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## The role of RAN and PA in predicting reading difficulties in multilingual population: evidence from Telugu native speakers

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### Abstract

This study addresses how one can screen reading difficulties in children with a multilingual background when there is no standardized tool for diagnosis in their native language. Rapid automatized naming (RAN) and Phoneme awareness (PA) are two widely applied tools for predicting reading difficulties. The role of PA in transparent languages and multilingual population is still a conundrum. We took a novel approach in developing RAN and PA in Telugu and tested them on the age-matched dyslexic and non-dyslexic groups. We analyzed our data with an independent sample t-test and found a high significance on RAN between the groups, but less significant difference in PA ability. These results demonstrate that RAN is a better predictor of reading difficulties in Telugu native speakers with a multilingual background.

**Keywords :** attenuated processing, bilingualism , multilingualism, orthographic consistency, reading difficulties, transparent language

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Rapid automatized naming (RAN) and phonological ability (PA) are considered standard methods in predicting skills and deficits in reading across orthographies (Catts, et al., 2015; Frith, 1985; Georgiou, G.K, Parrila, R, & Liao, C.H, 2008, Goswami, 2012; Kirby, et al., 2003; Snowling, 2000; Tan, et al., 2005; Wolf, et al., 2002; Wolf & Bower, 2000; Wimmer, et al., 2000; Wolf, 2002). However, the effectiveness of PA is being debated in transparent languages, because it is not clear why dyslexia manifests in some children who perform well in PA (Vidyasagar & Pammer, 2010). Moreover, there is evidence that even children with PA difficulties with a family history of dyslexia do not always go on to demonstrate dyslexia (Snowling, 2012). Interestingly, studies have demonstrated that reading difficulties in terms of decoding are less prevalent in transparent languages with a multilingual background (Abu-Rabia & Siegel, 2002; Chinta, Sampath, Bipin, 2016; Karanth, 2004; Paulesu et al., 2001). Given this background, the present study explores the RAN and PA abilities in Telugu native speakers with dyslexia who are from a multilingual background. We also examine whether or not PA is a useful diagnostic test for a transparent orthography with a multilingual population.

Reading is a complex cognitive task. Many children develop accurate reading with basic instruction and then achieve automaticity with time and practice, but this is a daunting task for children with dyslexia. However, there is not any single test and no absolute criteria for diagnosing dyslexia in multilingual people, because there are multiple processes involved in reading, and a breakdown of any of them can lead to reading failure. Inaccuracy at any level of language processing or lack of automaticity in connecting any of these circuits can lead to poor reading (Deheane, 2009). RAN and PA tasks are effective because children can perform RAN tasks (naming familiar objects or colors) and PA (speech sound manipulation) well before they can read, and research has shown that both are strong predictors of later reading ability and particularly for reading fluency (Goswami, 2012). RAN has been shown to be the best predictor of reading difficulties among transparent languages (Korhonen, 1995; Wimmer, 1993; Pennington, 2006), whereas PA has been shown to be most effective in alphabetic languages (Shankweiler & Liberman, 1989; Snowling, 2013).

However, the effectiveness of RAN and PA for multilingual people has not been addressed yet, though a study has found longer naming latencies and lower reading scores in multilingual children (Fawcett, 2016). The current paper explores the RAN and PA abilities of Telugu native speakers with dyslexia, as some studies have found severe RAN deficits and few phonological awareness deficits among transparent languages (Ibrahim, R. 2015; Siddaiah, A., & Padakannaya, P., 2015; Vidyasagar & Pammer, 2010; and Wimmer et al., 2000). However, although reading speed is typically found to be a better predictor of reading problems than decoding accuracy, this does not mean that these speed difficulties are not a consequence of phonological weaknesses. Nevertheless, the influence of phonological processing seems to vary across languages, and in this study focuses on Telugu, a relatively under-researched language, in an effort to shed some light on these potential differences.

