – 11.9
<u>Working memory<sup>d</sup></u>	
Quotient <sup>h</sup> (SD)	92.0 (23.7)
Interval	70.1 – 113.9
<u>Long term memory<sup>e</sup></u>	
Deciel <sup>j</sup> (SD)	5.1 (3.8)
Interval	1.7 – 8.6
<u>Executive functions<sup>f</sup></u>	
Ss <sup>i</sup> (SD)	8.9 (3.8)
Interval	5.4 – 12.3

Interval: 95% confidence interval; IQ: intelligence quotient; n: number of participants; pct: percentile; SD: standard deviation; Ss: Standard score; WBQ: word comprehension quotient.

<sup>a</sup> For determination of the intelligence quotient, the Wechsler Intelligence Scale for Children-III-NL (WISC-III-NL)<sup>67</sup> is used for five of the seven and the Sijnders-Oomen Non-verbal intelligence test (SON-R 6-40)<sup>68</sup> is used for two of the seven participants.

<sup>b</sup> For determination of the receptive skills, the Peabody Picture Vocabulary Test -III- NL (PPVT-III-NL)<sup>69</sup> is used.

<sup>c</sup> For determination of the auditory attention and visual attention, the Test of Everyday Attention for Children (Tea-ch)<sup>70</sup> is used.

<sup>d</sup> For determination of the working memory, the Working Memory Test Battery for children (WMTB-C)<sup>71</sup> is used.

<sup>e</sup> For determination of the long term memory, the Woorden Leer Test (WLT)<sup>72</sup> is used.

<sup>f</sup> For determination of the executive functions, the Behavioural Assessment of Dysexecutive Syndrome for Children (BADSC)<sup>73</sup> is used.

<sup>g</sup> Quotient (-1 SD to +1 SD ranges from 85-115).

<sup>h</sup> Standard score (-1 SD to +1 SD ranges from 7.0-13.0).

<sup>i</sup> Deciel (-1 SD to +1 SD ranges from 2.5-9.5).

**Table 2.** Study parameters.

Parameter	Comment
<u>Comprehension</u>	
CQ	Sum of correctly answered questions concerning the selected stories divided by the total number of questions.
<u>Microstructure</u>	
VRE	Sum of all errors related to verbs, divided by the sum of all t-units.
N-VRE	Sum of all non-verb related errors divided by the sum of all t-units.
GC	Sum of subordinate clauses divided by the total number of utterances in a story. These include: <ul style="list-style-type: none"><li>- MLU: The MLU is calculated based on t-units. A t-unit is a main clause with the related adjunct subordinate clauses.</li><li>- MLU5: the average length of the five longest utterances.</li><li>- Number of CC and SC divided by the sum of all clauses and subordinate clauses.</li></ul>
<u>Macrostructure</u>	
PE	Sum of all correctly realised plot elements divided by the total number of offered plot-elements.
SL	Total number of clauses and total number of subordinate clauses in a story.

CC: coordinate conjunctions; GC: grammatical complexity; CQ: comprehension question; MLU: mean length of utterance; MLU5: mean length of utterance of the five longest utterances; N-VRE: non-verb related errors; PE: plotting elements; SC: subordinate conjunctions; SL: story length in t-units; VRE: verb related errors.

**Table 3.** Score of comprehension questions of the Bus story (Retelling) and the Frog story (Telling).

Bus Story						Frog Story						
T1 (n=3)			T2 (n=5)			T1 (n=3)			T2 (n=4)			
M	SD		M	SD	Z	P	M	SD	M	SD	Z	P
Score comprehension questions												
86.7	5.8		96.7	5.8	-1.342	0.180	87.5	12.5	95.8	7.2	-1.414	0.157

M: mean; n: number of participant; P: p-score; SD: standard deviation; T1: pre-test; T2: post-test; Z: z-score.

