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HEALTH EDUCATION &  
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## The Effectiveness of Student-Delivered Speech Pathology Intervention in Schools: An initial Investigation



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## Abbreviations

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ANOVA: Analysis of variance

CELF-4: Clinical Evaluation of Language Fundamentals – Fourth Edition, Australian Standardised Edition

CFD: Concepts and Following Directions Subtest of the CELF-4

FS: Formulated Sentences subtest of the CELF-4

ONC: oral narrative comprehension

ONQ: oral narrative quality

PONA: Profile of Oral Narrative Ability

RS: Recalling Sentences Subtest of the CELF-4

SPAT-R: Sutherland Phonological Awareness Test – Revised

SPSS: Statistical Package for the Social Sciences

WS: Word Structure Subtest of the CELF-4

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# Abstract

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This study investigated the research question: can student-delivered speech pathology intervention improve school-age children's skills in the language areas targeted more than would be expected with normal maturity and education?

A non-equivalent pretest-posttest control group design was used to investigate the language outcomes of 28 school children aged 5-6 years who received student-delivered intervention through the newly established *Community Health in Schools – Student Speech Pathology Clinic*. In particular changes in phonological awareness and oral narrative skills are reported.

Results demonstrated that student-delivered phonological awareness and oral narrative intervention, can improve school-age children's skills in these important areas. Phonological awareness measures significantly improved, with children who received targeted therapy making significant gains (mean score change 8.4, sd 5.1,  $t=3.7$   $p=0.02$ ) whilst only minimal gains were made by children waiting for therapy (mean change 3.1, sd 4.6,  $t=1.9$ ,  $p=0.1$ ). Similarly measures of oral narrative production significantly improved following intervention (mean change 9.6, sd 7.0,  $t=4.7$ ,  $p<0.001$ ) and showed only minimal change for children waiting for therapy (mean change 0.3, sd 0.6,  $t=1.0$ ,  $p=0.4$ ).

These positive results add powerful evidence that student-delivered speech pathology clinics are a feasible and effective model for working with school-age children with language impairment. This model also has the potential to be replicated by other allied health disciplines working with this population.

## Keywords:

speech pathology; phonological awareness; oral narrative; treatment outcomes; school-age children

# Executive Summary

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This study confirmed that student-delivered speech pathology intervention can improve school-age children's phonological awareness and language skills. The positive results from this investigation add to the current evidence base for treatment and lend support for this new model of service delivery.

## Background

The prevalence of speech and language impairment in school-age children is significant, with large numbers of Australian children experiencing communication difficulties when they enter school. These communication difficulties may impact on a child's ability to participate in classroom activities, to interact with teachers and with peers, to understand directions, to retain new information, to reason, to use language for a variety of purposes in curriculum activities and to learn to read and write. In turn these difficulties may lead to low self-esteem, behavioural problems, and these children experiencing increased bullying and social exclusion.

As a local response to the wide spread shortage of public speech pathology services available to school-age children in NSW the Tweed Community Health, Child and Family Therapy Team developed the *Community Health in Schools - Student Speech Pathology Clinic* in partnership with Griffith University Speech Pathology Department, North Coast Region Department of Education and Communities, and local school principals. In this school-based clinic speech pathology students deliver services to school-age children under the direct supervision of a qualified speech pathologist in the role of clinical educator.

Using student-delivered and student-unit models to enhance services is not a new concept, with most Australian universities routinely incorporating such models into their clinical training of speech pathology students; however, few of these clinics specifically target school-age children. Although literature available regarding two school-based student clinics indicates that university students, teachers, parents, and health staff have positive feedback regarding their experiences, no explicit communication outcomes for the school-age children receiving student-delivered intervention have been formally reported. When looking to student unit models as a way to enhance service delivery it is essential that positive outcomes for the children receiving these services are verified.

## The Study

Twenty-eight school children aged 5-6 years from two northern NSW primary schools participated in the study which investigated the research question: can student-delivered speech pathology intervention improve school-age children's skills in the language areas targeted more than would be expected with normal maturity and education? A non-equivalent pretest-posttest control group design was used with a delayed intervention control group who received the same therapy program at a later date.

In particular, this study describes the language outcomes for school-age children participating in the newly established *Community Health in Schools – Student Speech Pathology Clinic*. It provides preliminary data required to establish the efficacy of utilising student-delivered therapy services for this population, and adds evidence to support the incorporation of student-delivered services into areas of need.

Paired t-tests were used to determine the significance of change in performance of each group and a two way repeated measures analysis of variance (ANOVA) was calculated to assess differences between the groups related to change over time. To provide further evidence of the effectiveness of therapy, the delayed intervention group's performance during the waiting period and following therapy was inspected with a one way repeated measures analysis of variance with planned single degrees of freedom comparisons and visual inspection of graphic data.

## Results and Discussion

This study demonstrated that student-delivered intervention, can improve school-age children's skills in the important areas of phonological awareness and oral narrative, providing initial evidence to support the incorporation of student-delivered therapy to extend and supplement speech pathology services that struggle to provide timely intervention to this population.

Following an average of nine student-delivered therapy sessions over a 12 week period positive effects on targeted skills were recorded, with children making significant gains in both phonological awareness and oral narrative production skills (phonological awareness mean score change 8.4, sd 5.1,  $t=3.7$   $p=0.02$ , oral narrative production mean change 9.6, sd 7.0,  $t=4.7$ ,  $p<0.001$ ). In contrast children who were waiting for therapy did not show significant change in these skills (phonological awareness change 3.1, sd 4.6,  $t=1.9$ ,  $p=0.1$ , oral narrative production mean change 0.3, sd 0.6,  $t=1.0$ ,  $p=0.4$ ). The results suggest that this progress was greater than would be expected with normal maturity and education (phonological awareness  $F(1,11)=3.77$ ,  $p=0.078$ ,  $\eta^2=0.26$ , oral narrative production  $F(1,14)=5.02$ ,  $p=0.04$ ,  $\eta^2=0.26$ ). Despite the low sample sizes, the robust statistical analyses found in this study suggests that the changes made by the school-age children are likely to be clinically relevant.

