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Evaluating an early literacy intervention in Singapore.

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Abstract

Research has shown that the early years can be critical for children's progress in literacy and learning. Moreover, a number of predictors for success can be identified at this stage, including letter naming and phonological skills. An investigation into the effectiveness of the Dyslexia Association of Singapore (DAS) Preschool Early Literacy Intervention Programme (ELIP) was conducted with 294 kindergartners in 2016. Pre and post test results indicated literacy gains in all areas of early literacy intervention. These areas include alphabet and phonogram knowledge, sight words, reading and spelling. Thematic analysis of feedback gathered from parents, early literacy intervention therapists, and children showed intangible gains such as a love for learning and increased confidence, which may point towards the emergence of resilience. A positive tri-partnership between the therapist, the child and the parent is critical for success.

Keywords: Preschool/kindergarten; early intervention; phonics; literacy; stakeholder feedback; Singapore

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INTRODUCTION

Individuals born with difficulties in areas of reading, writing and spelling are often labelled as dyslexic, and dyslexia is regarded as a specific learning disorder (DSM-V). Therefore, dyslexics need to be "helped" because they are "disabled". However, strengths in dyslexia have also been reported, although these are more difficult to quantify. This phenomenon is now increasingly recognised and it has even been discussed by the popular media. It was reported that "most people only get to see the full jigsaw picture when it's nearly finished while the dyslexic cryptographists can see what the jigsaw looks like with just two pieces" (Mail Online, July 13, 2013). Dreyer, a notable dyslexic and a major innovator in biotechnology, (West, 2014) who invented the automated gas-phased protein sequencer, reported "When I'm inventing an instrument or whatever, I see it in my head and I rotate it and try it out and move the gears. If it doesn't work, I rebuild it in my head" (Caltech, 1999).

Dyslexia, therefore, need not mean disabled in all areas of education – and it is important for the education system to support the development of the skills of individuals with dyslexia as much as it is any group. As a minority group, with dyslexia affecting only about 10% of the population, how can we nurture these unique abilities in young children, despite their known difficulties in areas of early reading, writing and spelling? Is there some way we can equip them with a dynamo to build their skills and ability to read, spell and write through holistic early literacy intervention? A dynamo that they can independently fuel (or refuel) on their own, to propel their personal academic (and non-academic) learning forward beyond the boundaries of their time with the Dyslexia Association of Singapore's (DAS) Preschool Early Literacy Intervention Programme? In this article, these issues are explored, to address the impact of a targeted programme on achievement and affect in a large group of young dyslexic children.

Research has indicated that it is possible to identify young children in Singapore at risk for failure (See and Poay, 2014). At DAS, children are referred at the preschool level following concerns that they are not making the expected progress towards learning and there may be risk of dyslexia or other learning difficulties. At the end of this two year period of support, they are eligible for formal assessment for dyslexia, and those diagnosed as dyslexic will continue onto the MAP course funded by the Ministry of Education. In line with increasing evidence of co-morbid conditions in this group, children will often show a range of problems that have been associated with dyslexia. The rationale for provision of this course is the strong literature base indicating that early intervention can be the most successful, providing proactive support before a child falls behind their peers. DAS Preschool Early Literacy Intervention Programme (ELIP) has been offering weekly 2-hour intervention to kindergarteners outside regular school hours since 2011, helping a total of over 1100 children to date. It uses a prescribed scope and sequence curriculum to early literacy intervention, which is guided by Orton-Gillingham principles integrated with sound early childhood pedagogy. The Educational Therapist

(EdT) to student ratio is 1:5, providing a realistic opportunity for children to catch up with their peers in the early years, before they have experienced too much failure.

This approach to early screening and support has been well validated internationally, with evidence suggesting that support in the early years is most effective if undertaken between 5/6 before the impact of failure on self-esteem affects a child's ongoing progress (Nicolson et al, 1999, Fawcett et al, 2000). By contrast, by the age of 7/8 a number of children will need more intensive support to catch up with their peers (Nicolson et al, 2000). Support provided for children struggling in nursery can be effective from the age of 4, and persists over the next 18 months (Fawcett et al, 2014). Studies from the USA have indicated that once a child reaches the age of 8 without support, up to 67.5 hours of individual support will be needed to bridge the gap with the rest of their classmates (Torgesen, 2001). Moreover, Ferrar and colleagues (2015) recently demonstrated that problems in reading identified in US 1st grade will persist into adolescence, whereas early support can successfully cut into this cycle of failure.

