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Correspondence: Dr Emily Dawes, Curtin University

Email: emily.dawes@postgrad.curtin.edu.au

Telephone: +61 401 915 551

Declaration of interest

The authors declare that there is no conflict of interest.

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Abstract

Purpose: The Squirrel Story Narrative Comprehension Assessment (NCA) was used to investigate the literal and inferential comprehension skills of young typically developing (TD) children aged between 4 and 6 years, and to compare the performance of 5 year old TD children and those with developmental language disorder (DLD).

Method: 132 typically developing children across three age groups between 4 to 6 years (4;0-4;11, 5;0-5;11, 6;0-6;11, years;months), and 94 children with DLD aged 5 years, were assessed using the NCA.

Result: There was a significant increase in both literal and inferential scores for TD children from 4 to 6 years. The TD children aged 4;0 to 4;11 scored significantly lower than the two older age groups for both literal and inferential comprehension, while there was no significant difference between the 5;0 to 5;11 and 6;0 to 6;11 TD groups. The 5;0 to 5;11 TD group scored significantly higher than the age-matched DLD group for literal and inferential comprehension.

Conclusion: The findings indicate that the Squirrel Story NCA is a clinically useful task which is sensitive to developmental improvement in literal and inferential comprehension in young typically developing children, and confirm previous research findings of poor narrative comprehension in children with DLD.

Background

Developmental language disorder and oral comprehension

Children whose expressive and/or receptive language development is significantly disordered in the absence of a known biomedical condition can be considered to present with a developmental language disorder (DLD) (Bishop,

Snowling, Thompson, Greenhalgh, & CATALISE-2 Consortium, 2016). Approximately 7% of children are diagnosed with DLD, which may involve disordered expressive and/or receptive language across a number of linguistic domains, including phonology, morphology, syntax, and semantics, at the word, sentence and discourse level (Leonard, 2014; Norbury et al., 2016; Tomblin et al., 1997).

Although it was initially thought that deficits in language comprehension were not common within the population of children with DLD, research over more recent years has provided evidence which refutes this (Bishop, 2014). Many children with DLD have weak syntactic comprehension (Conti-Ramsden et al., 1997; van Daal et al., 2004), and perform particularly poorly on oral comprehension tasks which tax higher cognitive and processing skills, such as the ability to draw inferences (Bishop & Adams, 1992; Botting & Adams, 2005; Norbury & Bishop, 2002).

Broadly, language comprehension is the ability to understand spoken and written words, sentences, and discourse. Effective comprehension of discourse involves a significant contribution from both top-down and bottom-up processes. Information from the environmental and social context, prior knowledge and experiences, must be integrated in order to build a mental model. This is combined with the bottom-up processing of the meaning and grammar of words and sentences (Bishop, 2014).

The model of written discourse comprehension developed by van Dijk and Kintsch (1983) can be applied to children's understanding of oral discourse, including narratives. When listening to a narrative text, the listener (or reader) must first comprehend the individual words, to create a literal or 'surface' representation of the meaning. As this surface level representation decays, propositions are connected across the text, resulting in an online representation of the meaning known as the

textbase. Finally, knowledge related to the text is activated, reflecting the top down processing which results in the mental model of the discourse, termed the situation model. Inferencing skills are required to construct both the textbase and the situation model, and inferences are thought to be drawn during comparison between the textbase and situation model (Graesser et al., 1997; Kintsch and Rawson, 2005). As stated by Bishop (2014, p. 253) “a critical point in the comprehension process is reached when the listener understands not just what the speaker said, but what was meant”. In other words, successful comprehension involves going beyond the literal interpretation of language, highlighting the importance of inferencing to successful comprehension, particularly at a discourse level.

Discourse comprehension is essential for successful participation in learning activities, reading comprehension, and academic achievement (Cain & Oakhill, 2007; Silva & Cain, 2015; van Kleeck, 2008). Poor inferential comprehension, particularly at the discourse level, has a significant impact on a child’s ability to participate in communicative interactions (Westby & Washington, 2017). This impact can be seen in both social situations (e.g. play and conversation) and in classroom learning (e.g. oral and written classroom discourse), which includes narrative, an important bridge to literate language (van Kleeck, 2008). This emphasises the need to assess discourse level inferencing in order to inform goal setting and measure change during interventions designed to target oral inferential comprehension.

Assessing inferential comprehension

Due to the critical importance of successful comprehension to learning and communication, assessment of comprehension is imperative. Literal and inferential comprehension are required for successful comprehension (van Kleeck, 2008).

Literal comprehension reflects understanding of information which has been explicitly

stated (i.e. surface representation), whereas inferential comprehension involves linking information to fill gaps, draw and develop meaning, and form predictions (i.e. textbase and situation model) (Bishop, 2014; Cain & Oakhill, 2007; van Dijk & Kintsch, 1983; van Kleeck, 2008).

Narrative discourse provides a useful context for comprehension assessment, and is commonly used as both an assessment and intervention context for young children with DLD (Boudreau, 2008). The development of comprehensive narrative schemas support top-down processing, and development of the situation model, and in turn coherent organisation of the linguistic information in a narrative (Bishop, 2014; van Dijk & Kintsch, 1983). Robust schemas support narrative comprehension, as well as production (Bishop, 2014; Dawes, 2017).