These positive outcomes add evidence to support the incorporation of student clinics into areas of need to build capacity in services. The outcomes from this research have the potential for positive impact on many speech pathology services, both rural and metropolitan, and may be replicated by other allied health disciplines.

# Introduction

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The prevalence of communication difficulties in the school-age population is high<sup>(1-4)</sup> and impacts on children's ability to participate in classroom activities, and to achieve full academic potential<sup>(5-8)</sup>, leading to low self-esteem and social problems<sup>(9)</sup>. In response to significant barriers school-age children face accessing speech pathology services, the *Community Health in Schools - Student Speech Pathology Clinic* was established.

This report describes the language outcomes for school-age children participating in the newly established *Community Health in Schools – Student Speech Pathology Clinic*. It provides preliminary data required to establish the efficacy of utilising student-delivered therapy services for this population, and adds evidence to support the incorporation of student-delivered services into areas of need.

## Background

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It is widely acknowledged that the prevalence of speech and language impairment in school-age children is substantial<sup>(1, 2, 4, 10)</sup>, with one study in New South Wales suggesting that 13% of primary and secondary school-aged children have a communication disorder<sup>(1)</sup>. Australian teachers report expressive language difficulties in around 21% of children, and receptive language difficulties in around 16% of children when they enter school<sup>(11)</sup>. Difficulties in communication may impact on a child's ability to participate in classroom activities, to interact with teachers and with peers, to understand directions, to retain new information, to reason, to use language for a variety of purposes in curriculum activities and to learn to read and write<sup>(5-8)</sup>. Children who enter school with language difficulties have been reported to have low self-esteem, social and behavioural problems, as well as experiencing significantly more bullying and social exclusion<sup>(9)</sup>.

The current widespread lack of speech pathology services for school-age children has been recognised at a national level by Speech Pathology Australia as a critical issue<sup>(12)</sup>. Locally, in the Tweed region, this difficulty may be attributed to increases in the referral base without increases in staffing to match. Policy<sup>(13)</sup> and evidence based practice also drives speech pathologists to give the highest priority to children with life threatening, medical, or highly complex conditions, as well as those children under 5 years of age<sup>(14-19)</sup>.

Currently, minimal numbers of school-age children receive speech pathology services in the Tweed region. A survey of fifteen local school principals was conducted by the author<sup>(20)</sup> investigating speech pathology services for school-age children in the Tweed region in August 2012. This survey indicated that, at this time, there were in excess of 280 school-age children waiting for speech pathology services in the Tweed region.

This difficulty accessing services is not compatible with the Rural Health Plan of 2002<sup>(21)</sup> which aims for more children to receive appropriate care closer to home, minimising disruption to families. While local families have the option to access private speech pathologists in a more timely fashion, financial burden, travel difficulties, and very limited availability of private speech pathology services mean that this is not a real option for many families.

In 2013 in response to the significant barriers that school-age children face accessing speech pathology services, and after consulting with stakeholders, the *Community Health in Schools - Student Speech Pathology Clinic* was established by the Tweed Community Health Child and Family Therapy Team in partnership with Griffith University Speech Pathology Department, North Coast Region Department of Education and Communities, and local school principals. In this school-based clinic speech pathology students deliver services to school-age children under the direct supervision of a qualified speech pathologist in the role of clinical educator.

Using student-delivered and student-unit models to expand or extend services is not a new concept, and most Australian universities routinely incorporate such models into their clinical training of speech pathology students. However, few of these clinics specifically target school-age children. Two such clinics are operating in NSW in the Broken Hill and Newcastle areas, where student speech pathology clinics have been established in schools. In these student-delivered intervention models, a number of university students undertaking speech pathology studies participate in clinical placement in local schools, delivering services to school-age children under the direct guidance of a speech pathology clinical educator, or in consultation with a speech pathologist, or general allied health clinical educator<sup>(2)</sup>. These innovative student-delivered intervention models have been established in the Broken Hill area by the Broken Hill University Department of Rural Health, and in the Newcastle area by the University of Newcastle. Literature available from these two programs indicates that university students, teachers, parents, and health staff have positive feedback regarding their experiences with the student unit<sup>(2, 22)</sup>. More specifically, Davies and colleagues (2005)<sup>(2)</sup> reported that teachers perceived that their student unit effectively promoted collaborative partnership between the speech pathology and teaching teams. They reported an increase in the teachers' understanding of communication difficulties together with an increase in their ability and confidence to implement appropriate classroom support strategies and to generally support children with communication difficulties. In addition, Davies and colleagues<sup>(2)</sup> concluded that student clinicians can add flexibility, vitality, and additional human resources, and thus are of significant value in satisfying needs encountered in school settings.

In personal communication with speech pathologists managing the Broken Hill and Newcastle student programs, it was indicated that no explicit communication outcomes for the school-age children receiving student-delivered intervention had been formally reported (phone conversations: Laurence 08/2012, Jones 12/2012, Hewatt 05/2014). A review of the literature also revealed a lack of focus on speech and language outcomes for the school-age children who have received student-delivered intervention. This is not surprising given that research into student-delivered clinics in speech pathology is a relatively new area, and its focus thus far has been on university student outcomes<sup>(23, 24)</sup>. Evidence confirming efficacy of student-delivered therapy exists in the adult stuttering literature<sup>(25)</sup> and anecdotally many clinical educators would report improved client outcomes from student-delivered programs. However, there is a strong need for research to establish the effectiveness of intervention provided to school-age children by speech pathology students. Positive outcomes would add further and powerful evidence to support the incorporation of student-delivered services into areas of need.

The efficacy of speech pathology intervention given by a qualified speech pathologist is well established in the literature for the school-age population<sup>(26)</sup>. However, as discussed, significant barriers to accessing speech pathology services exist for this group. Furthermore, access for school-age children must be improved, and student clinics is one, albeit temporary, way to enable this to occur<sup>(23, 27)</sup>.