As the study presented in this paper is focused on the Telugu language, we would like to provide some background and details of its writing system. Telugu is one of the four South Indian languages spoken by 70 million people in two states of India (Census 2001); and 8.8 million people in United States, Canada, Europe and South East Asia (The US Census, 2006-2008). Telugu is an Akshara / alpha-syllabic based writing system, which adopts characteristics of both alphabetic and syllabic system. Here the rules of the writing system differ from those of English. In the Telugu script, syllables are regarded as the unit of representation and consist of primary and secondary graphemes for vowels and consonants respectively. The Telugu script has 56 graphemes and allographs. The language curriculum focuses on mastering these 56 Aksharas by rote learning and not on phoneme-based instructions as in English (Vasanta, 2004, as said in Chinta et al., 2017). Hence, we explore the nature of reading difficulties in Telugu native speakers with dyslexia, and whether these are phonological in nature. We explore the hypothesis that RAN deficits underlie the reading problems in this population with greater impact than phonological deficits.

## METHOD

### Participants

Participants were forty-six right-handed children from two primary schools in Hyderabad (urban area). The participants formed two groups: one group of twenty-three children with dyslexia (all received a formal diagnosis of developmental dyslexia by a clinical psychologist at the primary level, and had a documented history of reading difficulties) with mean age 12 years ten months ( $SD = 0.26$  years); and a second group of twenty-three chronologically age-matched group (CA) of non-dyslexic children with mean age 12 years six months ( $SD = 0.10$  years). They were initially contacted via the school psychologist and special educator. With parental consent, we obtained the history of participants from school academic records, and excluded those who had autism, ADHD, and seizures. Inclusion criteria were checked after the first testing session, which were  $IQ \geq 100$ , reading ability (1.5 SD below the mean) and Telugu being the native language with a multilingual background (all children had received formal instructions in three languages: Telugu, Hindi, and English). We also assessed their verbal and performance intelligence and reading abilities according to the norms of NIMH, Hyderabad. This included IQ (tested with MISIC - Malin's Intelligence scale for Indian children, an adaptation of WISIC); and Seguin form board (SFB)/CPM (colored progressive matrices). Reading and spelling age were assessed using Schonell spelling test (the reading and spelling ages were determined only in relation to English, but not to Telugu). The sample had a fair representation of similar SES group (middle social-economic status) - this information was obtained from the school records (based on the employment status of their parents and residential/neighborhood level). Table 1 illustrates the descriptive statistics of participant's profiles.

## Procedure

Participants were seated comfortably in a quiet room in their school with minimum distraction and were administered the test on a one-to-one basis for both the groups on RAN and PA tasks respectively.

## Task

Given the absence of a standardized RAN and PA testing batteries in the local languages, we created a RAN and PA test stimuli for this study by adapting two sources. The first is the Telugu test of articulation and phonology developed for speech-impaired children (TTAP; Vasanta, 1990), which uses picture-based test stimuli. In the present study, we adapted the same material, but with the textual content (25 pairs of minimal pairs and 10 cluster words) and not the pictures. The reason is that the image-based material is designed for primary school children, whereas in the present study the participants were all 10-13 years (past primary school) and they all had formal instructions to read and write in Telugu (see Appendix for the stimuli).

We take the essence of the PA is to test for phoneme and syllable awareness – an ability to manipulate individual speech sounds in a spoken word. As we do not have a PA test in the Telugu language, we created one for our study as follows. The PA tasks consist of four sub-tasks: substitution; deletion; segmentation and non-word repetition skills, with each sub-task containing 10 items.

We conducted the experiment after three practice trials. Participants were instructed to listen carefully to the words said by the experimenter and respond as accurately as possible. Responses were recorded in an MP3 player and later scored for the percentage of accuracies.

### Syllable substitution

It is the ability to replace a speech sound of a word with another speech sound to form a new word. For instance upon hearing the word 'jaebu' (meaning pocket) and another speech sound 'ka', the participant has to replace the 'ja' sound with 'ka' sound and answer 'kaebu' – (a non-word).

### Syllable deletion

It is the ability to eliminate a speech sound of a word to form a new non-word. For instance, upon hearing the word 'udayam' (meaning 'morning'), the participant is expected to remove 'u' sound and report the remaining word as 'dayam' (a non-word).

### Segmentation

It is the ability to divide and count the number of constituent syllables in a word, and report them (but not the syllable names). For instance, in the word 'satram' (meaning

‘choultry’) the participant has to divide the word into ‘sa’ + ‘ta’ + ‘ra’ + ‘m’ and report as four syllables.

