



The clinical application of SALT to evaluate intervention program effectiveness in a school context

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KEYWORDS

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Language sample analysis (LSA) is highly recommended in the literature as a clinical tool for diagnosis, goal-setting and measuring effectiveness. This paper describes a project undertaken by a team of speech-language pathologists in a school context, whereby language samples of a narrative retell task from 91 children with developmental language disorder (DLD) were analysed using systematic analysis of language transcription (SALT) at two testing points. This was done in an effort to streamline usual narrative analysis processes and to evaluate the effectiveness of whole school narrative programming. Children’s linguistic performance on narrative macrostructure and microstructure measures, and suggestions for future directions are discussed. Conclusions from the project suggest SALT is a valuable clinical tool for evaluating intervention program effectiveness that is transferable to the school context.



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Developmental language disorder (DLD) affects approximately 7 per cent of the population (Norbury et al., 2016). Children with DLD experience language difficulties in the absence of sensory impairment or intellectual disability (Bishop, Snowling, Thompson, Greenhalgh, & and the CATALISE Consortium, 2017). In Perth, Western Australia, children with DLD may be offered an educational placement in one of five language development centres (LDCs). LDC speech-language pathologists (SLPs) and teachers work together to develop students’ skills and knowledge across the curriculum.

The Western Australian curriculum places great emphasis on classroom teaching of narrative skills. From kindergarten to year 6, the School Curriculum and Standards Authority (2016) states that children are expected to demonstrate understanding and use of text structure and organisation, including “how texts serve different purposes and how the structures of types of texts vary according to the text purpose” (p. 2), and “how texts work as cohesive wholes through language features that link parts of the

text together, such as paragraphs, connectives, nouns and associated pronouns” (p. 2). These definitions reflect aspects of narrative macrostructure (the rule-governed way episodes of text are organised at discourse level) and microstructure (the cohesive linguistic devices that link macro-elements), respectively. It is believed that narrative language serves as a bridge between oral and literate language (Westby, 1985) as it supports young language learners to move from contextualised to decontextualised language use necessary for academic performance. Further, academic success is predicted by narrative performance (Bishop & Edmundson, 1987). Therefore, a focus on teaching oral narrative directly and explicitly is necessary in a classroom context for young school-aged children, especially those with language difficulties.

It has been well documented that school-aged children with DLD have more difficulty in narrative comprehension and generation than their typically developing peers, and have been found to produce narratives that are less developed in story grammar, with a reduced range of vocabulary and less complex syntax (Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004). Children with DLD present with macrostructure errors including incorrect or illogical sequencing of events, omission of story elements, and reduced length of narratives (Petersen, 2010). Microstructure errors such as in grammar, reduced sentence complexity, incorrect word selection and reduced lexical diversity may also be present (Hayward & Schneider, 2000).

A responsiveness to intervention (RTI) model is useful to describe narrative intervention to address such difficulties (Gillam & Justice, 2010). RTI is often conceptualised as a framework of instructional support that uses a tiered approach: tier 1 (whole class); tier 2 (small group); and tier 3 (individual), where at the LDC, SLPs have a role of developing and implementing intervention across all tiers. There is evidence to suggest that narrative intervention is effective at improving language performance in broad tier 1 intervention over as little as four weeks (Spencer, Petersen, Slocum & Allen, 2014), for culturally diverse preschool aged children (Petersen & Spencer, 2016), as well as specifically for children with DLD in the classroom and in small groups (Petersen, 2010; Gillam, Gillam & Reece, 2012; Spencer et al., 2014).

Within LDCs, an evidence-based approach is taken to delivering narrative intervention with procedures replicating those described in the research literature. These intervention procedures form the foundation of language

intervention for students with DLD from kindergarten to year 2. SLPs work with teachers to deliver classroom-based, small-group and individual intervention within an RTI model. Narrative-based language intervention generally occurs daily, for between 20–60 minutes, depending on the age of the students. Narrative comprehension and expression skills are taught within an explicit teaching framework and are included in intervention procedures in the studies detailed above. Lennox, Westerveld and Trembath (2016) reported on the effectiveness of a classroom-based intervention to improve literacy performance for at-risk preschool-aged students using a similar approach to that implemented at the LDC. The authors found positive effects for oral language performance following 24 weeks of tier 1 intervention.

To ensure the provision of evidence-based practice, it is vital to monitor ongoing program effectiveness. Common narrative elicitation techniques used across studies in a recent systematic review of intervention literature (Petersen, 2010) include: repeated telling and/or generating narratives using single pictures/photos, wordless picture books and/or picture drawings to elicit narratives. Specific aspects of narrative language performance gathered through these means can be evaluated using measures available through systematic analysis of language transcripts (SALT; Miller, Gillon & Westerveld, 2015), such as number of different words (NDW) and mean length of utterance (MLU). Calder et al., (2017) previously discussed a process for using SALT as a method for analysing expressive language performance in a narrative context which is useful for establishing baseline data and planning intervention. The aim of this current paper is to report on the evaluation of the success of a classroom based narrative intervention program using the same procedures by comparing narrative performance of a cohort of students from 2015 to 2016.