# Methods

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## Study Design

A non-equivalent pretest-posttest control group design with school children aged 5-6 years was used to investigate the research question: can student-delivered speech pathology intervention improve school-age children's skills in the language areas targeted more than would be expected with normal maturity and education? For this investigation, a delayed intervention control group was used in preference to a no intervention control group, with children in the control group receiving the same therapy program at a later date. This design was chosen due to the ethical implications of withholding treatment from children who have been identified as potentially benefiting from intervention. This design also allowed language gains made by the control group while waiting for therapy to be compared with those made by this same group following participation in the therapy program.

## Recruitment

Children were eligible to participate in the study if they were referred to the *Community Health in Schools - Student Speech Pathology Clinic* in 2013 by their class teacher due to concerns regarding communication or literacy skills. The parents of all children who meet the inclusion and exclusion criteria were given an information sheet regarding the research and the opportunity to discuss with the researcher. Written consent was obtained from parents who agreed to their child's results being included in the research.

## Setting and Participants

The *Community Health in Schools – Student Speech Pathology Clinics* each ran for two days per week for 13 weeks. The first clinic ran from March through to June at school A, and the second from July through to October at school B. Both school principals were sent a letter outlining the research and inviting them to participate (Appendix 3). Both schools agreed to participate.

Thirty-nine children in the first two years of mainstream schooling at these two northern NSW schools were recruited: 26 from school A and 13 from school B. These schools were both medium sized (between 250 and 350 enrolments) government funded primary schools from the same postcode, with similar socioeconomic catchment area.

All children found to have communication impairment were offered intervention through the clinic. However children were only included in this study if they:

- were found to have a language delay of more than one standard deviation on at least one of the standard speech pathology tools used for initial assessment;
- attended 7 or more of the 12 sessions offered.

Children were excluded from the study if they were receiving speech pathology elsewhere, or had a known IQ of 70 or below. Children who were absent from school during the re-assessment period were withdrawn from the study.

School A was allocated to be the experimental (intervention) school and school B the control (delayed intervention) school based on the timing of the clinic in each school.

## Data Collection

As can be seen in the study timeline (Figure 1) school A, the intervention group, was the first school to participate in the clinic, with all eligible children receiving pre-therapy assessment followed by immediate speech pathology intervention, and then post-therapy assessment. At school B, the delayed intervention group, children received a baseline assessed two months prior to the clinic commencing. At the commencement of the delayed intervention clinic, children were re-assessed (pre-therapy) to record any natural improvement due to age and schooling. Following this assessment, children received immediate speech pathology intervention followed by re-assessment (post-therapy). Specific timing of assessments and therapy is also outlined in the study timeline (figure 1).

Figure 1: Study Timeline

	March			April				May				June				July				Aug				Sept				Oct						
Week Starting	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	2	9	16	23	30	7	14	21	28
Assessment Baseline																																		
Assessment Pre-therapy																																		
Therapy																																		
Assessment Post-therapy																																		

School A: Intervention Group	
School B: Delayed Intervention Group	

## Assessments

At initial presentation, all children were assessed with a comprehensive, individually administered, speech pathology assessment battery to determine the degree and nature of their difficulties. These baseline assessments were repeated for the delayed intervention group prior to them commencing therapy.

The full assessment battery included:

- Core Language Subtests of the Clinical Evaluation of Language Fundamentals – Fourth Edition – Australian standardised Edition (CELF – 4)<sup>(28)</sup>.

The CELF-4 is a broad spectrum language assessment that measures general language ability. It is used to screen for, and to diagnose, language disorders in children. The core language subtests assess the child's ability to understand concepts and follow directions, to recall utterances of increasing length and complexity, as well as the child's use of grammatical markers and pronouns, and their ability to generate sentences. Raw scores achieved were used to calculate scaled scores for each subtest. Scaled and standard scores were calculated in 6 month age intervals and were used for descriptive statistics. Raw subtest scores were used for the purpose of tracking change.

- Sutherland Phonological Awareness Test – Revised (SPAT-R)<sup>(29)</sup>

The SPAT-R assesses phonological awareness skills required for early literacy development at the level of syllable, onset-rime, and phoneme. More specifically, investigating skills of blending, segmenting and manipulation of phonemes together with non-word reading and spelling. Scores achieved on all subtests were added for a total raw score which was then converted to percentile rank depending on the year of schooling. The percentile rank was used for descriptive statistics and the total raw score for tracking change.

- Profile of Oral Narrative Ability (PONA)<sup>(30)</sup>

The PONA was used to investigate story comprehension, and story re-tell abilities. This protocol exposes children to a novel story, *Ana gets Lost*<sup>(31)</sup>, and then assesses the child's ability to answer comprehension questions, yielding an oral narrative comprehension (ONC) score, and to retell the story following a second exposure, yielding an oral narrative quality (ONQ) score. Oral narrative quotient scores reflect the child's skills at the macrostructure level indicating the child's ability to provide a coherent story containing story grammar, elements of setting, characters, problem, resolution, and conclusion. Full details regarding the scoring procedures are described in Westerveld and Gillon, 2010<sup>(32)</sup>.

All assessments were administered by student speech pathologists under the guidance of the clinical educator. Children's verbal responses were audio taped and transcribed verbatim with scoring of assessments conducted in group sessions with all students and the clinical educator present. Baseline assessments were repeated for the delayed intervention group prior to them commencing therapy.

### *Intervention*

All 28 children were allocated to small therapy groups that targeted either oral narrative skills or phonological awareness skills. Children were allocated to a phonological awareness group if their SPAT-R percentile rank fell below 25, or to an oral narrative group if their ONC or ONQ score fell below that expected for their age according to age norms reported by Westerveld and Gillon, 2010<sup>(32)</sup>. Once allocated to a group students were offered 12 one hour group therapy sessions over eight weeks. One child was allocated to both groups due to clinical need, and two children received additional individual speech sound therapy.

