



Effectiveness of an Early Intervention Programme for Pre-School Children at Risk of Dyslexia in Singapore

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Abstract

An investigation of the effectiveness of an early intervention programme for children at risk of dyslexia in Singapore was conducted with 56 children aged five to six years old identified to be at risk of dyslexia. After risk-identification, the children undertook a pre-test of literacy ability that measured alphabet knowledge, phonogram knowledge, sight word knowledge, reading ability, and spelling ability. The children then received intervention in the form of an early intervention programme at the Dyslexia Association of Singapore. After which, the children were post-tested for their literacy ability to measure literacy gains. The results showed that literacy scores at post-test were significantly higher than at pre-test and that overall literacy gain was significantly positively correlated with length of intervention. These results indicated that early intervention was effective and that the longer the intervention the greater the gain in literacy ability.

Keywords: early intervention, kindergarten, preschool, children, dyslexia, at-risk of dyslexia, reading, spelling, Orton-Gillingham, Singapore

There is now considerable evidence from research worldwide that early intervention is the most effective approach to help children with dyslexia and other learning difficulties (Rose, 2009). Research by

Torgesen (2001) indicated that one hour of individual intervention at 8 years of age led to an increase of between 0.2 to 0.3 standard score improvements and can lead to improvement of these children to

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a typical reading age. Evidence from studies with young children aged 4 and 5 in the UK have shown lasting benefits for early support (Fawcett, Lee, & Nicolson, 2014; Nicolson et al., 1999). Moreover studies from Singapore (See & Poay, 2014) have shown that it is possible to identify pre-school children at risk of failure before the formal age of diagnosis for dyslexia. The Dyslexia Association of Singapore (DAS) runs an early intervention programme (EIP)¹ in literacy for pre-school children younger than seven years old identified as being at risk of dyslexia.

Singapore is a multi-ethnic and multilingual society noted worldwide for its high educational outcomes in international tests such as the OECD's Programme for International Student Assessment (PISA) tests (OECD, 2011). Perhaps part of the reason for Singapore's success in the PISA test is due to its focus on early intervention for children with learning difficulties. One of these early intervention programmes is the Development Support Programme (DSP). A sum of S\$30 million was put aside in the Singapore budget in 2011 for this new programme (MOF, 2012). In addition, \$4 million has been set aside for the DSP annually. The Ministry for Social and Family Development aims to cater to 2,000 children in the DSP. The DSP provides learning support and therapy interventions to children with mild speech, language and learning delays (MSF, 2013). DAS's EIP aims to supplement the DSP and focuses on literacy development¹

In Singapore, children start Primary One (P1 for short, the equivalent of Grade 1) in

the year that they turn seven years old. Primary education is mandatory. English is the language of instruction for all subjects - math, science, art, etc., except for a second language which is taught in the children's mother tongue. As such, it is expected of young Singaporean children to be equipped with rudimentary English literacy skills prior to starting P1. Most children would have done so by attending two years of kindergarten education. Scarborough (2009) noted that the process of reading acquisition began before elementary school, a case that holds true in the Singapore context. Piasta and Wagner (2010) noted that children who started school with a weak grasp of letter names and sounds would likely have difficulty in learning to read. Singaporean children, at P1, are expected to have attained a certain level of reading, copying and writing ability (e.g. the ability to read and spell the word "neighbourhood"). This presents a significant challenge for children at risk of dyslexia, with specific learning differences and developmental delays in literacy.

There is unanimous agreement that problems with phonological processing are associated with dyslexia and associated reading and spelling difficulties. Research by Byrne (1998) and Hulme et al. (2002) indicate that awareness of individual speech sounds (phonemes) is the skill most crucially related to emergent literacy. The positive impact of phonological awareness training on literacy development was also confirmed by the National Reading Panel's (NRP) (2001) meta-analysis of 96 studies carried out in the United States of

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America. The NRP (2001) research indicated an improvement on reading ($d = 0.53$) and spelling ($d = 0.59$) from early intervention. Phonemic awareness training was also shown to be most effective when associations between sounds and letters are explicitly taught (NRP, 2001). Children's literacy skills can thus be improved with phoneme awareness and phonological skills training and that the benefits are greatest for younger children. Torgesen (1998) argued strongly on the need for early intervention, catching children before they fail/fall. The EIP offered by DAS shares this passionate belief. The programme takes a literal leaf out of Torgesen's research and provides early literacy intervention to preschool children ages five to six at risk of dyslexia, targeting their areas of literacy weakness with a focused contextualised programme.