Assessment of inferential comprehension is impacted by both a lack of understanding of how the skill emerges in typically developing children, and a lack of norm-referenced and standardised assessment protocols and tasks (Filiatrault et al., 2015). There is some evidence to suggest that, in young TD children, inferential comprehension develops progressively along a scale of difficulty, emerging at around two years of age and reaching a critical developmental period between three and six years (e.g. Filiatrault-Veilleux et al., 2015, 2016). A review investigating the development of inferencing revealed, however, that out of the 16 studies included, no two studies implemented the same assessment methods (Filiatrault-Veilleux et al., 2015). One of the most frequently used methods to assess inferential comprehension is asking questions in the context of a narrative (Filiatrault-Veilleux et al., 2015; van Kleeck, 2008). Such assessment approaches can be categorised into two types: *off-line* (i.e. after the story) and *on-line* (i.e. during the story task). Some studies have used off-line measures, such as asking comprehension or multiple choice questions,

after hearing or telling the story (e.g. Ford & Milosky, 2008; Deconti & Dickerson, 1994; Silva & Cain, 2015). Others have implemented on-line assessments where responses are required during a story, such as answering questions, thinking-aloud, and story narration tasks (e.g. Filiatrault-Veilleux, Bouchard, Trudeau, & Desmarais, 2016; Lynch & van den Broek, 2007; Tompkins et al., 2013). Studies also differ in the method of presenting the narratives, which range from audio-visual or aural narratives, to pictures with short texts (e.g. Adams, Clarke, & Haynes, 2009; Ford & Milosky, 2008; Lynch & van den Broek, 2007).

Whilst on-line assessments measure the integration of a coherent narrative representation in real-time (Renz et al., 2003), this approach is considered to activate a more superficial level of immediate inferencing (Kinstch & Rawson, 2005). In contrast, off-line questioning requires the listener to process the entire story and build an integrated mental model of the narrative. As such, an off-line approach is considered to capture the final mental, or situational, representation (van Dijk & Kintsch, 1983; Burris & Brown, 2014). Given off-line tasks closely reflect the activities children are familiar in the classroom and everyday life, this approach warrants further investigation (Burris & Brown, 2014).

According to van Kleeck (2008), there are three general types of inferences which can be made within a narrative: causal, evaluative, and informational. Causal inferences relate directly to story grammar, and may require the child to infer the initiating event, emotion (or 'internal response'), problem, attempts to solve the problem, resolution, goal, or theme. Causal inferences involve joining pieces of information within the text or with prior knowledge, generating predictions and inferring emotions. Evaluative inferences involve judgements of morality or convention, while informational inferences require a child to provide details of the

story setting, define words in the story, or draw upon prior knowledge (van Kleeck, 2008).

Paris and Paris (2003) aimed to create an assessment procedure for young children to assess comprehension of narrative discourse. Their off-line comprehension assessment included five literal comprehension questions targeting explicitly presented information, such as identification of characters, setting or problem. They also included five implicit questions, requiring inferences about character feelings, dialogue, causal relations, predictions, and theme. These inferential questions align with the causal and evaluative inferences described by van Kleeck (2008). Paris and Paris (2003) evaluated their task in three separate studies with samples of between 91 and 158 American children aged 5 to 8 years. Their findings demonstrated the task could be generalised across narratives as there were significant, positive inter-task correlations between different books, appropriate internal consistency ($\alpha = .69$ to $.79$), inter-rater reliability ($r = .97$), and concurrent and predictive validity (Paris & Paris, 2003).

In summary, there are few assessments available which measure both literal and inferential oral narrative comprehension in young children. Those available present a number of potentially confounding issues, such as: the inclusion of a small number of inferential comprehension questions, as few studies have specifically investigated inferencing; providing only a total score for comprehension (i.e. literal and inferential combined); using single pictures to present an entire story; and, not assessing discourse-level inferential comprehension.

The Squirrel Story Narrative Comprehension Assessment

In response to this need and, in particular, the importance of specifically assessing inferential comprehension, we developed the Squirrel Story Narrative

Comprehension Assessment (NCA) for use with children in the early years of school (i.e. 3 to 6 years). We adapted the questions and framework employed by Paris and Paris (2003), similar to recent research by Silva & Cain (2015). While Paris and Paris (2003) used wordless picture books, the Squirrel Story NCA was designed to measure comprehension of a heard (oral) narrative presented with pictures because oral narratives are typically heard in the classroom and at home by young children. Similar to Paris and Paris (2003), comprehension questions were asked following the story, as off-line comprehension is considered to capture the final situational representation and, therefore, demonstrate a child's ability to process and reflect on the story as a whole (van den Broek, Tzeng, Ridsen, Trabasso, & Basche, 2001).