The ELIP curriculum is continuously striving to provide enhanced holistic support for students, enabling success that is driven by the efforts of the children themselves. In anticipation of the common pitfalls faced by dyslexics, such as negative self-esteem, social challenges in daily routines, executive function issues and so on, elements of early social-emotional learning are carefully woven in with early literacy intervention. (For a full exposition see Wong et al,(2015, 2016) in the DAS Handbooks where details of these ongoing curriculum developments and examples of the impact on the children are provided.) A defining characteristic of the support provided is the recognition, derived from research on executive function (Diamond, 2013) that children learn best when they are fully engaged and challenged, but having fun.

In an extension of an earlier study by Sim, Wong, Samsudin and Bunn (2015), this research continues to examine the impact and effectiveness of the DAS preschool programmes' efforts with a much larger sample size (294 students as compared to the 56 students reported in the earlier publication). It also adopts a mixed measures design, seeking to examine the impact of the programme via feedback from the parents, the children and the EdTs, in addition to measuring outcomes in literacy attainments.

McConnell and Greenwood (2013, p. 143) observed that "The landscape of early childhood education has been changing to embrace the concept of response to intervention (RTI) specifically and intentional teaching more broadly as a means of improving all children's outcomes". Therefore, ongoing efforts in research reporting findings and sharing good practices are crucial in contributing to the expanding early literacy intervention landscape in Singapore. Research has indicated the importance of early intervention in all regions, but nowhere is this more applicable than Singapore, where standards are exceptionally high, and failure to progress can be potentially very damaging for the self-image of the developing child (Landulfo et al, 2015).

Research design

This investigative study uses a mixed design approach to analysis. A quantitative approach was used to measure participants' pre-post test scores during their early literacy intervention journey. A qualitative approach was applied to feedback gathered from surveys of parents, teachers, and students.

Research Questions and Hypotheses

This research aims to examine the effectiveness and impact of DAS Early Literacy Intervention Programme (ELIP), a phonics based intervention programme, for 5 to 7 year olds in Singapore. The research questions are

1. Is DAS ELIP's phonics based intervention approach effective in helping kindergarteners improve on their early literacy learning outcomes?
2. Is there a statistically significant relationship between the number of intervention hours and improvements, if any, in early literacy learning attainments?
3. Are there any common recurring themes from stakeholders' feedback?

The following hypotheses are proposed:

Hypothesis 1: The phonics based intervention approach was hypothesised to show statistically significant improvement in the areas of alphabet knowledge, phonogram knowledge, sight word knowledge, reading ability and spelling ability. Quantitative analysis was used to evaluate the effectiveness of the phonics based intervention approach

Hypothesis 2: A statistically significant positive linear correlation between intervention hours received by students and improvements will be found in the areas of phonogram knowledge, reading ability and spelling ability. That is to say, as the number of intervention hours increased, there would be an increase in scores for phonogram knowledge, reading and spelling.

Hypothesis 3: The experience would be positive for parents, students and EdTs alike. Thematic analysis was used to analyse and identify common themes brought up by all.

METHOD

Participants

Data were collected from 293 students (196 male, 97 female), primarily made up of kindergarten year one and year two students (59 five y/o, 209 six y/o, 23 seven y/o and

two 8 y/o). Students attended an average of 62 hours of intervention. The majority of the data was only available for 252 students, and analysis reported here focuses on these students. Discrepancy in sample size is due to incomplete data.

Materials

DAS ELIP Early Literacy Informal Test Kit (Wong, 2016, p. 110) was used as the pre-test and post-test measure. Five areas were assessed. These were alphabet knowledge, phonogram knowledge, sight words, ability to read and spell in combinations ranging from vc, cvc, ccvc, ccvcc to cccvcc (v=vowel, c=consonant) – these are detailed below. Individual parent, Educational Therapist and student survey forms were also crafted by DAS ELIP in order to gather feedback for thematic analysis.