**Table 4.** Microstructure measures of the Bus story (Retelling) and the Frog story (Telling).

Bus Story						Frog Story						
T1 (n=7)			T2 (n=7)			T1 (n=7)			T2 (n=7)			
M	SD		M	SD	Z	P	M	SD	M	SD	Z	P
Mean Length of Utterances <sup>a</sup>												
7.7	1.0		7.7	0.9	-0.105	0.916	7.6	0.5	7.7	0.8	-0.254	0.799
Mean Length of the 5 Longest Utterances												
11.8	2.4		12.2	2.6	-0.681	0.496	13.2	1.4	13.8	2.3	-0.631	0.528
Coordinate Conjunctions CC <sup>b</sup>												
0.57	0.08		0.65	0.12	-1.185	0.236	0.71	0.15	0.71	0.16	-0.507	0.612
Subordinate Conjunctions SC <sup>b</sup>												
0.13	0.08		0.14	0.02	-0.507	0.612	0.06	0.04	0.08	0.06	-0.676	0.499
Non-Verb Related Errors N-VRE <sup>b</sup>												
0.25	0.10		0.22	0.13	-1.014	0.310	0.36	0.19	0.40	0.30	-0.169	0.866
Verb Related Errors VRE <sup>b</sup>												
0.25	0.18		0.19	0.18	-0.845	0.398	0.17	0.07	0.21	0.11	-1.521	0.128

M: mean; n: number of participants; P: p-score; SD: standard deviation; T1: pre-test; T2: post-test; Z: z-score.

<sup>a</sup> The mean length of utterances is calculated based on t-units.

<sup>b</sup> Total number of coordinate conjunctions (CC), subordinate conjunctions (SC), non-verb related errors (N-VRE), or verb related errors (VRE) divided by the sum of all clauses plus subordinate clauses in the narratives.



**Table 5.** Macrostructure measures of the Bus story (Retelling) and the Frog story (Telling).

Bus Story						Frog Story						
T1 (n=7)			T2 (n=7)			T1 (n=7)			T2 (n=7)			
M	SD		M	SD	Z	P	M	SD	M	SD	Z	P
Plotting elements <sup>a</sup>												
0.47	0.21		0.62	0.13	-1.261	0.207	0.33	0.12	0.53	0.12	-2.120	0.034
T-units												
24.4	5.3		26.3	4.9	-1.101	0.271	55.0	10.7	56.7	18.3	-0.338	0.735
Subordinate clauses <sup>b</sup>												
7.0	3.9		10.3	4.1	-2.375	0.018	7.1	3.5	11.3	7.5	-0.877	0.380

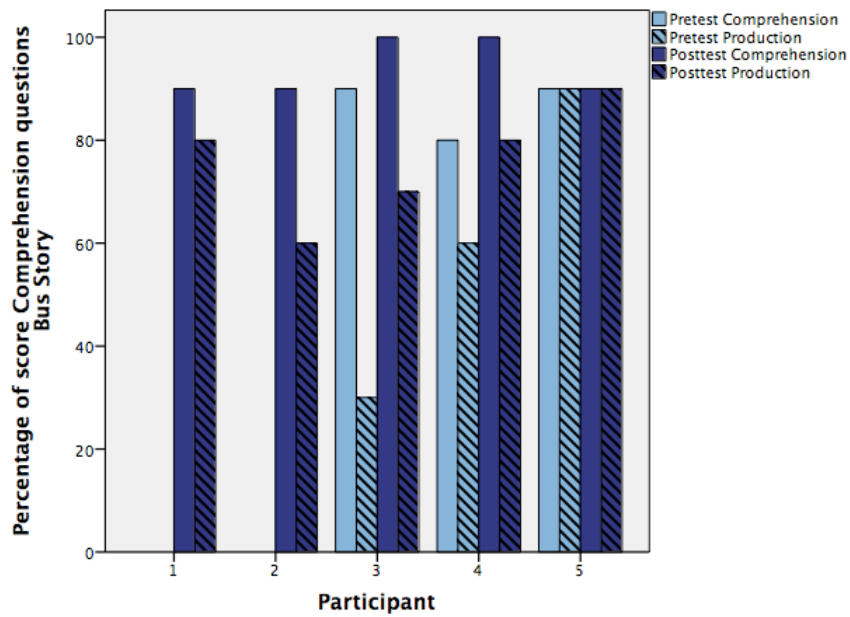
M: mean; n: number of participant; P: p-score; SD: standard deviation; T1: pre-test; T2: post-test; Z: z-score.

<sup>a</sup> Percentage of realised plotting elements.