The Dyslexia Association of Singapore Early Intervention Programme

The DAS early intervention programme (EIP) is based on evidence from research as reviewed. The DAS EIP targets the knowledge and skills required for letter knowledge, phonemic awareness, comprehension, sight words and fine motor skills acquisition within a suggested preschool scope and sequence (see Appendix 1).

Education therapists formulate and devise Individualised Intervention Plans (IIP) for students based on their specific learning needs obtained from Pre-Informal Assessment at the beginning of the first remediation session with the educational therapist. Lessons are delivered in an engaging and simultaneously multisensory

manner based on Orton-Gillingham (OG) approach and principles.

The OG approach is a language-based approach where students are explicitly taught the rules, facts and generalisations about the English language. Six principles govern the OG approach:

1. Language based

It encompasses an awareness and appreciation of the features of the English language that includes reading, spelling, writing and learning strategies as appropriate to young learners' developmental needs.

2. Cognitive

It was noted that 85% of the English language can be made predictable with explicit instruction in rules and generalisations that govern its use. This tool enables young learners to read/spell more effectively.

3. Structured, sequential and cumulative

This is especially vital to a dyslexic learner. In order to achieve automaticity, content needs to be taught systematically in a sequential manner. Consistent review of previously taught/learned material fosters retention and enables the learning of new material to "spiral" upwards with each accumulation.

4. Simultaneously multisensory

Through visual, auditory, kinaesthetic and tactile activities, that builds a strong and intense memory connection, young learners are more likely able to "retrace" and

"retrieve" the memory of what-was-taught in previous lesson/session.

5. **Diagnostic-prescriptive**

No two learners are alike. In view of young learners with literacy delay, individualised teaching through IIP (Individualised Intervention Plan) is essential.

6. **Emotionally-sound**

Stress, anxiety and negative emotions can act as an affective filter that comes between learning and what-is-being-taught. Emotionally-sound delivery fosters and promotes learning and acquisition.

The EIP is carried out in three tiers. A Preschool Screening Assessment at the point of admission into programme, intervention by Educational Therapists and a Full Age Psychological Assessment (point of exit of the programme) by our qualified DAS psychologists. Children are grouped according to Assessment results/Profiles. Each class consists of 2 to 4 children, each having their own IIP. Children who complete the programme and are diagnosed as dyslexic may continue on with DAS in its main literacy programme at Primary One.

Student progress is carefully monitored through observation made during each intervention session as appropriate. Based on the diagnostic-prescriptive nature of the OG principle, education therapists adjust the lesson content for the next session by addressing the areas of uncertainty, weakness and strength. Thereby, shoring up against weaknesses in foundation concepts, addressing gaps

in foundation knowledge and leveraging on student achievement and strength, promoting further interest and progress in learning.

Research Questions and Hypotheses

This research aims to evaluate the effectiveness of the DAS EIP programme. The research questions and hypotheses are firstly, does the DAS EIP improve overall literacy ability? And secondly, is the length of intervention correlated to overall Literacy Gain?

It was hypothesised that children at post-test would have significantly higher literacy scores than at pre-test and that there would be a significant positive correlation between length of intervention and overall literacy gain.

Method

Participants

Fifty-six children (37 boys and 19 girls) aged five to six years old were selected for this study. Parents' informed consents were obtained before the research was conducted.

Materials

The literacy score on a Comprehensive Literacy Assessment was used as the pre-test and post-test measure. There were five areas of assessment: alphabet knowledge (ability to sequence the alphabet, write lowercase letters, and write uppercase letters), phonogram knowledge (ability to identify basic consonants and short vowels, i.e. letter to sound correspondence), sight word

knowledge (ability to read sight words), reading ability (ability to read cvc, ccvc, cvcc, and ccvcc words, where c=consonant and v=vowel), and spelling ability (ability to spell cvc, ccvc, cvcc, ccvcc words). Scores were converted into percentages for easy comparison.

Procedure

The children were pre-tested before going on an intensive two-hour per week literacy intervention based on Orton-Gillingham principles (see Appendix 1 for lesson outline). Students were then post-tested to measure their overall gain.

The intervention length ranged from 10 to 70 hours ($M = 48.7$, $SD = 24.0$). There was no control group as it was deemed that withholding or delaying intervention

was unethical. Instead, as children entered the EIP at different times of the year and hence received differing intervention lengths, a correlation between length of intervention and overall literacy gain was conducted.