Therapy was predominately provided in small groups of two to four children from the same grade, with children being withdrawn from the classroom for these sessions. For the phonological awareness intervention, student speech pathologists followed the Gail Gillon Phonological Awareness Training Programme<sup>(33)</sup>. For the oral narrative intervention, the Westerveld Oral Narrative Intervention Program<sup>(34)</sup> was implemented. Therapy was delivered by a first or second year Masters-level speech pathology student under the guidance of a qualified speech pathologist in the role of clinical educator, with each student being responsible for conducting one or two groups, and remaining students contributing as helpers and observers. Reflection sessions were conducted for each group every day with all speech pathology students and the clinical educator.

### *Re-assessment*

On completion of the intervention program, all children were re-assessed with tools from the original assessment battery that related to the therapy program that they had attended. The CELF-4 was used to re-assess general language skills where children's pre-therapy CELF-4 scores fell more than 1.5 standard deviations below average for their age.

## Data Management

### *Outcome measures*

- Oral narrative intervention outcomes were measured by PONA scores.
- Phonological awareness intervention outcomes were measured by total SPAT-R score.
- Possible effects of specific treatments on more general language skills were measured by CELF-4 core language subtest scores.

### *Statistical procedures*

Paired t-tests were used to determine the significance of change in performance for both the intervention and delayed intervention groups during the intervention phase: pre and post-therapy assessment scores for the intervention group, and baseline and pre-therapy assessment scores for the delayed intervention group.

A two way repeated measures analysis of variance (ANOVA) was calculated for each assessment measure in the intervention phase for both groups to determine whether change in performance could be attributed to the intervention rather than to maturity and education. This analysis used a between-subject main effect of time (pre and post) together with the interaction effect of *time x group* which assessed any differences between the groups related to change over time.

The delayed intervention group's performance during the waiting period and following therapy was further inspected. One way repeated measures ANOVA with planned single degrees of freedom comparisons (baseline vs pre-therapy and pre-therapy vs post-therapy) were conducted to investigate the changes in performance of this group. Due to small group numbers, decreasing reliability of statistics, visual inspection of graphic data was utilised to investigate change in performance for this group<sup>(35)</sup>.

Effect sizes were calculated with  $\eta^2$  using Cohen (1998) benchmarks to define small ( $\eta^2 = 0.01$ ), medium ( $\eta^2 = 0.06$ ) and large ( $\eta^2 = 0.14$ ).

Data was analysed by the Rural Research Capacity Building Program's biostatistician using Statistical Package for the Social Sciences (SPSS) - version 22.

### Ethics Approval and Funding

Approval to conduct the study was obtained from:

- Student Engagement and Program Evaluation Bureau NSW Department of Education and Communities (SERAP no. 2012269) on 5<sup>th</sup> February 2013
- Griffith University Human Research Ethics Committee (PES/06/13/HREC) on 13<sup>th</sup> February 2013
- North Coast NSW Human Research Ethics Committee (No. LNR049) on 13<sup>th</sup> March 2013

Funding for this research was provided by:

- Health Education and Training Institute as part of the Rural Research Capacity Building Program;
- Griffith University Master of Speech Pathology Program HWA funding for clinical education.

# Results

Statistics are reported for the phonological awareness and oral narrative groups separately. Of the 28 children included in the study it should be noted that one child participated in both a phonological awareness therapy group and an oral narrative therapy group.

## Phonological Awareness Intervention Group Descriptive Statistics

Table 1 reports age, grade, gender, and standardised assessment scores at initial presentation to the study along with the number of therapy session attended for the children in the intervention and delayed intervention groups. On t-test comparison of assessment results across the two groups no significance differences were found.

Table 1: Baseline assessment information for the phonological awareness group, including the number of sessions attended

	Intervention Group n=5	Delayed intervention Group n=8	Sig (2 tailed)
<b>Age Mean (SD)</b>			
years;months	6;3 (0;4)	6;2 (0;6)	0.95 / 0.95
<b>Gender</b>			
Male / female	2 / 3	5 / 3	
<b>Grade</b>			
Kindergarten / Year one	5 / 0	6 / 2	
<b>Assessment Results Mean (SD)</b>			
PPVT-4 SS*	100.8 (8.5)	93.8 (10.8)	0.24 / 0.22
CELF-4 CFD <sup>#</sup>	5.2 (2.5)	5.9 (1.4)	0.73 / 0.75
CELF-4 WS <sup>#</sup>	8.0 (1.2)	7.4 (1.4)	0.59 / 0.64
CELF-4 RS <sup>#</sup>	5.8 (2.3)	7.1 (3.1)	0.36 / 0.29
CELF-4 FS <sup>#</sup>	7.4 (1.5)	7.0 (1.2)	0.58 / 0.55
CELF-4 Core <sup>^</sup>	80.2 (4.0)	80.1 (8.0)	0.41 / 0.36
SPAT-R %	6.4 (4.4)*	2.6 (4.45)	0.17 / 0.18
ONC	4.8 (1.1)	5.4 (1.7)	0.25 / 0.21
ONQ	25.0 (8.9)	21.1 (6.2)	0.42 / 0.46
<b>Sessions Attended Mean (SD)</b>			
	8.6 (1.1)	9.6 (1.1)	

PPVT-4 SS: Peabody Picture Vocabulary Test 4<sup>th</sup> Edition

CELF-4: Clinical Evaluation of Language Fundamentals 4th Edition; CFD: Concepts and Following Directions Subtest; WS: Word Structure Subtest; RS: Recalling Sentences Subtest; FS: Formulated Sentences subtest; Core: Core Language Score

SPAT-R %: Sutherland Phonological Awareness Test Revised, percentile rank for year of school

ONC: Oral Narrative Comprehension score, Maximum Score = 8

ONQ: Oral Narrative Quality score, range of scores 8-40

<sup>^</sup> Standard Score, Mean=100, SD=15

<sup>#</sup> Standard score, Mean 10, SD 3

\* significant group difference p <0.05

## Phonological Awareness Intervention Results

**Phonological awareness skills:** A significant change in SPAT-R assessment results post-therapy was found for the intervention group ( $p < 0.05$ ) and not for the delayed intervention group who were waiting for therapy ( $p = 0.95$ ) as shown in Table 2.