### Non-word repetition

In this test, ten pronounceable non-words differing in a single Akshara were created from a familiar word. Participants were instructed to listen carefully to the experimenter and repeat the non-word as accurately as possible.

The second source, adapted for RAN stimuli, was the Comprehensive Test of Phonological Processing (CTOPP) by Wagner and colleagues (1999). We developed four sets of RAN stimuli (objects, numbers, alphabets, colors), commonly used on RAN measures of English, and also added Akshara to test the automaticity in the native language. Since this set of RAN tasks were developed originally in English; a pilot study was executed with five Telugu-speaking children to evaluate the face validity of the RAN tasks.

The following modifications were incorporated in the Telugu version of RAN: the letter naming task was modified to reflect Telugu Akshara that do not represent the single consonant sounds as they do in English.

For instance, Telugu Akshara ‘క’-represents syllable /ka/ but not phoneme /k/ as in English. Second, the object-naming task was modified to reflect the vocabulary differences between English and Telugu. For instance, the picture of an onion can lead children to utter different words having the same meaning: urllagadda, ullipaya, or ‘erragadda’.

After the pilot study, the final RAN task for this study was composed of five plates (Figure 1) that represent each of the five stimulus sub-tasks:

- ◆ Digit-naming tasks consisting of five numbers (1, 2, 3, 4, 5)
- ◆ Alphabet-naming task consisting of five letters (d, s, a, p, o)
- ◆ Color-naming task consisting of five colors (blue, black, green, red and yellow)
- ◆ Object-naming task consisting of five objects similar to English RAN (ball, book, cup, dog, and the sun)
- ◆ Akshara-naming task consisted of five Telugu aksharas (బా – /ba/; సా – /na/ ;మ – /ma/; సా – /sa/; గా – /ga/)

This test was designed in the PsychoPy software, and all the readings were recorded in the software through the external microphone component. The total time taken to



Figure 1. Stimuli for RAN, illustrating five blocks: colors, digits, objects, alphabets and Aksharas.

complete each task was measured. In keeping with the standard procedure for testing, each test was administered twice and averaged to obtain the mean scores (Park 2012). Test-retest reliability ranged from .915 to .994 ( $p < .001$ ) and internal consistency scores (Cronbach's alpha) for each task ranged from .76 (Akshara naming) to .85 (digit naming).

## ANALYSIS

The independent-sample t-test was conducted to determine whether dyslexic and non-dyslexic group differ in RAN and PA respectively. Pearson's correlation coefficients were used to examine inter-correlation between the five RAN tasks and relationship between all the variables in the RAN and PA tasks.

## RESULTS

Table 1 illustrates the descriptive statistics of the groups on psychometrics. We found a significant group difference in the reading age and the spelling age with effect size, Cohen's  $d = 1.59$  and  $2.07$ , respectively.

Table 1. Descriptive Statistics of Psychometric Test: Mean, standard deviation,  $t$ ,  $p$ , and Cohen's  $d$ .

We observed a response-time difference on the RAN task on all the sub-tasks (see Table

<i>Parameters</i>	<b>Dyslexic <i>M (SD)</i></b>	<b>Non-dyslexic <i>M (SD)</i></b>	<b>T</b>	<b>P</b>	<b>Cohen's <i>d</i></b>
Chronological-age	12(1.3)	11.68(1.24)	.85	.39	.25
Reading-age	9.5(1.02)	11.68(1.64)	5.41	.001	1.59
Spelling-age	9.4 (.96)	11.68(1.20)	7.11	.001	2.07
ADHD.	16(1.2)	15.5(1.1)	1.47	.147	.43
IQ	102.8(1.03)	104.7(3.20)	2.75	.008	.79

*Statistical Significance at 0.05*

*Notes: ADHD – Attention deficit hyperactive disorder; IQ – Intelligence Quotient.*

2 for the descriptive statistics of RAN sub-tasks). There was a statistically significant difference between the overall response times of the dyslexic group ( $M = 53.29$ ,  $SD = 3.63$ ) and the non-dyslexic group ( $M = 44.63$ ,  $SD = 2.25$ ):  $M = 8.66$ , 95% CI [6.86, 10.45],  $t(44) = 9.72$ ,  $p < 0.05$ . As expected, the dyslexics were slower than their peer non-dyslexics on all the five naming tasks of RAN: color naming ( $p < 0.05$ , effect size = 3.77); alphabets ( $p < 0.05$ , effect size = 2.35); numbers ( $p < 0.05$ , effect size = 2.18); objects ( $p < 0.05$ , effect size = 3.44) and Akshara ( $p < 0.05$ , effects size = 2.6).