Results

There was a significant improvement in Overall Literacy Ability from pre-test ($M = 26.44$, $SD = 16.90$) to post-test ($M = 51.16$, $SD = 19.77$), $t(55) = 12.791$, $p < .001$, Cohen's $d = 1.34$. In addition, there were significant improvements in all five areas (see Figure 1):

Alphabet Knowledge: pre-test ($M = 56.04$, $SD = 31.34$) to post-test ($M = 80.43$, $SD = 21.35$), $t(55) = 7.519$, $p < .001$, Cohen's $d = 0.91$;

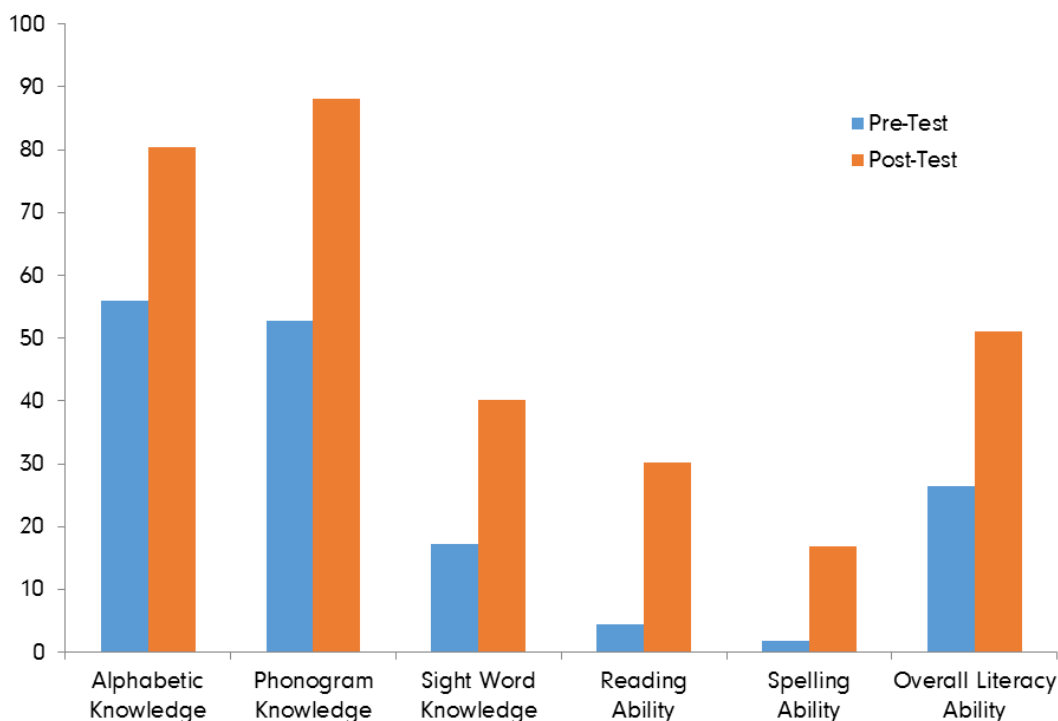


Figure 1. Mean Pre-Test and Post-Test Literacy Scores (in percentages)