Procedure

Students were pre-tested upon entry into the programme using DAS ELIP Early Literacy Informal Test Kit. Specific gaps in learning of the five areas (see above) were carefully noted and early literacy intervention plans drawn up. Early literacy intervention was then carried out holistically using sound early childhood pedagogy guided by OG principals. Intervention progress was carefully monitored and recorded.

Students were post-tested at the end of the programme year with results again recorded. No control group was established as DAS ELIP extends its services to all kindergartners showing signs of early literacy delays or at risk of dyslexia. The programme felt that it would be unethical to deprive or withhold early literacy intervention services from kindergartners in need of help. Instead, a correlation was established between literacy gains (specific pre to post-test components, including overall gains) and length of intervention hours.

Feedback from parents, DAS Educational Therapists and students themselves were also collected as part of DAS preschool programmes' ongoing programme evaluation published annually in retrospect. Thematic analysis was carried out to look for recurring areas of concern, issues and trends.

Data collection

Pre/Post Test

Test components: The assessment was split into 5 areas of concern

1) **Alphabet knowledge**
   This component consisted of letter naming, letter sequencing, ability to correctly form all lower and upper case alphabet letters.

2) Phonogram knowledge

Phonogram knowledge consisted of the letter sound correspondence of the 26 letters as well as advanced phonograms (e.g.: consonant digraph, trigraphs, magic e)

3) Learnt word knowledge

Learnt word knowledge looked at student ability to read up to 50 sight words.

4) Reading ability

Reading ability was split into words of increasing difficulty starting with vc, cvc, ccvc, ccvcc, cccvcc and magic e words. There were 3 words in each category of difficulty. Therefore, a student with a score of 3 would have only been able to manage reading words in the vc category while a student with a score of 11 would have been able to read words in the ccvcc category.

5) Spelling ability

This component was similar to reading ability with participant being asked to spell words of increasing difficulty starting with vc, cvc, ccvc, ccvcc, cccvcc and magic e words. There were 3 words in each category of difficulty.

Survey forms from parents, EdTs and students

A Likert scale was used throughout the survey in interest of consistency. The survey used feedback forms which were given to all three categories of stakeholders—parents, EdTs and students—after the post test, at the end of the programme year. The student survey was carried out by the EdTs interviewing their own students and used emoticons. Each emoticon was assigned a score from one to five for the purposes of analyses.

RESULTS

Quantitative data from Pre-test post-test

The results of the pre-/post-intervention measures can be found in Table 1, which also includes the results of paired samples t-tests that were performed (one for each pre- to post-test): the number of participants varied between tests. A Cohen's effect size (1992) was computed based on the mean difference and average standard deviation, with 0.2 indicating a small impact, 0.5 a medium impact and 0.8 and above a large impact of the intervention.

Overall difference

A paired samples t-test was used to compare overall mean score before versus after intervention. On average the participants improved by 51.67 points, which was statistically significant ($t(242)=-20.06$, $p<0.001$) with a large effect size ($d=-0.90$).

Alphabet knowledge
A paired samples t-test was used to compare mean alphabet knowledge scores before and after intervention. On average the participants improved by 22.14 points, which was statistically significant ($t(251) = -12.38$, $p<0.001$) with a medium effect size ($d=0.68$).

Phonogram knowledge
A paired samples t-test was used to compare mean phonogram knowledge scores before and after intervention. On average the participants improved by 10.30 points, which was statistically significant ($t(250) = -17.68$, $p<0.001$) with a large effect size ($d=1.10$).

Learnt word knowledge
A paired samples t-test was used to compare mean learnt word knowledge scores before and after intervention. On average the participants improved by 11.90 points, which was statistically significant ($t(250) = -14.62$, $p<0.001$) with a medium effect size ($d=0.77$).

Reading ability
A paired samples t-test was used to compare mean reading ability scores before and after intervention. On average the participants improved by 4.65 points, which was statistically significant ($t(246) = -16.24$, $p<0.001$) with a large effect size ($d=1.27$).