The literal and inferential questions and scoring guide were created using The Squirrel Story Narrative (Carey, Leitão, & Allan, 2006), based on the questions and scoring rubric by Paris and Paris (2003), and drawing on the framework proposed by van Kleeck (2008). Similar scoring frameworks have been used by Desmarais et al. (2013), Filiatrault-Veilleux, Bouchard, Trudeau, & Desmarais, (2016) and van Kleeck, Vander Woude & Hammett (2006). The Squirrel Story NCA has 14 inferential questions and 5 literal questions (please see Appendix for the Squirrel Story narrative text). The Squirrel Story NCA scoring guide includes a three-point scale (0, 1, or 2 points per question), with example responses for each score. In general, a score of 0 indicates no response or an irrelevant, inappropriate, or highly ambiguous answer; a score of 1 indicates a partially appropriate response or a response which is correct but non-specific; and a score of 2 indicates a fully correct response including all necessary information. For example, for the question "Who are the characters in this story?", a score of 2 = includes four to five characters, *Mummy squirrel, baby squirrel, baby rabbit, baby mouse, Mr Badger*; a score of 1 = includes two to three of

the characters; a score of 0 = includes only one character, or the response is inappropriate. The Squirrel Story NCA therefore provides a total score out of 28 for inferential and 10 for literal comprehension. The Squirrel Story NCA questions and scoring guide can be freely downloaded via <https://www.blacksheeppress.co.uk/product/squirrel-story-narrative-comprehension-assessment-nca/> (Dawes, Leitão, Claessen, & Black Sheep Press Ltd, 2018; Dawes, 2017).

The aims of this study were, therefore, to:

- Investigate the Squirrel Story Narrative Comprehension Assessment's sensitivity to the developmental progression of oral literal and inferential comprehension in typically developing children aged 4;0 to 6;11;
- Compare the performance of typically developing children and those with developmental language disorder aged 5;0 to 5;11 on the Squirrel Story NCA to build on existing research, and;
- Explore and describe the children's responses to the different literal and inferential question types in the NCA.

Our hypotheses were that, 1) there would be a significant increase in both literal and inferential scores on the Squirrel Story NCA between 4 and 6 years and, 2) the Squirrel Story NCA would be sensitive to comprehension differences between TD children and children with DLD, as demonstrated by significantly higher literal and inferential scores of the TD 5 year olds compared to the scores of the 5 year olds with DLD.

Method

Participants

Following ethical approval from the Curtin University Human Research Ethics Committee, and the Western Australian Department of Education, 132 typically developing children (70 females and 62 males) were recruited from mainstream primary schools in Perth, Western Australia. Information letters and consent forms were sent to the parents/carers of students who the class teacher identified as having typical speech and language skills, and who spoke English as their primary language. Typically developing participants ranged in age from 4;0 to 6;11 (years; months), with 44 children aged 4;0 to 4;11 (mean age 4;5), 31 children aged 5;0 to 5;11 (mean age 5;8), and 57 children aged 6;0 to 6;11 (mean age 6;5).

Ninety four children with developmental language disorder (19 females and 75 males; aged 5;0 to 5;11, mean age 5;6) were recruited from Language Development Centres in Perth, Western Australia. Language Development Centres provide language focused early years schooling to children with DLD in Perth. Each Language Development Centre services a broad geographical area of metropolitan Perth. In Western Australia formal optional schooling commences between 3 to 4 years of age, with compulsory schooling commencing between 4 to 5 years of age. Criteria for entry to an LDC requires assessment by a speech-language pathologist using standardised language assessments and assessment of language functioning, assessment by a registered psychologist, and teacher and parent developmental and behavioural checklists. Referrals are processed by speech-language pathologists at the LDC to confirm that potential students demonstrate a profile of skills consistent with DLD. For the DLD group, information letters and consent forms were sent to the parents/carers of students who the class teacher identified as having mostly intelligible speech at discourse level within a known context.

All data was collected by a speech-language pathologist or a trained research assistant (final year speech-language pathology student).

Procedure

The Squirrel Story NCA was administered in a quiet room during school hours by a speech-language pathologist using the iPad app with the Australian male voice setting. The child listens to the story on the iPad while looking at the pictures. The child is then asked the comprehension questions (5 literal and 14 inferential) by the speech-language pathologist while looking back through the story pictures. All responses are audio-recorded using the iPad app and transcribed and scored off-line. Administering the NCA took 5 to 10 minutes per child.

Inter-rater reliability was calculated using intra-class correlation (ICC) for both literal and inferential comprehension scores across the TD and DLD samples. Ten percent of the NCAs in each group were re-scored by a speech-language pathologist. The ICC values indicated excellent reliability ($>.75$) for both literal scores (range = .832 to 1.00) and inferential scores (range = .893 to .988) (Cicchetti, 1994).

Result

The descriptive statistics for the literal and inferential comprehension scores of the TD and DLD groups on the Squirrel Story NCA are displayed in Tables I and II, respectively.

Insert Tables I and II about here

Comparison of NCA Scores in the TD Group

One-way between groups analysis of variance (ANOVA) were used to investigate the impact of age on the literal and inferential Squirrel Story NCA scores of the TD participants. The sample size provided an 87% chance of capturing moderate to large effects at an alpha-level of .05 (Faul, Erdfelder, Lang, & Buchner, 2007).