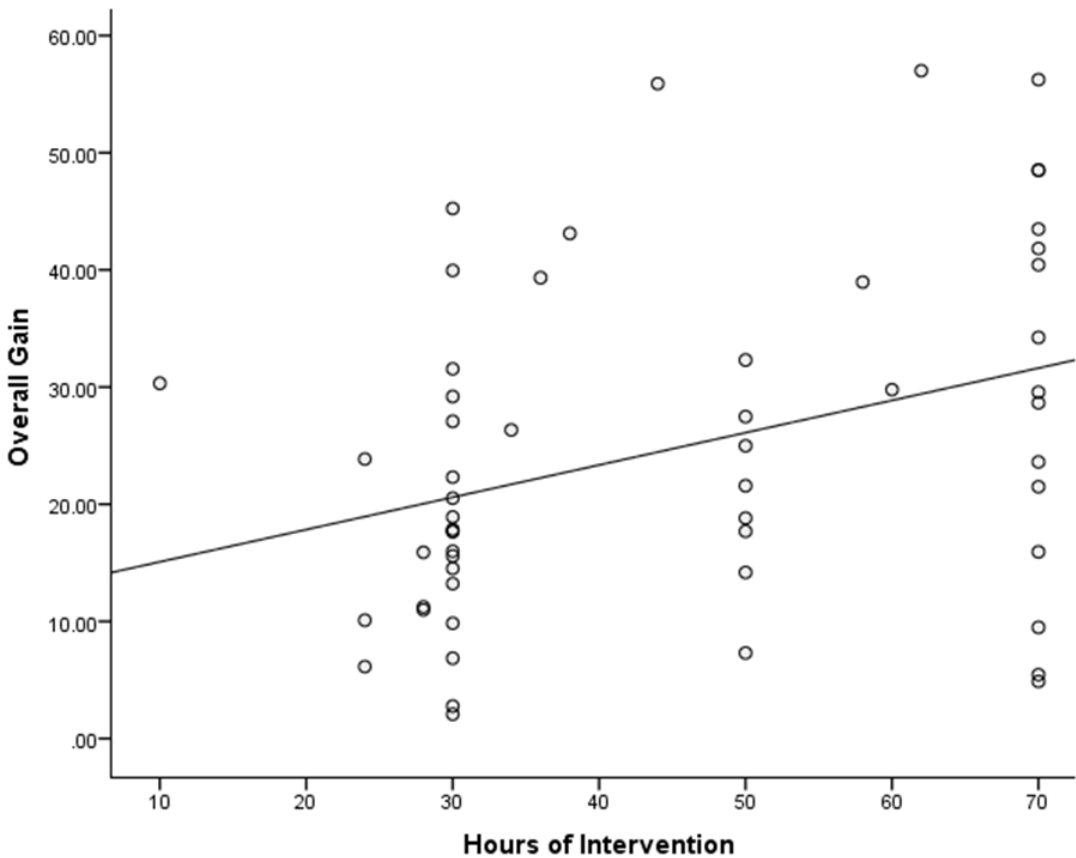


Figure 2. Scatter-Plot of Length of Intervention and Overall Literacy Gain.

Phonogram Knowledge: pre-test ($M = 52.68$, $SD = 34.43$) to post-test ($M = 88.19$, $SD = 20.47$), $t(55) = 8.661$, $p < .001$, Cohen's $d = 1.25$;

Sight Word Knowledge: pre-test ($M = 17.32$, $SD = 22.69$) to post-test ($M = 40.14$, $SD = 30.95$), $t(55) = 8.366$, $p < .001$, Cohen's $d = 0.84$;

Reading Ability: pre-test ($M = 4.38$, $SD = 11.60$) to post-test ($M = 30.27$, $SD = 31.28$), $t(55) = 6.714$, $p < .001$, Cohen's $d = 1.10$; and

Spelling Ability: pre-test ($M = 1.79$, $SD = 5.17$) to post-test ($M = 16.79$, $SD = 25.05$), $t(55) = 4.790$, $p < .001$, Cohen's $d = 0.83$.

In addition, no child had a lower score at post-test than at pre-test (i.e. all children showed improvement in all five areas and in overall literacy score).

There was a significant positive correlation between Hours of Intervention and Overall Literacy Ability Gain, $r(54) = .347$, $p = .009$. (see Figure 2).

Discussion and Conclusion

The results supported both hypotheses that children at post-test would have significantly higher literacy scores than at pre-test and that there would be a significant positive correlation between length of intervention and overall literacy

gain. These results indicated that the DAS EIP was effective and that the longer the intervention the greater the gain in literacy ability. The results of this research parallel research conducted by Fawcett et al., (2014); Nicolson et al., (1999); and Torgesen (2001).

Fawcett et al.'s (2014) research indicate that children with intervention as little as 15 minute sessions twice weekly for 10 weeks (5 hours in total) would show a good improvement versus a control group. The length of intervention in this research ranged from 10 to 70 hours with all children showing a literacy improvement. The child that received 10 hours of intervention received this intervention over 10 weeks (one Singapore school term), whereas children that received 70 hours of intervention received intervention over 40 weeks (four Singapore school terms comprising one school year). All this seems to indicate that length of intervention may not be as important as frequency of intervention and the effectiveness of sustained intervention versus intensive intervention.