Spelling ability
A paired samples t-test was used to compare mean spelling ability scores before and after intervention. On average the participants improved by 2.92 points, which was statistically significant ($t(244) = -14.04$, $p<0.001$) with a large effect size ($d= -1.06$).

A bivariate Pearson's product-movement correlation coefficient was calculated to assess size and direction of the linear correlation between intervention hours and improvements in reading. The bivariate correlation between these two variables was positive and significant, $r(243) = .32$, $p<.001$. Although a small effect size, this suggests the ability to read improves as intervention time increases.

A bivariate Pearson's product-movement correlation coefficient was calculated to assess size and direction of the linear correlation between intervention hours and improvements in spelling. The bivariate correlation between these two variables was positive and significant, $r(241)=.23$, $p<.001$. Again, the effect size is small, but suggests that the ability to spell improves as intervention time increases.

A bivariate Pearson's product-movement correlation coefficient was calculated to assess size and direction of the linear correlation between intervention hours and improvements in phonogram knowledge. The bivariate correlation between these two variables was not significant, $r(247)=.04$, $p>.05$. Phonogram knowledge does not significantly increase with intervention hours.

Table 1. Results of Paired Samples t-test comparing pre-test and post-test

Group	N	Mean	SD	t	df	p
Overall Pre test	243	100.68	53.67	-20.06	242	<.001
Overall Post-test		152.35	56.20			
Alphabet knowledge Pre test	252	74.25	35.45	-12.38	251	<.001
Alphabet knowledge Post test		96.39	29.47			
Phonogram knowledge Pre test	251	14.60	10.17	-17.68	250	<.001
Phonogram knowledge Post test		24.90	8.54			
Leant word knowledge Pre test	251	9.82	13.05	-14.62	250	<.001
Learnt work knowledge Post test		21.71	17.71			
Reading ability Pre test	247	1.01	2.38	-16.24	246	<.001
Reading ability Post test		5.66	4.95			
Spelling ability Pre test	245	0.91	1.76	-14.04	244	<.001
Spelling ability Post test		3.83	3.75			

Qualitative data from surveys

Thematic analysis of the stakeholder feedback (parents, educational therapists and children) was performed on 160 responses. Of these responses, 51 unique themes emerged. These themes were then further grouped into 14 categories. Of these themes, only six captured more than five percent of the total responses. These six general themes are presented in Table 2 along with the percentage of responses that they represent.

Table 2. Themes derived from stakeholder feedback and percentage of responses these represent

Themes	Percentage (%)
Learning through fun	41.3
Improvements in literacy	17.5
Supported by educational therapists	15.6
External assistance	13.1
Love for learning	12.5
Confidence	6.8

Table 3. A breakdown of themes reported by stakeholders

Stakeholder	n	Theme	Percentage
Children	81	Learning through fun	67.9
		Love for learning	22.2
Educational Therapists	42	External assistance	38.0
		Improvements in literacy	23.8
		Confidence	19.0
Parents	37	Supported by educational therapists	70.3
		Improvements in literacy	32.4
		Love for learning	5.4
		Confidence	5.4

Themes that accounted for less than 5% of responses are not represented. Some responses consisted of multiple themes.

Learning through fun
This theme appeared most commonly in children responses. They commented that they liked 'play', 'card drill' type activities in their intervention sessions. They also seem to say how 'fun' sessions were and that it made them 'happy'.

Love for learning
This theme noted in feedback from parents and children comprised of responses that seem to indicate an increase in a child's desire to learn, read or write more since intervention. For example, 'Teacher [] is an excellent therapist who has equipped my child with skills that will aid her for a lifetime. (e.g. learning attitude, systematic learning & a love for reading). Any child under her guidance will benefit from her love and genuine concern for them'.

External assistance
This theme was noted primarily in the responses made by Educational Therapists. It comprised of descriptions of comorbidities in specific learning differences such as social, emotional behavioural issues that needed extra support. For instance, ASD (autism spectrum disorder) or SID (sensory integration disorder). This category also included responses that seem to suggest possible demand for 'SLT' (speech and language therapy) or 'OT' (occupational therapy) support for children.