Table 2: Change in assessment scores from time 1 to time 2 for phonological awareness groups

Assessment task	Intervention Group			Delayed Intervention Group		
	Mean Change (SD)	df	sig	Mean Change (SD)	df	Sig
SPAT-R Total	8.4 (5.1)	4	0.02*	3.1 (4.6)	7	0.10
CELF-4 CFD	8.2 (5.3)	4	0.03*	7.4 (3.2)	4	0.01*
CELF-4 WS	1.8 (4.7)	4	0.44	-1.6 (3.7)	4	0.35
CELF-4 RS	2 (3.7)	4	0.30	6.8 (4.9)	4	0.04*
CELF-4 FS	5.2 (2.8)	4	0.01*	-1.8 (6.5)	4	0.57

SPAT-R Total: Sutherland Phonological Awareness Test Revised, total raw score;

CELF-4: Clinical Evaluation of Language Fundamentals 4th Edition; CFD: Concepts and Following Directions Subtest; WS: Word Structure Subtest; RS: Recalling Sentences Subtest; FS: Formulated Sentences subtest

\* significant difference  $p < 0.05$

There was no significant interaction effect for *time x group* on SPAT-R results ( $F(1,11) = 3.77$ ,  $p = 0.078$ ,  $\eta^2 = 0.26$ ) as can be seen in Table 3. However, whilst not significant, there was an indication of change for SPAT-R scores with  $p < 0.1$ . Due to the very low numbers, this may indicate some impact of the intervention and is visible on graphing of means in Figure 2.

Table 3: Two-way repeated measures analysis of variance (ANOVA) comparing change in performance of the

Assessment	Time				Time by Group				Int/control			
	F	df	p	eta sq	F	df	p	eta sq	F	df	p	eta sq
Phonological												
SPAT-R Total	17.98	1,11	<0.01*	0.62	3.77	1,11	0.08	0.26	12.68	1,11	<0.01*	0.54
CELF-4 CFD	31.61	1,8	<0.01*	0.80	0.08	1,8	0.78	0.01	0.00	1,8	0.95	<0.01
CELF-4 WS	0.01	1,8	0.94	0.00	1.75	1,8	0.22	0.18	5.43	1,8	0.08	0.40
CELF-4 RS	10.41	1,8	0.01*	0.57	3.10	1,8	0.12	0.28	0.48	1,8	0.51	0.06
CELF-4 FS	1.15	1,8	0.32	0.13	4.86	1,8	0.06	0.38	4.20	1,8	0.08	0.34
Narrative												
ONC	35.02	1,14	<0.01*	0.71	2.52	1,14	0.14	0.14	0.08	1,14	0.79	0.01
ONQ	5.77	1,14	0.03*	0.29	5.02	1,14	0.04*	0.26	0.42	1,14	0.53	0.03

intervention group and delayed intervention group

SPAT-R Total: Sutherland Phonological Awareness Test Revised, total raw score;

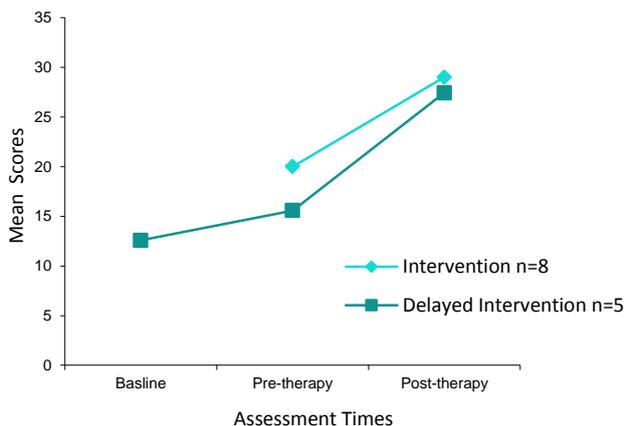
CELF-4: Clinical Evaluation of Language Fundamentals 4th Edition; CFD: Concepts and Following Directions Subtest; WS: Word Structure Subtest; RS: Recalling Sentences Subtest; FS: Formulated Sentences subtest; Core: Core Language Score

ONC: Oral Narrative Comprehension

ONQ: Oral Narrative Quality

\*significant difference  $p < 0.05$

Figure 2: SPAT-R Mean scores for Intervention and Delayed Intervention Groups at Baseline Pre-therapy and Post-therapy.



**Language skills:** A significant change in CFD and FS assessment results at  $p < 0.05$  was found for the intervention group post-therapy, while the delayed intervention group also showed significant change on CFD as well as RS for the corresponding period, as shown in Table 2. There was no significant interaction for *time x group* on any of these language measures as can be seen in Table 3. There was an indication of change differences for FS scores with  $p < 0.1$ , and again due to the very low numbers this could be an indication of the impact of the intervention, and is visible in graphing of means in Figure 3.

**Delayed intervention Group:** Visual inspection of Figures 2 to 6 shows an increase in scores for the delayed intervention group following phonological awareness therapy in the areas of: phonological awareness, word structure, and formulated sentences.

Figure 3: Formulated Sentences Mean scores for Intervention and Delayed Intervention Groups at Baseline Pre-therapy and Post-therapy.

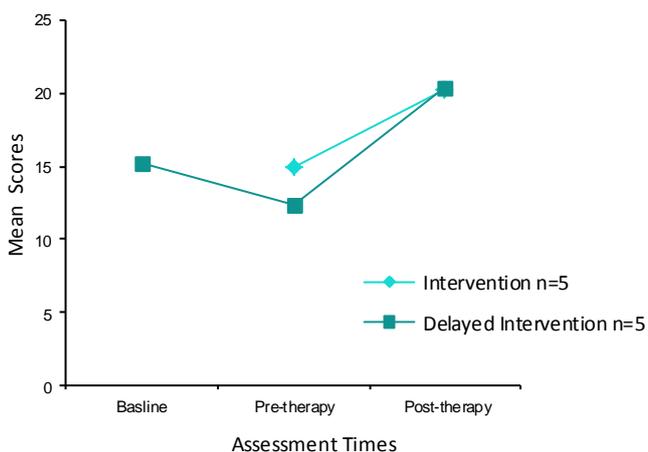


Figure 4: Concepts and Following Directions Mean scores for Intervention and Delayed Intervention Groups at Baseline Pre-therapy and Post-therapy.