However, there was less statistical difference between the PA ability for the dyslexic group ( $M = 95.79$ ,  $SD = 2.49$ ) and the non-dyslexic group ( $M = 96.64$ ,  $SD = 2.06$ ):  $M = -0.85$ , 95% CI [-2.20, 0.50],  $t(44) = 1.26$ ,  $p = 0.21$ . The dyslexics performed similarly to the non-dyslexics on all the PA tasks: substitution ( $p > 0.05$ , effect size = .46); segmentation ( $p >$

0.05; effect size = .45); deletion ( $p > 0.05$ , effect size = .18); and non-word ( $p > 0.05$ , effect size = .15). See Table 2 for the detailed scores both RAN and PA tasks.

Table 2 Descriptive Statistics of RAN and PA: Mean, standard deviation, t, p and Cohen's d

**Inter-correlation among the five RAN task**

Parameters	Dyslexic M (SD)	Non-dyslexic M (SD)	T	P	Cohen's d
RAN-Color	64.08(3.2)	54.07(1.96)	12.75	.001	3.77
RAN-Alphabets	33.87(2.37)	29.39(1.28)	2.87	.006	2.35
RAN-Numbers	34.80(2.13)	30.47(1.82)	7.41	.001	2.18
RAN-Objects	64.79(2.7)	56.71(1.92)	11.69	.001	3.44
RAN-Akshara	68.94(7.79)	52.52(4.31)	8.84	.001	2.6
PA-substitution	96.32(1.52)	97.09(1.79)	1.53	.13	.46
PA- segmentation	93.90(6.1)	96(2.3)	1.54	.12	.45
PA- deletion	97.95(.65)	98.14(1.28)	0.59	.55	.18
Non-word	95(1.7)	95.36(2.9)	0.49	.62	.15

*Note: Statistical significance at 0.05*

Overall, RAN tasks were highly correlated. For children with dyslexia, the inter-correlation among RAN tasks ranged from .610 (alphabet naming with color naming,  $p < 0.05$ ) to .535 (alphabet naming with Akshara naming,  $p < 0.05$ ) and .443 (alphabet naming with Akshara naming,  $p < 0.05$ ) and .443 (alphabet naming with digit naming  $p < 0.05$ ). The strongest correlation was between the alphanumeric and non-alphanumeric tasks. Similarly, the inter-correlation among the RAN tasks for the non-dyslexic group ranged from .608 (alphabet naming with digit naming,  $p < 0.05$ ) to .418 (Akshara naming with digit naming,  $p < 0.05$ ) and .694 (Akshara naming with color naming,  $p < 0.05$ ). However, we observed only a moderate correlation between the PA tasks, with a

Table 3 Correlation between RAN and PA tasks of Dyslexic and Non-dyslexic group.

<i>Dyslexic</i>	Numbers	Objects	Alphabets	Aksharas	Substitution	Deletion	Segmentation	Non word
Color	.553*	.548*	.610*	.627*	.374	-.099	.020	.097
Numbers		.454*	.443*	.388	.293	.218	.061	.117
Objects			.392	.328	.397	-.294	.279	.103
Alphabets				.535*	.300	-.247	-.043	.013
Akshara					.380	-.157	-.136	-.126
Substitution						.159	-.044	.229
Deletion							.525*	.358
Segmentation								-.087
<i>Non-dyslexic</i>	Numbers	Objects	Alphabets	Aksharas	Substitution	Deletion	Segmentation	Non word
Color	.271	.425*	.169	.694*	.043	.219	.071	-.291
Numbers		.332	.608*	.418*	.052	-.105	-.007	-.287
Objects			.354	.654*	.068	-.206	-.295	-.189
Alphabets				.290	.156	.136	-.083	-.122
Akshara					.026	-.107	-.429*	-.480*
Substitution						.160	.364	-.079
Deletion							.397	.087
Segmentation								.223