The assumption of normality was violated for literal scores in the 4;0 to 4;11 and 6;0 to 6;11 groups, and the inferential scores in the 6;0 to 6;11 group, however the histograms appeared normally distributed. The homogeneity of variance assumption was not violated for any age group on either literal or inferential scores. The ANOVA was statistically significant, indicating that both mean literal and inferential Squirrel Story NCA scores differed by age group, $F(2, 129) = 38.51, p < .001, \eta^2 = .37$ and $F(2, 129) = 47.91, p < .001, \eta^2 = .43$, respectively.

For literal comprehension scores, post hoc analyses with Tukey's HSD demonstrated that the 4;0 to 4;11 group ($M = 4.23, SD = 1.20$) scored significantly lower ($p < .001$) than both the 5;0 to 5;11 group ($M = 5.94, SD = 1.34$) and the 6;0 to 6;11 group ($M = 6.65, SD = 1.54$). There was no significant difference between the literal scores of the 5;0 to 5;11 group and the 6;0 to 6;11 group ($p = .059$).

For inferential comprehension scores, post hoc analyses with Tukey's HSD demonstrated that the 4;0 to 4;11 group ($M = 8.95, SD = 4.11$) scored significantly lower ($p < .001$) than both the 5;0 to 5;11 group ($M = 14.97, SD = 3.11$) and the 6;0 to 6;11 group ($M = 16.11, SD = 3.82$). There was no significant difference between the inferential scores of the 5;0 to 5;11 group and the 6;0 to 6;11 group ($p = .369$).

Comparison of NCA Scores between the TD and DLD Groups

Independent samples t-tests were used to compare the mean literal and inferential Squirrel Story NCA scores of the TD ($n = 31$) and DLD ($n = 94$) children aged 5;0 to 5;11. The sample size provided a 93% chance of capturing moderate to large effects at an alpha-level of .05 (Faul et al., 2007). The assumption of normality was not violated for either of the TD group scores nor the inferential score of the DLD group. The Shapiro-Wilk statistic was significant for literal scores in the DLD group, however the histogram appeared normally distributed. The assumption of equal variances was not violated for literal or inferential scores across the two groups.

The t-test for literal comprehension was statistically significant, with the TD group mean ($M = 5.94$, $SD = 1.34$) significantly higher than that of the DLD group ($M = 3.96$, $SD = 1.36$), $t(123) = -7.05$, $p < .001$, two-tailed, $d = 1.47$. The t-test for inferential comprehension was also statistically significant, with the TD group mean ($M = 14.97$, $SD = 3.11$) significantly higher than that of the DLD group ($M = 11.76$, $SD = 3.08$), $t(123) = -5.02$, $p < .001$, two-tailed, $d = 1.04$.

Tables III and IV report the mean scores for each individual question used in the Squirrel Story NCA for the TD groups and the DLD group, including inference type and story grammar element, when relevant (Paris & Paris, 2003; van Kleeck, 2008). For most of the literal and inferential questions, the pattern of results for each individual question is similar to the pattern in the group data (i.e., lower scores for the 4 year olds compared to the 5 and 6 year olds, while the 5 and 6 year olds score at a similar level). Individual question performance is discussed below with consideration of the findings from the small body of existing literature.

Insert Tables III and IV about here

Discussion

This study aimed to investigate the sensitivity of the Squirrel Story Narrative Comprehension Assessment to the developmental progression of oral literal and inferential comprehension in typically developing children aged 4 to 6 years, and to compare the performance of TD children and those with DLD aged 5 years. Our first hypothesis was partially confirmed, as the 4 year old group scored significantly lower than the two older age groups for both literal and inferential comprehension. While the mean scores increased between 5 and 6 years, the difference was not significant for either literal or inferential comprehension. These results indicate that, as measured by the Squirrel Story NCA, significant improvement in both literal and inferential comprehension occurred in TD children between 4 to 5 years, followed by a consolidation of these skills between 5 to 6 years.

The large effect sizes indicated that 37% and 43% of the variability in literal and inferential comprehension scores, respectively, could be attributed to age. As such, the results provide support for the Squirrel Story NCA as a measure of oral narrative comprehension which is sensitive to developmental progression in literal and inferential comprehension across this age group.

In similar research, Filiatrault-Veilleux et al.,(2016) investigated *on-line* inferential comprehension (questions asked during narration of a story on an iPad) and found a significant increase in scores and the quality of responses between 3 to 4, 4 to 5, and 5 to 6 years. The present study did not employ a 3 to 4 year old group, so it would be interesting to investigate whether the Squirrel Story NCA would demonstrate sensitivity to comprehension development in a younger age group. Additionally, it would be interesting to see if the task used by Filiatrault-Veilleux et al., (2016) demonstrated a similar consolidation of overall inferential comprehension skills between 5 to 6 and 6 to 7 years.

The second hypothesis was confirmed, as the 5 year old children with DLD scored significantly lower than the 5 year old typically developing children for both literal and inferential comprehension, supported by large effect sizes. This aligns with a significant body of previous research identifying poor discourse-level literal and inferential comprehension in children with DLD (Adams et al., 2009; Bishop & Adams, 1992; Leinonen & Letts, 2001; Norbury & Bishop, 2002). Interestingly, the literal comprehension mean score of 3.96 for the DLD group fell approximately 1.5 standard deviations below the mean of the age-matched TD group. Similarly, the inferential comprehension mean score of 11.76 for the DLD group fell approximately 1 standard deviation below the mean of the age-matched TD group. These findings indicate that the Squirrel Story NCA is sensitive to differences in both literal and inferential comprehension between TD children and children with DLD aged 5 years.