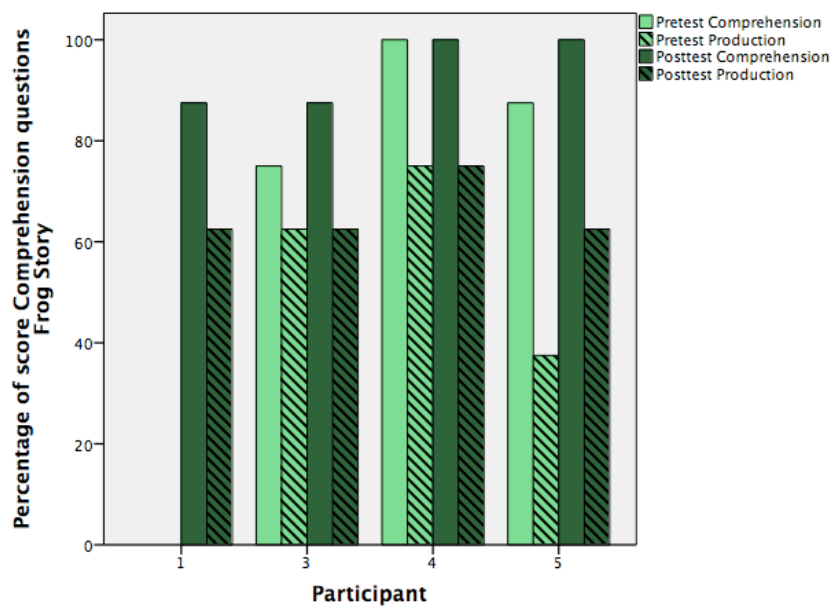
<sup>b</sup> Total number of subordinate clauses divided by the sum of all clauses in the narratives.

## Figures

**Figure 1.** Bus story comprehension and production of plotting elements.



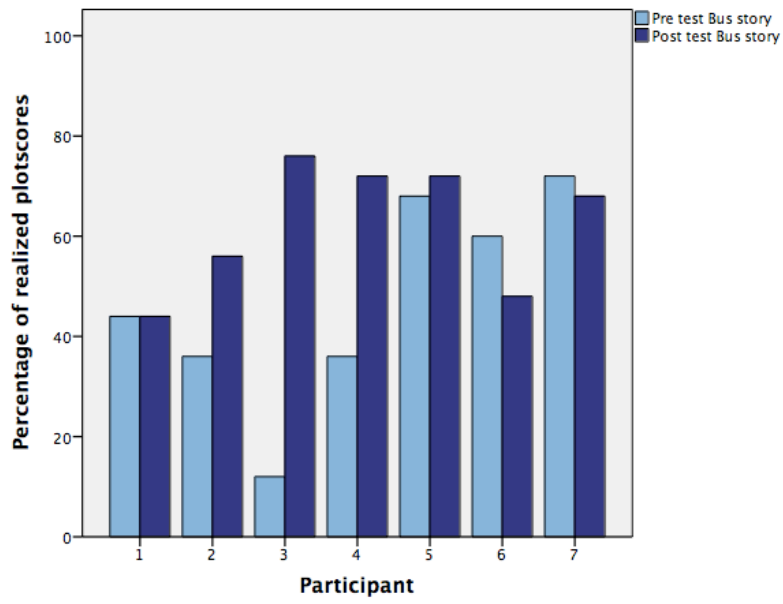
**Figure 2.** Frog story comprehension and production of plotting elements.



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**Figure 3.** Bus story score plotting elements.

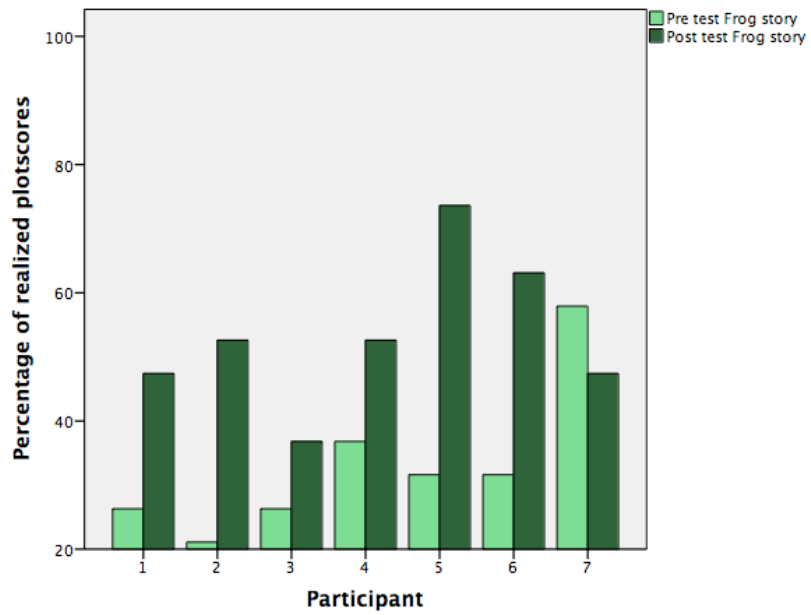
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**Figure 4.** Frog story score plotting elements.