Note: \*  $P < 0.05$

maximum significance level of 0.05 for both groups. For children with dyslexia, the inter-correlation among PA tasks ranged from .525 (deletion and segmentation,  $p < 0.05$ ) to .358 (deletion and nonword,  $p < 0.05$ ) to least correlation .229 (substitution and nonword,  $p > 0.05$ ) to .159 (substitution to deletion,  $p > 0.05$ ). Similarly, for non-dyslexics a correlation was observed ranging from .397 (deletion and segmentation,  $p > 0.05$ ) to .087 (deletion and nonword,  $p > 0.05$ ) and -.160 between (substitution and segmentation,  $p > 0.05$ ) to .364 (substitution and deletion,  $p > 0.05$ ). (See Table 3.)

## DISCUSSION

Numerous studies have shown that RAN and PA skills play a fundamental role in predicting current and later reading skills, and also in distinguishing proficient readers from poor readers in school-aged children (Bowers & Newby-Clark 2002, Wolf et al., 2000). Associations between RAN and PA reading scores have been documented in both alphabetic and logographic scripts (Leong et al., 2008; Ho & Lai 1999). However, there are not many studies on the performance on RAN and PA in transparent orthographies, especially with a multilingual background. Therefore, the present study investigated the potential differences in RAN and PA among multilingual Telugu native speakers with and without dyslexia.

Significant differences were observed in all the five RAN tasks between the groups. Despite the familiarity of items in the RAN tasks, dyslexics were slow in recalling and naming them, indicating a delayed processing. Differences in the speed of naming were also observed. The dyslexic group performance on the naming speed revealed this pattern: alphabet > digit > color > object > Akshara. For the non-dyslexic group, this was similar except the interchange of the Akshara and color positions, i.e., alphabet > digit > Akshara > color > object. The inter-correlation among the five RAN tasks was high, but within the group differences were observed. The dyslexic group showed a high correlation between alphanumeric tasks (alphabet and digit naming). Interestingly, the strongest effect sizes here were found for the non-literacy based tasks, with both color and object naming more significant than the other RAN tests. Moreover, performance for both groups was slower on these tasks, suggesting that these might be particularly useful in screening, even prior to school age.

However, we did not find a significant difference in the sub-tasks of PA between the groups. Additionally, we observed a weak inter-correlation within the PA tasks. Qualitative analysis of the PA tasks found that the accuracy differences were negligible between the groups, but found a difference in response times. This indicates an attenuated processing in the dyslexic group, which could be a cause for deficits in naming too. This result supports Ibrahim., 2015 and Chinta et al., 2017.

Although phoneme awareness deficits are considered as causal factors for reading deficits in dyslexia, we did not find a significant difference between the groups. We

consider this important difference between the groups on the PA as an advantage of reading transparent languages, where the phonological representation is syllabic (i.e., the unit grain size is a syllable, and the phonological consistency is transparent (one-to-one mapping between grapheme and its constituent phoneme). Another factor is the consequence of being multilingual, which improves their cognitive, and word-level skills as they get exposed to different languages and adapted to different speech sounds, thereby enhancing their PA ability. This study implies that response time or naming speed (RAN) in the area of reading ability is a useful diagnostic tool for learning difficulties. Based on these results, we claim that it is more of an attenuated processing speed across all the activities among the dyslexic group and these results are consistent with the earlier studies (Bialystok, 2001; Cho & Chiu, 2015 and Oren 1981).

In further research it would be useful to explore further the reasons for this lack of significance for PA in Telugu. For example, the novel aspect of an akshara representing both syllable and phoneme information, may lead to differing influences of phonological processing in this language. Alternatively, the teaching method of focusing on rote learning reported as the method used in schools here, may lead to less emphasis on phonological decoding. Finally, the nature of the phonological tasks created may identify less differences between the groups, and alternative tasks might have been more useful. An excellent way forward here would be to explore some of these skills in younger children.

Given the absence of standardized screening test for dyslexia in native languages or in the languages that the child gets the instructions in a multilingual discipline, we suggest that RAN is the best predictor for early diagnosis reading difficulties. Although PA is considered a golden standard for diagnosis, it was not effective for transparent languages with a bilingual and multilingual backgrounds.