Finally, we explored the children's responses to the different question types included within the task, predicting that there would be some evidence of developmental progression in keeping with broad predictions from the literature.

Literal Questions – Typically Developing Children

For the literal questions (Table III), the pattern of results for individual questions is similar to the results for the group data – with lower scores for the 4 year old group, and the 5 and 6 year olds scoring at a similar level. It is noteworthy that this difference was greatest for Questions 2 (literal – setting) and 10 (literal – attempts/consequence). While these questions are literal, as the information required to answer these questions was provided in the story model, it is possible that the 4 year olds may be consolidating their understanding and ability to respond to 'where' questions (Tyack & Ingram, 1977), particularly at the discourse level. As such, this age group were much less likely than the older age groups to provide one or two

appropriate settings (e.g. example 4 year old responses: *I don't know, in here*; example 5 year old responses: *in the trees and in a garden, It happened in like trees or maybe in a forest*). Additionally, for Question 10, a fully correct response required the recall of specific information related to at least two of the three actions (see Figure 1). The results indicate that, at a group level, the 4 year olds were poorer than the 5 and 6 year olds at recalling the level of information required to respond to this literal question (e.g. example 4 year old response: *he jumped*; example 5 year old response: *the baby squirrel was flying because they pushed too hard*). This pattern of performance was similar across the literal question scores.

While the 6 year old mean for literal questions was higher than that of the 5 year old group, the difference was not statistically significant. This finding may reflect that literal comprehension, as assessed by the Squirrel Story NCA, is similar across this age range. It may also indicate that the NCA is not sensitive to developmental improvement in this age group. Additionally, the Squirrel Story NCA includes 5 literal questions (compared to 14 inferential questions) and, as such, may need to include a greater number of questions to detect developmental changes in literal comprehension between 5 to 6 years. The Squirrel Story narrative was also designed for a younger age group (3 to 6 years) and so it is possible that assessment using a higher level narrative may demonstrate a greater difference in these age groups.

As previously discussed, comprehension of discourse, such as narratives, involves both bottom-up and top-down processing, as the listener must integrate the incoming message with previously stored knowledge to develop story meaning (Van Dijk & Kintsch, 1983). The listener must first comprehend the individual words, known as the literal or 'surface' representation. This surface representation is fleeting, but what remains after it decays from memory is a second level called the textbase, the

online representation of meaning that has been taken from the surface representation. It is possible that the textbase representation of 4 year old children is of poorer quality compared to the older age groups, and hence they are poorer at recalling accurate and specific information from the story. Additionally, the younger age group may not have consolidated their understanding of some of the concepts required in the literal questions (such as 'who' and 'where') and were therefore more likely to respond inappropriately or with less information.

Inferential Questions – Typically Developing Children

For the inferential questions (Table IV), the overall pattern of results is again similar for each individual question as for the group data – with lower scores for the 4 year old group, while the 5 and 6 year olds showed similar scores. As compared to the 5 year old group, the 6 year old group showed a pattern of slightly higher scores across some of the questions (e.g. Question 11, causal related to attempts), including the more complex questions requiring prediction (12a and 12b) and evaluative reasoning (13a and 13b).

Overall, the scores indicate that inferring a character's internal response (emotion) was easiest for the 4 year olds (Questions 3a and 8a), consistent with a prior scoping review indicating that internal response is the first type of inference to emerge in young children (Filiatrault-Veilleux et al., 2015). Our finding is in keeping with Deconti and Dickerson (1994) who suggested that the ability of children to make emotional inferences emerges as early as 3 years, and that by 4 years, children have developed the ability to recognise emotions and infer internal responses (Ford & Milosky, 2008). Additionally, this also aligns with the finding of Filiatrault-Veilleux et al., (2016) who found that typically developing children aged 4 to 5 years are fairly accurate at inferring character internal responses.

Each of the internal response questions are followed by a 'why' question. For example, Question 3a "*Look at the animals in this picture. How do you think they are feeling?*" is followed by Question 3b "*Why do they feel _____?*". While both 3a and 3b are classified as causal inferencing, the 'why' questions are thought to promote deeper inferencing because they require an explicit explanation of reasoning (as opposed to a single word to express an emotion). The scores indicate that the 4 year old group were much poorer in providing this explicit reasoning when compared to the 5 and 6 year old groups. While the five and six year olds in this study were generally not providing specific, higher level reasoning, they were able to provide appropriate reasoning, which aligns with previous evidence that typically developing children generally respond appropriately to 'why' internal response questions between four and five years of age (Spackman et al., 2006).