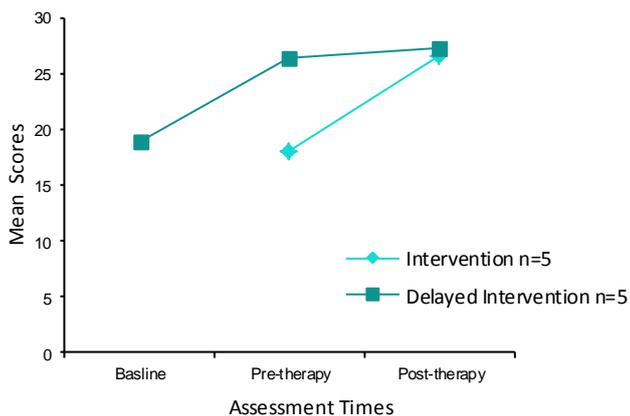


Figure 5: Recalling Sentences Mean scores for Intervention and Delayed Intervention Groups at Baseline Pre-therapy and Post-therapy.

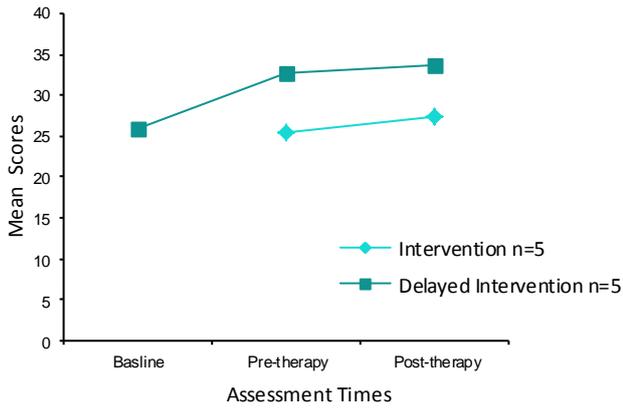
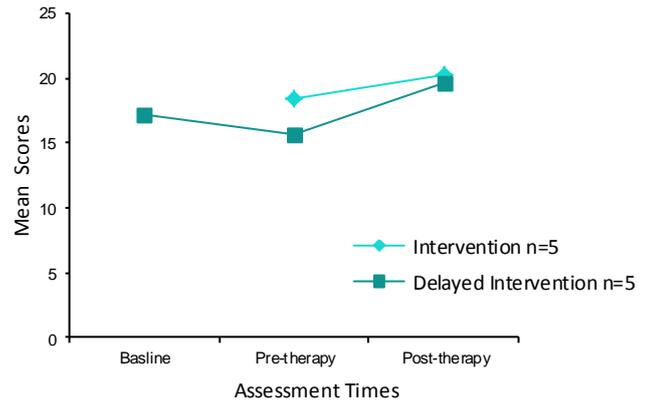


Figure 6: Word Structure Mean scores for Intervention and Delayed Intervention Groups at Baseline Pre-therapy and Post-therapy.



This change over time was significant for SPAT-R scores ( $F(2,6)=9.15, p < 0.05, \eta^2=0.75$ ) and CFD scores ( $F(2,3)=12.77, p < 0.05, \eta^2=0.90$ ) as shown in Table 4.

Table 4: Repeated measures ANOVA, three time points for delayed intervention groups

Group	Assessment task				
		F	df	p	eta sq
<b>Phonological Awareness</b>	SPAT-R Total	9.15	2,6	0.02*	0.75
	CELF-4 CFD	12.77	2,3	0.03*	0.90
	CELF-4 WS	2.64	2,3	0.22	0.64
	CELF-4 RS	3.73	2,3	0.15	0.71
	CELF-4 FS	6.73	2,3	0.08	0.82
<b>Oral Narrative</b>	ONC	7.00	2,1	0.26	0.93
	ONQ	0.30	2,1	0.82	0.33

SPAT-R Total: Sutherland Phonological Awareness Test Revised, total raw score;

CELF-4: Clinical Evaluation of Language Fundamentals 4th Edition; CFD: Concepts and Following Directions Subtest; WS: Word Structure Subtest; RS: Recalling Sentences Subtest; FS: Formulated Sentences subtest; Core: Core Language Score

ONC: Oral Narrative Comprehension

ONQ: Oral Narrative Quality

\* significant difference  $p < 0.05$

## Oral Narrative Intervention Group Descriptive Statistics

Table 5 reports age, grade, gender and standardised assessment scores at initial presentation to the study for the children, along with the number of therapy sessions attended in the intervention and delayed intervention groups who received oral narrative therapy. Using t-test comparison of assessment results across the two groups, no significance differences were found.

Table 5: Baseline assessment information for the oral narrative group, including the number of sessions attended

	Intervention Group n=13	Delayed intervention Group n=3	Sig (2 tailed)
<b>Mean Age (SD)</b>			
years;months	5;8 (0;7)	5;11 (0;4)	0.76 / 0.65
<b>Gender</b>			
Male / female	6 / 7	3 / 0	
<b>Grade</b>			
Kindergarten / Year one	10 / 3	1 / 2	
<b>Mean Assessment Results (SD)</b>			
PPVT-4 SS*	105.9 (10.7)	95.7 (7.6)	0.14 / 0.12
CELF-4 CFD <sup>#</sup>	9.1 (1.7)	6.7 (2.5)	0.33 / 0.24
CELF-4 WS <sup>#</sup>	8.8 (3.0)	9.0 (0.0)	0.64 / 0.36
CELF-4 RS <sup>#</sup>	8.6 (3.2)	8.3 (2.3)	0.63 / 0.34
CELF-4 FS <sup>#</sup>	8.1 (2.6)	10.0 (1.4)	0.32 / 0.03
CELF-4 Core <sup>^</sup>	91.2 (11.9)	86.7 (6.4)	0.98 / 0.95
SPAT-R %	18.7 (11.2)	24.0 (32.4)	0.40 / 0.71
ONC	5.8 (1.3)	5.0 (0.0)	0.42 / 0.10
ONQ	17.7 (6.6)	21.7 (4.0)	0.41 / 0.33
<b>Mean Sessions Attended (SD)</b>			
	9.2 (1.2)	10.3 (0.6)	