We summarize the current study as follows: First, the performance of the dyslexic group in five RAN tasks was significantly lower than that of the non-dyslexic group. Second, the number of accurate responses in the nonword repetition test showed moderately negative correlation with the object naming and the color naming tasks, indicating relative closeness between the alphanumeric and non-alphanumeric processing. By contrast, the correlation for the dyslexic group was very low.

Notably, there were good negative correlations for the non-dyslexic group between the naming speed for the Akshara, and non-word repetition, indicating that the faster a control student completed this naming task, the more rapidly and accurately that student repeated the given non-word. This pattern was not present for the dyslexic group, suggesting that they did not benefit from the familiarity of the akshara in their performance, or the similarities to known akshara in the non-word repetition. By contrast, the dyslexic group show a positive correlation between deletion and segmentation, suggesting that performance on these tasks are similar, as would be expected as they

are both syllable based. The strongest correlations for the dyslexic group were found between the naming tasks, most highly between color naming, Aksharas, alphabets and numbers in descending order, reflecting similar slowness in naming these categories. Here their pattern of performance is similar to, but slower than non-dyslexics.

Interestingly, Abu- Rabia and Siegel (2002) conclude that ‘Phonological processing skills, as measured by pseudo-word reading, are highly correlated with word recognition skills in both English and Arabic. Disabled readers in Arabic show the same difficulties with phonological processing as do disabled readers in English.’ (page 675). In further studies it would be useful to consider non-word as well as word reading for this group. Nevertheless, this study implies that the parameters response time and naming speed are in themselves effective measures of reading ability. Analogous results have been found in other transparent languages, for instance, in German, Spanish, Chinese and Hungarian (Wimmer et al., 2000; Escribano & Katzir, 2008; Smythe, Everatt, & Salter, 2004). Interestingly, in the past RAN has been subsumed under phonological processing, and considered as either developing in conjunction with PA, or as a separate core deficit (Wolf and Bowers, 2000). Our results suggest that in an environment and language that does not favour the development and teaching of phonological awareness, processing speed overall may be more useful in early identification of dyslexia.

## CONCLUSION

This study concludes that RAN is a better predictor of reading difficulties than PA in children with dyslexia. Limitation of this study is that it included only the Telugu native speakers in the urban area, further research is needed to explore the RAN and PA deficits among rural schools, where Telugu is the medium of instruction, for generalising the results.

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## AUTHOR NOTE

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## APPENDIX : STIMULI USED FOR THE PA TEST

Substitution	Segmentation	Deletion	Non-word
1. ఈగ - ఉ	1. బాగుంది - బ+గ+ఉన్+ది	1. ఆకరు - ఆ	1. పట్టు - బప్పు
2. అల్లం - ఇ	2. అపాయం - అ+ప+య+ం	2. చంద్రిస్తు - చ	2. కళ్ళు - కచ్చి
3. ఆరు - య	3. నలుగు - న+లు+గు	3. మధ్యనం - మ	3. నల్లి - నబ్బి
4. డబ్బా - మ	4. ఉదయం - ఉ+ద+య+ం	4. కషాయం - షా	4. అతుకు - సతుకు
5. ఫలం - త	5. వస్తువు - వ+స+తు+వు	5. విషయం - వి	5. అద్దె - అప్పె
6. పాలు - చ	6. నేరము - న+ఇ+ర+ము	6. పొదున్న - పొ	6. భయం - సయం
7. బటణి - న	7. పచ్చని - ప+చ+ని	7. రుచిగా - చి	7. డబ్బు - వబ్బు
8. జేబు - క	8. మామిడి - మ+మి+డి	8. విమానం - వి	8. లాభం - లాకం
9. చేప - మ	9. సమయం - స+మ+యం	9. పల్లె - ప	9. అల్లం - చిల్లం
10. పకోడి - ట	10. యంత్రం - య+న్+త్ర+ం	10. టిక్కెట్టు - టి	10. పీచు - జీచు

## OUR AIM

The SES Preschool Programme aims to help pre-schoolers at risk of having dyslexia or developmental delay in early literacy, acquire skills and strategies to become confident achievers when they enter primary school.