Some of the casual consequence questions, such as Question 4b, were particularly hard for all three age groups in our study. This is consistent with the finding that inferences related to causal relations (i.e. consequences) were rarely produced by 4 and 5 year olds (Tompkins et al., 2013). Similarly, questions requiring prediction beyond the end of the story (12a and 12b) were difficult for all three age groups, with scores indicating that, at a group level, the 4 year olds were unable to provide an appropriate prediction (M scores = 0.18 and 0.05, respectively). Filiatrault-Veilleux et al., (2016) found that the ability to make predictions during a story increased gradually between 3 to 6 years, with the majority of 5 to 6 year olds providing appropriate prediction. This differing finding may be reflective of the method of assessment (i.e. on-line vs. off-line questions) and thus the placement of prediction questions. In the Filiatrault-Veilleux et al., (2016) study, prediction was required *during* the story whereas in the present study prediction was required *after*

the story, potentially reflecting a higher level of global coherence as a complete, integrated representation, and reflection on, the story was required to make an accurate prediction. This warrants further investigation.

Additionally, the evaluative questions appeared difficult for all three age groups, with appropriate responses demonstrated at a group level in the 6 year olds. Responding appropriately to the evaluative questions required understanding, judgement, and reflection on the story theme, and therefore can be considered to probe more complex inferencing requiring integration of the whole story with background knowledge (van Kleeck, 2008).

As per the finding for literal comprehension, while the 6 year old group scores were higher than those of the 5 year old group for inferencing, the difference was not statistically significant. While this may indicate that there was no significant improvement in inferential comprehension between these ages, the finding may also reflect that the Squirrel Story NCA is not as sensitive to any developmental improvement in this older age range. As for literal comprehension, it would be interesting to compare these findings to assessment of the same age groups with a higher level narrative.

Literal and Inferential Questions – Children with Developmental Language Disorder

The 5 year old DLD group performed more poorly than the 5 year old TD group across all literal questions. Their ability to respond correctly to 'who' and 'where' questions was weaker than all of the TD age groups – including the 4 to 5 year olds – and their performance on the 'what's happening/happened' questions was similar to the younger, 4 to 5 year old TD group.

In terms of inferential comprehension, the DLD group performed similarly to the 5 and 6 year old groups on causal questions relating to the character's internal response (3a), consequence, and initiating event/goal. Interestingly, the DLD group performed better than all TD groups when required to infer a higher level emotion (8a). It is possible that the intervention provided at the Language Development Centre influenced this finding, as there is a strong focus on higher level emotions within narratives in the classroom programmes. The DLD group showed poorer performance than the 5 and 6 year old TD groups on causal inference requiring reasoning for a character's internal response (8b), initiating event/goal, and prediction. They performed similarly to the younger, 4 year old TD group on causal questions requiring reasoning for a character's internal response (3b), consequence, and evaluation of the story theme, and poorer than all TD groups on the causal question related to attempts. As such, descriptively, the results indicate that the 5 year olds with DLD had the most difficulty with inferential questions requiring explicit causal reasoning (related to initiating event/goal, internal response, attempts, and consequence), prediction, and evaluative reasoning. Consistent with the literature, these findings reflect poor literal and inferential comprehension in young children with DLD, which may reflect a variety of difficulties including both bottom-up and top-down processing, such as poor understanding of the question concepts, vocabulary, and syntactic comprehension, poor phonological short-term memory, and poorer story schema, (Adams et al., 2009; Bishop & Adams, 1992; Currie & Cain, 2015; Dawes, Leitão, Claessen, & Kane, 2018; Norbury & Bishop, 2002; Potocki et al., 2013).

Overall, the emerging patterns in our exploration of this data are in keeping with the few studies that have explored the development of oral narrative comprehension in young TD children (Filiatrault-Veilleux et al., 2015, 2016). The

findings are also consistent with the body of literature demonstrating that children with DLD tend to show particularly poor literal and inferential discourse comprehension (Bishop & Adams, 1992; Botting & Adams, 2005; Norbury & Bishop, 2002). We plan to explore these patterns in more detail with further collection of data on typically developing children and across a wider range of age groups for children with DLD.

Limitations

This study provides preliminary data for The Squirrel Story NCA with young TD and DLD children. It is pertinent for the findings of this study to be replicated and extended. It is also important to note that teachers identified the TD participants as having typically developing speech and language skills as the research team did not have the resources to complete speech and language assessments with all participants. Additionally, the Squirrel Story is a simple narrative for young children so it is possible that greater differences in comprehension between 5 to 6 and 6 to 7 years would emerge using a higher level narrative.

Clinical Implications

The Squirrel Story Narrative Comprehension Assessment is a reliable, practical, and efficient way of assessing both literal and inferential oral comprehension in young children, particularly between the ages of 4 to 6 years. It is sensitive to developmental changes in typically developing children, particularly between the ages of 4 and 5 years, and to differences in both literal and inferential comprehension between typically developing children and children with developmental language disorder. Effective discourse comprehension is a vital skill for effective communication and learning, and this study provides clinicians and teachers with reference data which can be used to guide interpretation of the

performance of children aged 4 to 6 years and inform goal setting for intervention and the classroom context.