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## English abstract

*Title:* The efficacy of story grammar training on narrative skills of children with specific language impairment.

*Background:* Narrative abilities are an important prognostic indication of future school success and language proficiency. Children with specific language impairment (SLI) show limitations in their narrative skills and are therefore in need of effective interventions for improving those narrative skills. The story grammar training is considered to be a possibly effective narrative intervention.

*Aim and research question:* This research studied the efficacy of the intervention 'story grammar training' for children aged 9;02 to 11;02 with SLI. The study comprised of an analysis on the levels of story comprehension, microstructure, and macrostructure (all established indicators for narrative skills).

*Method:* Seven participants received individual story grammar training over a period of 4-8 weeks. During the pre-test and post-test, the expressive narrative skills were measured via two narrative tests. Plotting elements and story length were evaluated on the level of macrostructure. Microstructural complexity was analysed using verb related errors, non-verb related errors, and grammatical complexity. Receptive narrative skills were measured via comprehension questions.

*Results:* A comparison of the pre-test and post-test shows a significantly increased usage of Additive coordinate conjunctions, the adverb 'er', subordinated clauses, and the number of realised plotting elements. On the contrary there are significant inclined deletion of nouns, argument structure deletion, and congruency errors.

*Conclusion:* The clinical setting yearns for evidence by means of scientific research in effective narrative interventions. This research delivers limited evidence for the efficacy of story grammar training. Further well-designed research is needed to confirm these findings.

*Recommendations:* A recommendation for future research is to study a greater sample size containing homogeneity at two age ranges and an increased duration and intensity of the specific intervention.

**Keywords:** 'Specific language impairment', narrative, intervention, macrostructure, microstructure.

## **Dutch summary**

*Titel:* De doelmatigheid van de interventie 'story grammar training' met betrekking tot de vertelvaardigheid van kinderen met een taalontwikkelingsstoornis(TOS).

*Inleiding:* Vertelvaardigheid is een belangrijke voorspeller van later schoolsucces en taalvaardigheden. Kinderen met een TOS laten regelmatig problemen zien met betrekking tot de vertelvaardigheid. Het is daarom van belang dat wetenschappelijk onderbouwde vertelvaardigheidsinterventies worden uitgevoerd. De 'story grammar training' kan hier mogelijk aan bijdragen.

*Doel en onderzoeksvraag:* Dit onderzoek richt zich op het vinden van wetenschappelijk bewijs voor de effectiviteit van de 'story grammar training' bij kinderen van 9;02 tot 11;02 jaar in een klinische werksetting. Het onderzoek bestaat uit een analyse van verhaalbegrip en van het micro- en macroniveau van een verhaal.

*Methode:* Zeven participanten hebben gedurende 4-8 weken individueel 'story grammar training' ontvangen. Tijdens de voor- en nameting zijn de expressieve vertelvaardigheden via twee verteltaken geanalyseerd. Op microniveau werd gekeken naar het gebruik van niet-werkwoord gerelateerde fouten, werkwoord gerelateerde fouten en grammaticale complexiteit. Op macroniveau werd gekeken naar het aantal gerealiseerde plotelementen en de verhaallengte. Het verhaalbegrip werd bekeken aan de hand van verhaalbegripsvragen.

*Resultaten:* Vergelijking van de voor- en nameting laat zien dat er significante verbetering is in het gebruik van additieve voegwoorden, het bijwoord 'er', bijzinnen en het aantal gerealiseerde plotelementen. Ook werd een significante toename gevonden van deletie van zelfstandig naamwoord en argumenten en congruentiefouten.