Torgesen (2001) concluded that 70 hours of intervention would be sufficient to return a child to a typical reading age. However, the results of this study supports the idea that any amount of intervention (as low as 10 hours) would be useful to help children at risk of dyslexia. The results also indicate that more hours of intervention would be more effective than lesser hours. However, the lack of a control group limits this conclusion. Ethical considerations suggest that it would be difficult to conduct control group versus intervention group research in this area and that investigating correlations

with length of intervention would be a good compromise in terms of scientific knowledge versus ethical concerns.

The effect sizes of the improvement in overall literacy scores achieved by the DAS EIP was $d = 1.34$ with effect sizes of the five individual areas ranging from $d = 0.83$ to $d = 1.25$. An effect size is a statistic used to estimate improvements in intervention studies. This allows for comparisons to be made between different studies, and to assess the magnitudes of improvements resulting from different interventions. An effect size of 0 means that there was no improvement. An effect size of 1 means an improvement of 1 standard deviation. In terms of the statistical significance of effects sizes (expressed as d), $d = 0.20$ is considered low, $d = 0.50$ is moderate and $d = 0.80$ is high (Cohen, 1988). The NRP's (2001) meta-analysis showed that effect sizes greater than 0.80 were found in only 32% of studies and effect sizes of 2.0 and above were rare (6%). The DAS EIP overall improvement of $d = 1.34$ is thus a very great achievement and the improvements of the five individual areas from $d = 0.83$ to $d = 1.25$ was also remarkable. This in turns validates the effectiveness of the DAS EIP. It is particularly important in this context to highlight the striking and significant improvements in reading ability, with mean score accelerating from 4.38 to 30.27, plus the significant increase in sight word reading. One of the key findings of the National Reading panel was that although intervention improved phonology, it was more difficult to impact on reading ability. It may be seen from these results that the DAS EIP was able to improve not just the phonology but also

the overall literacy ability, including reading and spelling.

Although this study showed that more hours of intervention would be more effective than lesser hours, due to limited resources, it is not feasible to have unlimited hours of intervention for every child. Future research could be focused on whether there was an optimum number of hours of intervention so as to make better use of manpower and other resources available for intervention.

In conclusion, the results provided strong evidence for an OG-based early literacy intervention approach and validates the effectiveness of the DAS Early Literacy Intervention Programme. The scope and sequence used at DAS may thus be useful for adoption by other providers of early intervention programmes.

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Appendix 1.

<p style="text-align: center;">DAS Preschool Programme - Suggested Lesson Breakdown</p>	<p style="text-align: center;">First Hour Lesson</p> <ul style="list-style-type: none"> ◆ Story Telling / Oracy ◆ Card Drill ◆ New Phonogram / Letter Formation / Alphabet Sequencing ◆ Phonic Awareness ◆ Targeted Words to Read
	<p style="text-align: center;">Two Hour Lesson</p> <ul style="list-style-type: none"> ◆ Story Telling / Oracy ◆ Card Drill ◆ New Phonogram/ Letter Formation / Alphabet Sequencing ◆ Phonic Awareness ◆ Targeted Words to Read ◆ Targeted Words to Spell ◆ Sight Words ◆ Fine Motor Activity / Assistive Technology
<p style="text-align: center;">Second Hour Lesson</p> <ul style="list-style-type: none"> ◆ Card Drill ◆ Sight Word ◆ Review Phonogram / Letter Formation / Alphabet Sequencing ◆ Targeted Words to Spell ◆ Fine Motor Activity . Assistive Technology 	

DAS Preschool Programme - Suggested Scope and Sequence					
Literacy Appreciation	Story Telling, Rhymes	Oracy Curriculum			
Letter Knowledge a, t, b, l, f, h, p, s, u, m, r, c, w, g, y, v, i, n, d, j, z, qu, o, k, e, x	Letter Recognition	Letter Formation	Letter Sound	Alphabet Sequence	
Phonemic Awareness	Word Awareness	Syllable Awareness	Phoneme Isolation B, E, M	Oral Blending CV, CVC	Oral Blending CVCC -st, -sk, -sp, -nd, -nt, -it, -mp, -ft CCVC sl, cl, fl, pl, bl, gl, br, cr, dr, fr, pr, tr, gr st, sp, sn, sw, sk, sm sh, th, ch, wh
Sight Words	Sight Word Curriculum				Oral Blending -ng, -nk, Floss, -ck,
Fine Motor Skills	Fine Motor Curriculum	Handwriting			Phoneme Counting
* Comprehension	Comprehension on Curriculum	Handwriting without tears®			

Components can be done concurrently according to students' needs.

* Comprehension component to be done for students at advance level.