The research hypotheses are:

1. Following a year of classroom based narrative intervention, year 1 and 2 students with DLD will demonstrate significant improvement on narrative macrostructure measures (setting, character, initiating event, internal response, plan, actions, complication, solution, and consequence).
2. Following a year of classroom based narrative intervention, year 1 and 2 students with DLD will demonstrate significant improvement on narrative microstructure measures (MLU, NDW, percentage of maze words, conjunctions, adverbials, and word level errors).

Method

Ethics

Ethics approval for this project was obtained from Curtin University (HRE2016-0047) and the Department of Education, Western Australia.

Participants

Participants were 91 children with developmental language disorder (DLD); 64 children entering pre-primary (5;11–6;7 years) and 27 beginning year 1 (6;11–7;4 years). All children attended the same LDC, in the Perth metropolitan area. All children were diagnosed as having DLD based on formal and informal assessment including the *Clinical Evaluation of Language Fundamentals-Preschool* (Wiig, Secord, & Semel, 2004). All children demonstrated sound adaptive behaviour and average or above-average non-verbal skills to

differentiate students from those that may have a global developmental delay, as determined by a referring psychologist. These factors combined are considered evidence of a diagnosis for DLD (Bishop, Snowling, Thompson, Greenhalgh, & the CATALISE Consortium, 2016).

Data collection tools and procedures

Narrative samples were collected from all participants in term 4 of 2015 prior to intervention in 2016 using the wordless picture book *Peter and the Cat* (Leitão & Allan, 2003). Children listened to the story while looking at the pictures. Children were then required to retell the story using the pictures as visual prompts. *Peter and the Cat* (Leitão & Allan, 2003) contains all key macrostructure elements (Stein & Glenn, 1979).

Narrative intervention blocks at the LDC typically begin with a whole-class book share, incorporating a “before, during and after” reading process focused on: a) activating prior knowledge of the story or theme within the book, b) completing a picture walk to support predicting and development of vocabulary, c) sticking narrative macrostructure icons into the book as elements are revealed during the read through, and d) completing a brief oral discussion of the book, focusing on recalling narrative macrostructure elements. Following this initial read through, the whole class listens to and is encouraged to join in with the reading of the book daily for two to four weeks, at the beginning of each narrative lesson. Intervention activities related to the narrative are then completed in small group rotations led by the teacher or education assistant or independently.

Intervention activities used in this study included sequencing of pictures from the narrative and creating story boards, explicit targeted lessons on the macrostructure elements of the story (e.g. character, setting or central plot), group choral retells of the story using a story board or story map, and individual oral retells of the story with visual support. Additional activities focused on semantic organisation and vocabulary, grammar, and comprehension related to the text were also included throughout the two-to four-week period.

Following one year of intervention, all participants were re-assessed using *Peter and the Cat* in term 4 of 2016. The same procedure was followed to collect narrative samples. See Table 1 for a breakdown of assessment schedule.

Table 1. Assessment time points and number of students from 2015 to 2016

Term 4, 2015	Term 4, 2016
64 pre-primary students	64 year 1 students
27 year 1 students	27 year 2 students

All language samples were audio recorded and samples were transcribed verbatim by LDC classroom teachers. SLPs listened to the recorded samples and checked the teachers’ transcription, which were edited accordingly.

Data analysis

Samples were segmented into c-units using SALT segmentation guidelines and analysed by SLPs using SALT *Research Version* software (Miller et al., 2015). All samples were coded in accordance with SALT coding guidelines in order to allow for calculation of SALT standard measures



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including MLU, NDW, mazes, and error codes. Samples were also coded for presence of macrostructure elements; temporal and causal conjunctions; and, adverbials of time, place and manner. For each cohort, *SPSS Statistics 23* was used to compare samples collected from each student in 2015 to 2016. Scale measures (actions, MLU, NDW, percentage of maze words, conjunctions, adverbials and word level errors) were counted each time they appeared in each sample, while binary measures (setting, character, initiating event, internal response, plan, complication, solution, and consequence) were coded for presence (1) or absence (0). Statistical difference between 2015 and 2016 samples for parametric measures were analysed using paired-samples *t*-tests with a α level of .05. Probabilities of difference between 2015 and 2016 non-parametric measures were analysed using McNemar's Test of Change.