## COMPONENTS COVERED IN A TYPICAL LESSON:

- Spelling
- Reading
- Phonograms
- Alphabet knowledge
- Sight words
- Social-emotional learning

## OUR APPROACH

Three key features of our approach:

1. Hands-on and multisensory activities: In teaching alphabet knowledge, phonograms and sight words.
2. Interactive and engaging lessons: When practicing skills and strategies in reading, spelling and writing.
3. Incorporation of Social-emotional Literacy (SEL) in sessions: To foster soft skills necessary for greater Primary 1 readiness.

## RECOMMENDED FOR

K1 and K2 children attending kindergarten, childcare centre and/or EIPIC programmes who have difficulties in learning to read, spell and/or write.

Preschoolers in our programme will be advised to go for a School Age Psychological Assessment when they turn 6. Children diagnosed with dyslexia have the option to continue with the Main Literacy Programme.

For more info, visit [www.das.org.sg](http://www.das.org.sg)

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## Exploring the effectiveness of the Family Literacy Programme with Singaporean preschool children at risk of literacy difficulties

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### Abstract

Early literacy lays the foundation for the acquisition of conventional literacy skills, with lack of adequate literacy skills profoundly impacting on later school success. Family Literacy Programmes (FLPs) are interventions that promote active participation among families to improve their child's literacy. This research explored whether an FLP impacts on the early literacy achievement on Singaporean preschool children identified at risk of literacy difficulties. Two research questions were investigated: (a) Does FLP increase the early literacy attainment for preschool children, at risk of developing literacy difficulties, attending an existing literacy intervention programme? and (b) What were parents' perceptions of the effectiveness of FLP following workshops on early literacy? Participants included 8 parents and 9 preschool children from 4 to 7 years old enrolled in the DAS Preschool Programme. Data sources for analysis included pre- and post-test scores before and after intervention, post-workshop questionnaires and interview data. The research concluded FLP did not significantly improve the early literacy achievement of this group of children, although there was clear evidence of the impact of the programme overall. However, this masked differences between improvement on concepts of print for the experimental group, but only the controls for letter identification, key factors in early progress. Moreover, parents had a positive perception of the effectiveness of FLP, which provided skills and knowledge for parents to teach and guide their child in home-based literacy activities. Future research could look into the content and design of FLP in order to train parents more effectively, and provide literacy knowledge, skills and instructional strategies. In-depth and research-based evidence should be implemented to evaluate the long-term effectiveness of FLP.

**Keywords:** early intervention, preschool, parents, family literacy programme

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## INTRODUCTION

Research has shown that the development of emergent literacy skills at preschool is related to the development of conventional literacy skills required for academic success in later school years (Lonigan et al., 2013). Children with inadequate emergent literacy demonstrated poorer academic achievements, compared to their peers with competent literacy skills (Dennis and Horn, 2011; Duncan et al., 2007). Consequently, early intervention has been widely advocated to reduce the literacy gap. The earlier the child receives the intervention, the lower the likelihood that the child develops severe reading difficulties (See and Koay, 2014). Moreover, family environment influences a child's literacy acquisition.

A number of factors, including family income, parental occupation and educational qualifications strongly predict a child's literacy attainment (Feinstein, Duckworth and Sabates, 2008). Parents from low-income families were less likely than middle-income families to engage in conversations and book reading routines to promote literacy skills (Hoff, 2006). Children from low SES acquired lower literacy skills and higher risk for future literacy difficulties (Heath et al., 2014; Baroody and Diamond, 2012). These children's literacy attainment tended to be poorer compared to their more advantaged peers. Family Literacy Programmes (FLPs) were designed to encourage literacy development at home, based on the theories of Vygotsky and Bronfenbrenner.

## LITERATURE REVIEW

Two well-established theories, Vygotsky's Sociocultural Theory (1978) and Bronfenbrenner's Bioecological System Theory (1977) underpin the Family Literacy Programme (FLP), a family intervention programme that promotes literacy to alleviate literacy difficulties.