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Table I: Squirrel Story Narrative Comprehension Assessment Scores for the Typically Developing Group

Score	Age Group	<i>n</i>	Mean (<i>SD</i>)	Median	Range	1SD Range
Literal (/10)	4;0 – 4;11	44	4.23 (1.20)	4	2 – 6	3.03 – 5.43
	5;0 – 5;11	31	5.94 (1.34)	6	4 – 9	4.60 – 7.14
	6;0 – 6;11	57	6.65 (1.54)	7	3 – 10	5.11 – 8.19
Inferential (/28)	4;0 – 4;11	44	8.95 (4.11)	9	0 – 19	4.84 – 13.06
	5;0 – 5;11	31	14.97 (3.11)	14	11 – 22	11.86 – 18.08
	6;0 – 6;11	57	16.11 (3.82)	17	9 – 23	12.29 – 19.93

Table II: Squirrel Story Narrative Comprehension Assessment Scores for the Developmental Language Disorder Group

Score	Age Group	<i>n</i>	Mean (<i>SD</i>)	Median	Range	1SD Range
Literal (/10)	5;0 – 5;11	94	3.96 (1.36)*	4	1 – 7	2.6 – 5.32
Inferential (/28)	5;0 – 5;11	94	11.76 (3.08)*	12	4 – 19	8.68 – 14.84

Note: an asterisk (*) denotes a statistically significant difference between DLD and TD scores in the same age group.

Table III: Literal Questions

	Question	General category	Mapped to story grammar elements	Age Group	Group	Mean (SD)
1	<u>Who</u> are the characters in this story?	Literal	Character	4;0 – 4;11	TD	0.93 (.625)
				5;0 – 5;11	DLD	0.69 (0.57)
				5;0 – 5;11	TD	1.42 (0.56)
				6;0 – 6;11	TD	1.47 (0.54)
2	<u>Where</u> does this story happen?	Literal	Setting	4;0 – 4;11	TD	0.50 (0.55)
				5;0 – 5;11	DLD	0.40 (0.49)
				5;0 – 5;11	TD	1.06 (0.44)
				6;0 – 6;11	TD	1.28 (0.65)
4a	Look at the animals here. Tell me <u>what's happening</u> in the story <u>now</u> ?	Literal	Initiating event	4;0 – 4;11	TD	0.91 (0.29)
				5;0 – 5;11	DLD	0.91 (0.38)
				5;0 – 5;11	TD	1.06 (0.25)
				6;0 – 6;11	TD	1.07 (0.37)
6	What is happening <u>now</u> ?	Literal	Consequence	4;0 – 4;11	TD	1.16 (0.53)
				5;0 – 5;11	DLD	1.07 (0.55)
				5;0 – 5;11	TD	1.19 (0.48)
				6;0 – 6;11	TD	1.47 (0.57)
10	What happened here?	Literal	Attempts / Consequence	4;0 – 4;11	TD	0.73 (0.59)
				5;0 – 5;11	DLD	0.87 (0.55)
				5;0 – 5;11	TD	1.19 (0.48)
				6;0 – 6;11	TD	1.32 (0.60)

Table IV: Inferential Questions

	Question	General category of inference	Mapped to story grammar elements	Age Group	Group	Mean (SD)
3a	Look at the animals in this picture. How do you think they are <u>feeling</u> ?	Causal	internal response (how)	4;0 – 4;11	TD	1.36 (0.72)
				5;0 – 5;11	DLD	1.79 (0.53)
				5;0 – 5;11	TD	1.84 (0.45)
				6;0 – 6;11	TD	1.88 (0.33)
3b	<u>Why</u> do they feel _____?	Causal	internal response (why)	4;0 – 4;11	TD	0.84 (0.71)
				5;0 – 5;11	DLD	0.98 (0.83)
				5;0 – 5;11	TD	1.45 (0.62)
				6;0 – 6;11	TD	1.42 (0.65)
4b	<u>Why</u> is that an important part of the story?	Causal	Consequence	4;0 – 4;11	TD	0.50 (0.70)
				5;0 – 5;11	DLD	0.72 (0.69)
				5;0 – 5;11	TD	0.81 (0.65)
				6;0 – 6;11	TD	0.75 (0.66)
5	<u>Why</u> did baby squirrel and his friends decide to go into the apple field?	Causal	Initiating event / Goal	4;0 – 4;11	TD	0.77 (0.42)
				5;0 – 5;11	DLD	0.86 (0.45)
				5;0 – 5;11	TD	0.94 (0.36)
				6;0 – 6;11	TD	0.91 (0.29)
7	<u>Why</u> couldn't baby squirrel fit back through the fence?	Causal	Consequence	4;0 – 4;11	TD	0.86 (0.46)
				5;0 – 5;11	DLD	0.83 (0.48)
				5;0 – 5;11	TD	1.13 (0.34)
				6;0 – 6;11	TD	1.18 (0.38)
8a	Look at baby squirrel in this picture. How do you think he is <u>feeling</u> ?	Causal	Internal response (how)	4;0 – 4;11	TD	0.89 (0.69)
				5;0 – 5;11	DLD	1.44 (0.60)
				5;0 – 5;11	TD	1.26 (0.73)
				6;0 – 6;11	TD	1.28 (0.77)
8b	<u>Why</u> does he feel _____?	Causal	internal response (why)	4;0 – 4;11	TD	0.61 (0.54)
				5;0 – 5;11	DLD	0.89 (0.56)
				5;0 – 5;11	TD	1.13 (0.62)
				6;0 – 6;11	TD	1.16 (0.59)
9a	What could the mouse and rabbit be <u>saying</u> here?	Causal requiring prediction	Character dialogue	4;0 – 4;11	TD	0.66 (0.61)
				5;0 – 5;11	DLD	1.13 (0.47)
				5;0 – 5;11	TD	1.16 (0.58)
				6;0 – 6;11	TD	1.26 (0.58)
9b	<u>Why</u> do you think they would say that?	Causal	Initiating event / Goal	4;0 – 4;11	TD	0.55 (0.55)
				5;0 – 5;11	DLD	0.81 (0.45)
				5;0 – 5;11	TD	0.97 (0.58)
				6;0 – 6;11	TD	1.09 (0.61)
11	<u>Why</u> does baby squirrel fly so high?	Causal	Attempts	4;0 – 4;11	TD	0.64 (0.75)
				5;0 – 5;11	DLD	0.39 (0.61)
				5;0 – 5;11	TD	1.10 (0.79)
				6;0 – 6;11	TD	1.39 (0.77)