Improvements in Literacy
Improvements in literacy was an important theme for both Educational Therapists and Parents. It comprised of improvements in phonemic awareness activities such as blending, reading and writing. For instance, a child who 'started with good phonics background but was not able to read. Now he is able to blend and read ccvcc words and recognise silent e words'.

Confidence
This theme comprised of any comments that mention an improvement in confidence in reading, spelling or otherwise since joining the programme. For instance, ' [our child] has built much more confidence compared with prior. Thanks for the good efforts'. It was noted in both Educational Therapist and Parent responses.

This also includes comments that mention a decrease in anxiety in relation to tasks, such as, 'he was timid when he first started, always crying and full of anxiety. Now he is able to read independently up to level 'D' from "Razkids". (Note from author: Razkids is an online reading programme that provides a library of carefully structured levelled readers for learners. There are 29 levels in total. Level D readers were meant for kindergarteners to grade 1. For more information, https://www.raz-kids.com/)

Supported by educational therapists
This theme was found in most responses by Parents. It included support that was provided to either parents or students by educational therapists. Parents seemed to feel supported by educational therapists. Strategies on how to work with their child through regular feedback appeared to be appreciated. For example, 'Teacher gives us regular feedback on [our child] so that we can help her along. We have seen a significant improvement in [her] and she is now able to read on her own, and I feel this is mostly due to Teacher. Thank you Teacher.'

Some parents also seem to feel that their children were supported in their literacy intervention journey. Example, 'The teacher is encouraging and supportive. My child can finally read and I am thankful.'
The implications of these themes will be further examined the discussion section.

DISCUSSION

Returning to the hypotheses outlined at the beginning of this article, the following conclusions can be reached based on the significance levels identified in this study.

Hypothesis 1:
The data shows statistically significant improvement in overall scores folllowing intervention. This is also reflected in each of the five components of alphabet knowledge, phonogram knowledge, learnt word knowledge, reading ability and spelling ability. Large effect sizes were found in the areas of reading spelling and phonogram knowledge indicating meaningful improvements in these skills

Hypothesis 2:
Correlations comparing intervention hours against phonogram knowledge, reading ability and spelling ability were then conducted. The results indicated significant correlations with reading and spelling ability but not with phonogram knowledge. The latter result may be because children, in general, do not require 62 or more hours to master basic phonograms. Not all students necessarily start with little or no knowledge: on average, the children scores 14.6 on known phonograms pre-intervention and attained an average of 24.9 by the time of the post-test, which is close to ceiling. However, the standard deviation indicated considerable variability in scores even post-intervention: those not attaining near ceiling scores may be those who require longer intervention.

The average scores at the end of intervention for reading (5.65) and spelling (3.82) indicated that students were at the cvc level at the end of intervention. It is notable that largest effect sizes were achieved for both reading and spelling in this study, largely because the students started from a low baseline. These results correspond to the average phonogram level retained by students at the end of intervention (24.9) which is

close to the full set of alphabet letters. Letter naming has consistently been identified as a key predictor of early literacy, providing the building blocks for later learning (Vellutino et al, 2004). Once students were able to master basic phonogram knowledge, the focus of intervention gets redirected to blending and segmenting to aid with reading and spelling. Students typically do not learn advanced phonograms until they have mastered reading and spelling at the ccvcc level. As the current pool of participants averaged performance cvc word level, they had not yet been taught advanced phonograms. While the length of intervention did not affect mastery of phonogram knowledge, intervention itself significantly improved their phonogram knowledge. This mastery of phonogram knowledge was then able to provide them the tools they needed to make significant strides in reading and spelling.

Hypothesis 3:
The thematic analysis of feedback from teachers, parents and students identified 51 unique themes emerging from 160 respondents. Six of the most common reoccurring themes included (1) learning through fun, (2) improvements in literacy, (3) support from educational therapists, (4) external (multi-disciplinary) support, (5) intrinsic love for learning, and (6) growing confidence.