Results

Average total utterances for pre-primary in 2015 was 18.20 (sd = 5.118) complete and intelligible utterances, and 22.56 (sd = 6.00) for year 1s in 2016. Average total utterances for year 1 in 2015 was 19.93 (sd = 4.64) complete and intelligible utterances, and 19.74 (sd = 4.24) for year 2s in 2016.

Macrostructure

Differences in macrostructure for year 1 ($n = 64$) and year 2 ($n = 27$) participants are summarised in tables 2 and 3, respectively. Students included character, initiating event, internal response, actions and consequence in their narrative samples significantly more in 2016 than in 2015. Greater use of setting, plan and complication was seen in students' narrative samples in 2016 as compared to 2015; however, these differences were not statistically significant.

Table 2. Pre-primary to year 1 change in macrostructure frequency scores and statistical significance

	Frequency 2015	Frequency 2016	Significance
Character	50	62	< .01***
Setting	18	45	> .99
Initiating event	49	63	< .01***
Internal response	0	11	< .01***
Plan	13	41	.35
Actions	2.69 (<i>sd</i> = 1.64)	4.34 (<i>sd</i> = 2.14)	< .01***
Complication	17	48	> .99
Solution	36	28	< .01***
Consequence	29	58	.02*

Note. $n = 64$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4. Pre-primary to year 1 change in microstructure frequency scores and statistical significance

$n = 64$	Average 2015	Average 2016	Significance	Cohen's <i>d</i>
MLU	6.14 (1.20)	7.01 (1.10)	< .01***	.61
NDW	48.66 (16.71)	62.70 (16.71)	< .01***	.73
% Maze words	.83 (0.06)	.07 (0.05)	.18	.20
Error codes	7.86 (4.61)	8.55 (4.89)	.33	.12
Connectors	7.70 (5.11)	10.22 (4.45)	< .01***	.45
Adverbs	4.16 (2.50)	4.09 (0.79)	.88	.02

Note. $n = 64$; * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3. Year 1 to year 2 change in macrostructure frequency scores and statistical significance

	Frequency 2015	Frequency 2016	Significance
Character	23	26	< .01***
Setting	9	20	.87
Initiating Event	22	27	< .01***
Internal Response	0	1	< .01***
Plan	13	25	.11
Actions	2.89 (<i>sd</i> = 1.40)	4.07 (<i>sd</i> = 1.74)	.02*
Complication	7	18	.87
Solution	22	27	.375
Consequence	17	27	.01**

Note. $n = 27$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 5. Year 1 to year 2 change in microstructure frequency scores and statistical significance

$n = 27$	Average 2015	Average 2016	Significance	Cohen's <i>d</i>
MLU	6.94 (1.20)	7.15 (1.35)	.44	.15
NDW	60.78 (15.93)	63.44 (14.00)	.34	.19
% Maze words	.10 (0.06)	.07 (0.05)	.84	3.46
Error codes	6.70 (4.95)	5.19 (4.20)	.59	.38
Connectors	11.26 (4.07)	8.93 (4.96)	.05*	.41
Adverbs	4.22 (2.60)	5.11 (2.67)	.17	.27

Note. $n = 27$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Microstructure

Differences in microstructure for year 1 ($n = 64$) and year 2 ($n = 27$) participants are summarised in tables 4 and 5, respectively. Year 1 students demonstrated a significant increase in MLU, NDW and connectors and a significant decrease in usage of adverbials. All differences in microstructure for year 2 participants were non-significant, excepting a significant decrease in connectors.

Reliability

Interrater reliability of narrative sample transcription and coding was evaluated by calculating intraclass correlation coefficients (Cohen's kappa) for SALT measures and narrative macro- and microstructure codes (see Table 6). Guidelines for interpretation for kappa/ICC inter-rater agreement measures follows Cicchetti's (1994) recommendations: *poor* (< 0.40); *fair* ($0.40-0.59$); *good* ($0.60-0.74$), and *excellent* (0.75 and 1.00). We had excellent agreement for all the SALT standard codes, and for microstructure codes, but poor or fair agreement for macrostructure codes (with the exception of complication).

Feature	ICC/Cohen's χ	Interpretation
%MzWrds	.948	Excellent
ErrCodes	.923	Excellent
MLUm	.913	Excellent
NDW	.99	Excellent
Setting	.53	Fair
Character	.243	Poor
Initiating event	-.147	Poor
Internal response	-.07	Poor
Plan	.592	Fair
Actions	.488	Fair
Complication	.839	Excellent
Solution/resolution	.32	Poor
Consequence/tie-up	.356	Poor
Connectors	.762	Excellent
Adverbs	.838	Excellent

Discussion

This paper reports on the results of a tier 1 narrative intervention program delivered within the classroom in a school for children with DLD. As professionals, SLPs are charged with demonstrating treatment effectiveness in everyday clinical practice. Within specialised service delivery contexts, such as LDCs, SLPs are required to report on treatment effectiveness at both the individual student and cohort level. In such contexts, clinicians are faced with challenges in demonstrating effectiveness given the number of clients on the active caseload.