LITERAL AND INFERENTIAL NARRATIVE COMPREHENSION

12a	This is the last picture in the story (<i>Go to next page – end of story</i>). What <u>do you think</u> happens <u>next</u> ?	Causal requiring prediction	-	4;0 – 4;11	TD	0.18 (0.45)
				5;0 – 5;11	DLD	0.53 (0.67)
				5;0 – 5;11	TD	0.84 (0.69)
				6;0 – 6;11	TD	0.95 (0.81)
12b	<u>Why</u> do you think so?	Causal requiring prediction	-	4;0 – 4;11	TD	0.05 (0.21)
				5;0 – 5;11	DLD	0.19 (0.47)
				5;0 – 5;11	TD	0.55 (0.68)
				6;0 – 6;11	TD	0.61 (0.75)
13a	If you were one of baby squirrel's friends and you knew that you weren't meant to go in the apple field, what would you tell baby squirrel so that the same thing didn't happen again?	Evaluative (theme)	-	4;0 – 4;11	TD	0.52 (0.59)
				5;0 – 5;11	DLD	0.55 (0.65)
				5;0 – 5;11	TD	0.74 (0.56)
				6;0 – 6;11	TD	1.05 (0.55)
13b	<u>Why</u> would you tell him that?	Evaluative (theme)	-	4;0 – 4;11	TD	0.52 (0.79)
				5;0 – 5;11	DLD	0.60 (0.69)
				5;0 – 5;11	TD	1.06 (0.73)
				6;0 – 6;11	TD	1.18 (0.74)

Figure 1: Question 10 Scoring

<p>What happened here?</p>	<p>Response includes specific information related to at least two actions, including the initiating action (<i>Baby squirrel is <u>pushed</u> out of the hole</i>), the result of the initiating action (<i>baby squirrel <u>flies</u> through the air</i>), and the action of the resolution (<i>baby squirrel <u>lands</u> on his own tree</i>, e.g. <i>Mr Badger pushes Baby squirrel through the fence and he flies through the air; baby squirrel <u>flies</u> through the air and then he lands back on his own tree</i>).</p>	<p>Response includes one action OR nonspecific information about two actions, including the initiating action (<i>Baby squirrel is <u>pushed</u> out of the hole</i>), the result of the initiating action (<i>baby squirrel <u>flies</u> through the air</i>), and the action of the resolution (<i>baby squirrel lands on his own tree</i>, e.g. <i>baby squirrel is flying, he got/went/popped/came out of the hole and is flying</i>).</p>	<p>Response does not identify an appropriate action or uses nonspecific information to identify an action (e.g. <i>the squirrel is in the air, he went out in the air, he got out</i>).</p>
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Appendix: Squirrel Story Script

Carey, J., Leitão, S., & Allan, L. (2006). *Squirrel Story Narrative Assessment*.
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Page 1 Once upon a time there was a mummy squirrel and a baby squirrel. They lived in a big oak tree on the edge of the forest.

Page 2 One sunny day, Mummy squirrel said to baby squirrel, 'would you like to play in the little garden near our tree?'

'Oh, yes please!' said baby squirrel. 'But don't go in the apple field!' Said Mummy. 'The farmer will be very cross and will chase you!'

Page 3 So baby squirrel set off to play. He met baby rabbit and baby mouse and they ran around. After a little while, baby squirrel got hungry.

Page 4 'Let's go and eat the apples in the apple field', he said. The other animals knew it was naughty, but went along. They squeezed through a little hole in the fence.

Page 5 Baby squirrel ate, and ate, and ate until he was very, very full. Soon it was time to go home. They ran to the hole in the fence. But oh dear!!!

Page 6 Baby squirrel was so fat he got stuck in the hole. His friends pushed and pulled, pushed and pulled but couldn't get him out.

Page 7 They tried and tried. Mr. Badger was walking past. 'Can I help you?' He said.

Page 8 He was very strong. He took a big breath, and everyone gave one big, giant PUSH!!!

Page 9 Baby squirrel shot out of the hole, right up into the sky. He flew through the air like a bird. He shut his eyes. He landed with a thud. And where do you think he was?!

Page 10 He had landed in his very own tree!!! 'Where have you been?' Said Mum.