Results from the thematic analysis seem to suggest that kindergarteners find the DAS ELIP approach to early literacy intervention non-threatening (i.e. does not induce stress or anxiety) and above all "fun". They seem to associate direct explicit literacy instructional activities with "play". Card drill, a mentally demanding task, appeared to be a favourite activity for quite a few. This may seem surprising, given that phonological awareness is a known area of weakness for students at risk of dyslexia. However, this may be related to the delivery of direct, immediate, and positive feedback as part of the card drill process. This includes a warm, encouraging smile from the teacher with praise (or a hi-5) for every card that he/she gets correct.

Results from the thematic analysis seem to suggest that communication between the parent and EdT is crucial to student well-being and success. The presence of specific learning difficulties and challenges including mild autism spectrum disorder, speech and language delays, global developmental delay and so on make continued communication vital. While students received formal literacy intervention support within the confines of DAS ELIP (using a specially designed curriculum), what about their parents? Who is going to help reduce their anxiety in this context? Therefore, ongoing conversation between EdT and parent needs to continue, moving forward to ensure their developing understanding of their child and their learning. Professional development to keep EdTs abreast in related knowledge domains, is a necessity for addressing many of these co-morbid issues.

These results from the thematic analysis seem to point towards possible intrinsic motivators such as love for learning, and confidence, but these are items that are difficult

to quantify and measure, despite the positive response of the students and parents. These are qualities one would associate with "resilience", the ability to overcome adversity or hardship, an area that has not been systematically evaluated in children at risk of dyslexia. Werner (2013) noted, 'most longitudinal studies of resilient children and youths report that intelligence (especially communication and problem-solving skills) and scholastic competence (especially reading skills) are associated positively with the ability to overcome adversity'. Thus, one might speculate that the DAS ELIP curriculum, the approach adopted and the method of lesson delivery may inadvertently foster or even trigger the development and emergence of resilience in some of these students. However, further research would be needed to establish whether or not this could be attributed to the intervention undertaken.

LIMITATION AND DIRECTIONS FOR FURTHER RESEARCH

Notably, the degree of improvement hinges in this study as in others on the presence or absence of comorbidity, the severity of these comorbidities, and the extent of early literacy delay that the student may be experiencing, in addition to the amount of time available for literacy intervention to take place and for learning to take root. No attempts were made to quantify formally the extent of co-morbidity, although from work with older dyslexic children it is clear that a considerable overlap would be expected (Kaplan et al., 2001). Naturally, this group of children were too young for formal diagnosis, and it would be predicted that they would form a heterogeneous group.

There is a significant correlation between the number of intervention hours and improvements in early literacy attainments. However, due to a lack of control group and diversity in some of students with additional learning needs (e.g. in speech and language), no optimum number of hours for intervention was established. Future research could address some of these issues by utilising a group of children waiting for placement in the DAS Pre-school system, or children attending alternative provision as controls in order to evaluate the impact of this programme in comparison to normal maturation.

However, it is not possible from the data extracted from this sample to support the insights of the authors on the importance of executive function and fun in learning. In future research, this aspect should be addressed explicitly, possibly via an intervention aimed at developing resilience in this age group, building executive function and using language to mediate behaviour (Greenberg, 2016) and building on the concepts of positive dyslexia in identifying strengths. The suggestive evidence that the thematic analysis has provided for improved resilience and love of learning in this group needs to be investigated more systematically to address issues such as self-esteem, behavioural inhibition, early memory skills, and attention in the Preschool classroom.

CONCLUSIONS

Based on outcomes derived from the above study, it appeared that DAS ELIP phonics based intervention approach is effective in helping kindergarten age students improve on their early literacy outcomes. The results indicate that:

(1) all children are capable to some extent of learning and acquiring early literacy skills despite specific learning difficulties,
(2) early literacy intervention does seem to make a difference to children's overall well-being that includes literacy improvements, and
(3) the approach of the early literacy intervention programme, how it was delivered and the way it was pitched, is as important as having a prescribed curriculum that has been carefully researched and monitored.

However, it could still be argued that early literacy intervention is effective only if all stakeholders work together in synchrony. Where there appears to be a gap in technical knowledge, or a shortfall in relevant research and literature in the Singaporean context, collaborative efforts across the industry will bring about positive change benefitting all children.

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