Ninety-one children with DLD received a narrative intervention program within their classrooms, delivered by

teachers and SLPs. As hypothesised, significantly more children included appropriate characters, initiating events, internal responses, actions and consequences following intervention. While significant increases were not observed for setting, plan, solution and complications, this may be due to the nature of the intervention program, which focused mainly on the link between initiating event and internal response within the narratives. These elements are critical for improving knowledge of cause-and-effect relationships within story telling. This focus may have been at the expense of ensuring the use of other macrostructure elements were secure before progressing with intervention.

At a microstructure level, significant improvements were made in MLU, NDW, and number of connectors used between pre primary (PP) and year 1, in line with hypothesis 2. Between year 1 and year 2 no significant difference was seen in percentage of maze words, error codes, or use of adverbials. Despite a significant increase in the number of the macrostructure measure of actions, a significant reduction in use of connectors was found alongside an increase in MLU. This may suggest that students are focusing on elaborating sentences (i.e., within simple sentence structures) rather than expanding sentences (i.e., to compound and complex sentences). Unfortunately, the coding system used in this project did not allow the evaluation of elaborated noun phrases (e.g., inclusion of noun modifiers) to explore this outcome further. Future intervention may need to focus on linking these sentences to others within the text to improve use of complex language at discourse level for this cohort. Nonetheless, in general, findings suggest narrative language is more elaborate with increased grammatical and semantic accuracy (e.g., fewer error codes) by the end of year 2. The use of SALT allowed clinicians to measure oral language change quantitatively using a narrative sampling context (*Peter and the Cat*) at a cohort level following tier 1 narrative intervention, which would have otherwise not been possible using the paper version of the task alone.

Results suggest that LDC students responded positively to evidence-based tier 1 narrative language intervention (Spencer et al., 2014; Petersen & Spencer, 2016). In future, more time may be spent encouraging the use of foundation elements, such as setting before progressing to more complex elements. Furthermore, focus is needed on understanding and use of the grammatical functions of structures such as adverbials in narrative discourse to further elaborate sentences, as well as connectors that may be used to expand sentences to improve narrative cohesion.

Limitations

This paper reports on the use of SALT in a school context to track student progress following tier 1 narrative intervention. Notwithstanding the large sample size of this study, there are limitations to the generalisability of the findings to contexts outside the LDC. First, student performance was unable to be referenced against norms for typically developing, age-matched speakers. Although this function exists in SALT, the reference database stimuli were not utilised in the current project. Similarly, performance was not evaluated against a control group, and therefore threats to external validity such as maturation or history effects must be considered. Further, randomisation of children to treatment versus control groups would address possible selection bias but this was not possible within the current context and remains a

challenge to clinicians working in a school setting. Finally, interrater reliability for standard SALT measures was *excellent* indicating that sample transcription according to SALT guidelines was followed closely by the SLP team. However, agreement was fair to poor for macrostructure codes, suggesting that more training is needed to build consensus on how these elements are coded. This presents a threat to internal validity, in that subjectivity in coding using the SALT protocol may have resulted in inconsistencies in scoring narrative samples. These are challenges likely to be faced by clinicians working in various service provider contexts outside of research, and therefore represent a realistic picture of service delivery and outcome measurement.

Future directions

There are many possible future directions following this preliminary study of using SALT to evaluate intervention effectiveness. The processes described for collecting data provide an opportunity for LDC SLPs to systematically progress through levels of evidence, from longitudinal studies to group comparison studies (e.g., Lennox, Westerveld, & Trembath, 2016), ultimately improving confidence in reporting program effectiveness (NHMRC, 2009). As such, the team will continue to collect year-end data to build a database of LDC students' narrative performance, using procedures described above and in Calder et al. (2017). These data may be used to evaluate effectiveness of programs at both cohort and the individual level. A more defined macrostructure coding system, such as the Monitoring Index of Scholarly Language (Gillam & Gillam, 2013; Gillam, Gillam, Fargo, Olszewski, & Segura, 2016) may also be used in future. This system uses a 0–3 scoring range so that performance can be analysed for the quality, not just quantity of included narrative elements. This would add value to the interpretation of current findings by assessing how well, not just how often, children are using narrative elements during retells.

Conclusion

The findings from this project in combination with those reported in Calder et al. (2017) suggest that SALT is a viable tool for intervention planning and evaluation at a cohort level for children with DLD receiving intervention at a class level (tier 1). Significant improvement in a range of narrative macrostructure measures was observed. Although the generalisability of these findings may be limited, this project contributes to the growing evidence base suggesting that narrative intervention is effective in improving expressive language of early school-aged children with DLD.

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