PPVT-4 SS: Peabody Picture Vocabulary Test 4<sup>th</sup> Edition

CELF-4: Clinical Evaluation of Language Fundamentals 4th Edition; CFD: Concepts and Following Directions Subtest; WS: Word Structure Subtest; RS: Recalling Sentences Subtest; FS: Formulated Sentences subtest; Core: Core Language Score

SPAT-R %: Sutherland Phonological Awareness Test Revised, percentile rank for year of school

ONC: Oral Narrative Comprehension score, Maximum Score = 8

ONQ: Oral Narrative Quality score, range of scores 8-40

<sup>^</sup> Standard Score, Mean=100, SD=15

<sup>#</sup> Standard score, Mean 10, SD 3

## Oral Narrative Intervention Results

**Oral narrative comprehension:** A significant change was found for the intervention group, ( $p < 0.05$ ) and not for the delayed intervention group ( $p = 0.074$ ). There was no significant interaction effect for *time x group* on ONC results ( $F(1,14) = 2.52$ ,  $p = 0.14$ ,  $\eta^2 = 0.135$ ) as can be seen in Table 3.

**Oral narrative quality:** A significant change in ONQ results was found for the intervention group, ( $p < 0.05$ ) and not for the delayed intervention group ( $p = 0.42$ ) as shown in Table 6. There was also a significant interaction effect for *time x group* on ONQ results ( $F(1,14) = 5.02$ ,  $p < 0.05$ ,  $\eta^2 = 0.26$ ) as can be seen in Table 3.

Table 6: Change in assessment scores from time 1 to time 2 for oral narrative group

Assessment task	Intervention Group			Delayed Intervention Group		
	Mean Change (SD)	df	Sig	Mean Change (SD)	df	Sig
ONC	1.2 (0.8)	12	<0.01*	2.0 (1.0)	2	0.07
ONQ	9.6 (7.0)	12	<0.01*	0.3 (0.6)	2	0.42
CELF-4 CFD	1.2 (5.4)	4	0.64	na		
CELF-4 WS	5.4 (3.9)	4	0.04*	na		
CELF-4 RS	2.8 (4.0)	4	0.20	na		
CELF-4 FS	6.6 (9.1)	4	0.18	na		

ONC: Oral Narrative Comprehension

ONQ: Oral Narrative Quality

CELF-4: Clinical Evaluation of Language Fundamentals 4th Edition; CFD: Concepts and Following Directions Subtest; WS: Word Structure Subtest; RS: Recalling Sentences Subtest; FS: Formulated Sentences subtest

\* significant difference  $p < 0.05$

**Language skills:** A significant change at  $p < 0.05$  was found for the intervention group post therapy on WS assessment results (Table 6). In the oral narrative control group only one child had CELF-4 scores that fell below one standard deviation on initial assessment. For this reason no CELF-4 comparisons for the oral narrative intervention and control groups are reported.

**Delayed Intervention Group:** Due to small numbers in the oral narrative delayed intervention group following therapy ( $n=3$ ) a visual analysis of the graphic display of the data was used to determine the change in oral narrative skills for this group immediately post-intervention<sup>(35)</sup>. Figures 7 and 8 illustrate means for the intervention and delayed intervention groups at all assessment points. Visual inspection suggests no meaningful change in oral narrative assessment results for the delayed intervention group following therapy.

Figure 7: Oral Narrative Comprehension Mean scores for Intervention and Delayed Intervention Groups at Baseline Pre-therapy and Post-therapy.

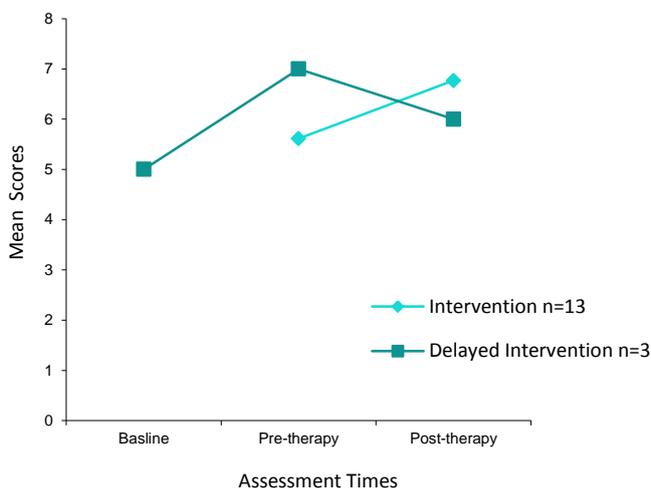
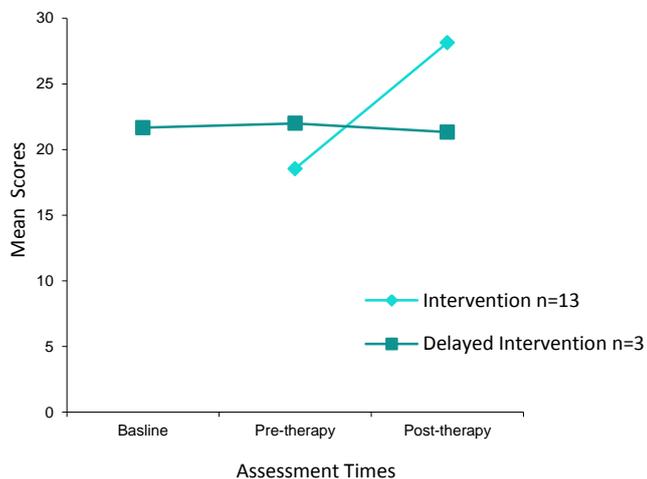


Figure 8: Oral Narrative Quality Mean scores for Intervention and Delayed Intervention Groups at Baseline Pre-therapy and Post-therapy.