*Conclusie:* In de klinische praktijk is grote behoefte aan het vinden van evidentie voor vertelvaardigheidsinterventies. Met dit onderzoek is beperkt bewijs gevonden voor de doelmatigheid van de 'story grammar training'. Er is meer onderzoek nodig om deze bevindingen te bevestigen.

*Aanbevelingen:* Aanbevelingen voor toekomstig onderzoek zijn het herhalen van de studie met een grotere homogene steekproef, bestaande uit twee verschillende leeftijdsgroepen, en het verhogen van de duur en frequentie van de specifieke vertelvaardigheidsinterventie.

Trefwoorden: Taalontwikkelingsstoornis, narratief, interventie, microniveau, macroniveau.

## Appendix 1

Inter-rater reliability scores.

Variable	Measure <sup>57</sup>	Result	Data	Reviewers
<u>Microstructure</u>				
Conjunctions	Cohen's Kappa	0.941	10%	2
MLU	Cohen's Kappa	0.989	10%	2
MLU5	Cohen's Kappa	0.987	10%	2
N-VRE	Cohen's Kappa	0.960	10%	2
VRE	Cohen's Kappa	0.960	10%	2
<u>Macrostructure</u>				
Plotting element	Cohen's Kappa	0.960	10%	2
T-units	Cohen's Kappa	0.953	10%	3
Subordinate clauses	Cohen's Kappa	0.930	10%	2

## Appendix 2

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### Story elements of the 3D-symbols of the story-braid<sup>50</sup>.

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Main character	Who or what is the story about?
Setting	When and where does the story take place?
Kick-off	What happened to the character?
Feelings	How did the character feel about what happened?
Plan	What does the character want to do?
Action/event	What action does the character take to achieve the plan?
Direct consequence	What happened as a result of the attempt/action?
Resolution	How does the character feel about the direct consequence?

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### Appendix 3

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#### Intervention protocol Story Grammar Training<sup>50</sup>.

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- Step 1 The picture book is observed with the subject; the depicted story is told, not read.
- Step 2 The story is interactively read out loud, whereby the symbols of the 'story-braid' function as support. The therapist formulates the links from the symbols to the story-elements.
- Step 3 The child stages the story with corresponding materials and/or hand held puppets. The therapist supports the story intensively through making use of: complementary sentences, specific questioning for clarification or repetition and focused stimulation (offer same sentence structure repeatedly). The pictures from the book function as support too.
- Step 4 The child retells the story using the 'story-braid' and one picture from the book.
- Step 5 Attention is paid to the microstructure of the story in relation to the language goals of the child, for example the practice of sentence structures.
- Step 6 The child is provoked to tell the story on basis of one complex picture depicted in the book, without support of the 'story-braid'. The story is audio recorded.
- Step 7 The in step 6 recorded story is played back while the symbols of the 'story-braid' are shown. The therapist and the child discuss which of the symbols are absent.
- Step 8 Step 5 is repeated
- Step 9 Together with the therapist the child tells the story once again on basis of the symbols shown on the 'story-braid'. Use can be made of symbol magnets on a white board or a worksheet with stamps. Special attention is given to the element that was not sufficiently told in step 8.
- Step 10 The story is retold once again, but in an alternative work form as in: telling the story with the aid of a digital picture book, recording the story accompanied by pictures of the book, drawing a comic strip or by creating a logical sequence of pictures from the book as a screenplay.
-



## Appendix 4

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List of abbreviations and relevant definitions.

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CC	Coordinate Conjunctions
CQ	Comprehension Question
GC	Grammatical Complexity
MLU	Mean Length of Utterances
MLU5	Mean Length of Utterance of the Five longest utterances
(N)VRE	(Non) Verb Related Errors
PE	Plotting Elements
Retelling	Retelling task, the Bus story
RDK	Speech and Language Centre of Royal Dutch Kentalis
STAP	Spontaneous Language Analysis Procedure (in Dutch: Spontane Taal Analyse Procedure)
SC	Subordinate Conjunctions
SGT	Story Grammar Training
SL	Story Length
SLI	Specific Language Impairment
Telling	Generation telling task, the Frog story
WMO	Medical Research Involving Human Subjects Act (in Dutch: Wet Medisch-wetenschappelijk Onderzoek met Mensen)

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