# Discussion

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This study showed that student-delivered therapy can improve school-age children's phonological awareness skills and their ability to construct well-structured narratives. The results from this investigation have yielded positive language outcomes, which add to the current evidence base for treatment and lend support for new models of service delivery.

## Phonological Awareness Intervention

The results showed that student-delivered phonological awareness therapy had a significant effect on these targeted skills, with children who received this therapy making significant phonological awareness gains whilst those waiting for therapy did not. Adding to this, the delayed intervention group showed significant improvement in performance after receiving their phonological awareness therapy when compared to their pre-treatment scores. Despite the low sample sizes (n=5 intervention group, n=8 delayed intervention group), robust statistical significance suggests positive impact from the intervention.

The current finding that student-delivered phonological awareness intervention appears to have positive treatment effects has not been explicitly reported in the literature, but supports the many studies that show similar positive phonological awareness gains when delivered by trained speech-language pathologists<sup>(36-39)</sup>, and literature that reports positive therapeutic gains from student-delivered treatment<sup>(40, 41)</sup>. It is important to note that the students in this study had well-developed programs to follow, training in program implementation prior to delivery, and ongoing support during delivery, and these elements are seen as being critical to successful client outcomes when using students<sup>(41)</sup>. The results show that students can deliver high quality and effective phonological awareness interventions to school-age children.

Also, positive treatment effects were evident where children attended an average of nine of the 12 sessions over an eight week period, indicating that the phonological awareness therapeutic program at this intensity was robust, specific, and reliable. This finding adds to the body of research advocating the benefits of small group phonological awareness intervention delivered by speech pathologists to increase capacity in services for school-age children<sup>(37, 42)</sup>, and introduces the idea that trained students may also effectively deliver such intervention.

An unexpected finding was improvement in the phonological awareness intervention group's ability to formulate grammatically and semantically correct, complete sentences post-treatment. In the absence of any clear-cut psycholinguistic relationships between processes for phonological awareness and formulating sentences, metalinguistic factors (e.g., improved overall attention) need to be considered. Adding further to this, the effect of improvement in formulating sentences was seen clearly in the delayed intervention group with only one of the five children showing significant improvement in these skills while waiting for therapy, and four children showing improvement following therapy.

## Oral Narrative Intervention

In line with the phonological awareness results, the results for the oral narrative intervention indicated that student-delivered programs improved children's narrative ability, resulting in significant gains in both story comprehension and story quality scores. However, unlike the phonological awareness groups, these positive gains were limited to the immediate treatment group only with the delayed intervention group showing no positive gains following the oral narrative treatment. This discrepancy is important, but does not render the immediate treatment group's results invalid as this group had good numbers (n=13) and robust statistical significance. It is likely that the very low numbers of participants in the delayed group (n=3) made it difficult to detect real treatment effects. A study with larger numbers and greater statistical power would be more likely to detect any treatment effect.

Despite the delayed group showing a different outcome, the results from the first group support the literature that shows that oral narrative treatment can result in positive outcomes<sup>(43, 44)</sup>. The results further reinforce the themes raised from the phonological awareness treatment outcomes, namely, that student-delivered interventions can be effective, when specific and monitored. Again this group averaged attendance at nine of the 12 therapy sessions over an eight week period indicating that small group interventions for school-age children at this intensity can be effective and add to service efficiency. The oral narrative therapy, like the phonological awareness therapy, was specific, repetitive, and meaningful, which speaks to key principles of neuroplasticity that enhance learning<sup>(45)</sup>.

A point of interest from the oral narrative treatment for the intervention group was the finding of a significant improvement in grammatical skills as assessed by the Word Structure subtest of the CELF-4. Speculatively, it is possible that the oral narrative treatment program, by explicitly teaching the superstructural time-frames and macrostructure of narratives, was simultaneously reinforcing many inflectional and derivational aspects of words, as well as pronoun use. Also, throughout the oral narrative treatment sessions, students actively and consistently corrected children's morphology, tense, and pronoun errors during the group treatments, thereby enabling children to use and potentially improve skills in this area. In addition, such correction occurred in a small group setting, allowing children to potentially benefit indirectly from one another. This observation has not been reported in the literature as many investigations related to oral narrative therapy have focused primarily on reporting changes in narrative ability<sup>(43, 44)</sup> rather than improvement in general language skills.

## Strengths and Limitations

A limitation of this study is the small numbers of children involved in each of the groups, which decreases the power of the statistical analysis and limits the applicability of findings to the wider population. However, the robust statistical outcomes found in this study suggest that the changes made by the school-age children are likely to be clinically relevant.

## Future Directions

It is recommended that further research be undertaken with increased numbers and greater statistical power to verify the findings of this pilot study. In addition subsequent investigations could be extended to include functional educational, social and self-esteem outcomes for these children utilising educational assessment together with self, teacher, peer and family reports. Qualitative investigation would provide greater depth and add valuable information. Future investigation should include health economics and cost-benefit ratio calculations in order to establish the true financial and other costs and benefits of student-delivered

interventions to small groups of children. Such data is becoming increasingly important for health service development.

## Conclusion

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The results demonstrate that student-delivered intervention, can improve school-age children's skills in the important areas of phonological awareness and oral narrative, and confirm that progress was greater than would be expected with normal maturity and education, providing initial evidence to support the incorporation of student-delivered therapy to extend and supplement speech pathology services that struggle to provide timely intervention to school-age children with phonological awareness or oral language difficulties. In addition, these findings support the use of small group, semi-intensive, therapy as an effective service delivery model.

These positive outcomes add evidence to support the incorporation of student clinics and small group interventions into areas of need to build capacity in services.

The cumulative outcomes from this research have the potential for positive impact on many speech pathology services, both rural and metropolitan, and can yield new service delivery models that are able to be translated across, and imported into, other allied health disciplines.

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