Vygotsky's sociocultural theory (1978) described learning as a social process that is influenced by the interaction between people and sociocultural experiences. He proposed children developed language through interaction with a more knowledgeable other (MKO) that is any individual who has a better understanding or a higher ability than the child. Parent and child literacy interaction helped to scaffold and support their child's zone of proximal development (ZPD) which is the difference between what a child can accomplish alone, and what they can achieve with the support of a MKO (Shaffer, 2009). There are advantages of this theory. First, it is a child-centred approach where the child is an active participant in the learning process. Second, a MKO can scaffold, extend and enhance learning to increase their language and early literacy skills. Third, it recognised the importance of the child's environment. Differences in family environment such as parental education and household income have been found in a number of studies to contribute to a child's development of literacy skills (Heath et al., 2014; Baroody and Diamond, 2012).

Bronfenbrenner's bioecological theory (1994) also proposed that the environment, including genetics, affected an individual's development. It consisted of four components: Process-Person-Context-Time. The process referred to the interaction between the individual and his environment, the person referred to a child and his individual characteristics such as age, and the context and time. The context comprised of four systems: microsystem, mesosystem, exosystem and macrosystem. These consist of the following:

- ◆ **Microsystem:** Immediate institutions and individuals that the child interacts with. Examples include family and school. Proximal processes occur to produce and sustain development.
- ◆ **Mesosystem:** Interactions between the microsystem. Examples include neighbourhood, school, and religious or peer groups.
- ◆ **Exosystem:** The broader community the child lives in where the child rarely has direct interactions. Examples include educational system and government agencies.
- ◆ **Macrosystem:** The attitude and ideology of the culture such as the laws, cultures, economic system, public policies.

The time dimension highlights changes over time affecting both the individual and his environment. There were advantages of this theory. First, it recognised differences in the individual's characteristics may affect development. Genes may make individuals at risk of developing literacy difficulties (Kendler and Baker, 2007; Parachinni, Scerri and Monaco, 2007). Second, different systems interplayed to influence the child's development. Dearing and colleagues (2006) found increased family involvement predicted an increase in the child's literacy achievement, especially for children at risk. With high family involvement, children from low income and low maternal education are able to gain literacy achievement.

### **Contribution of family literacy as an intervention towards literacy gains**

Research has indicated that the Family Literacy Programmes (FLPs) are an effective intervention approach to promote active participation among families to improve their child's literacy development (Steensel et al., 2011). They create a literacy rich home environment that supports and manages literacy development.

A meta-analysis covering 16 FLP studies involving Kindergarteners and Grade 3 students reported parents who used specific literacy strategies made greater gains in reading achievement compared to parents whose involvement was limited to listening to their child reading (Senechal and Young, 2008). Furthermore, Sheridan et al., (2011) found

improvements in preschool children's language use, reading, and writing ability. Although both control and experimental groups made consistent gains during the first year of study, those in experimental groups continued to make gains during the school holiday period, arguably due to parents' continuous literacy engagement in the absence of a classroom. However, despite the positive contribution of FLP in literacy development, there are weaknesses in this field of research that must be considered here.

Brooks, Pahl, Pollard and Rees (2008) found there were few negative findings in a meta-analysis on sixteen FLP research studies conducted in the English language, predominantly from England, with non-English speaking countries; Malta, Turkey, and a Zulu-speaking area in South Africa, and bilingual program in Malta and Chicago, United States. However, this may indicate a potential bias in reporting positive findings because academic journals are less likely to accept negative findings. In addition, four studies using the gold standard in intervention research, randomised controlled trials, reported low significance for results on the effectiveness of FLP implemented in the United Kingdom and other countries. The four FLPs studied were Raising Early Achievement in Literacy (REAL), Dialogic Reading, the Even Start In-Depth Study, and Parent Empowerment through Family Literacy (PEFa) (Brooks et. al., 2008).

By contrast, Steensel et al., (2012) in a review of eight different meta-analyses on FLPs research from 2008 to 2010 concluded FLP contributed significantly to children's literacy skills. However, literacy gains ranged from large and negative scores to large and positive scores. Despite using well-designed research and meta-analyses on FLP, discrepancies in research findings could be due to challenges in methodology and implementing FLP.

The first challenge is based on participant retention as most FLPs comprised of families from low socioeconomic status whose family situation such as lack of caregiver, busy schedules and family commitments may limit their participation (McElvany and van Steensel, 2009). Second, the medium of instruction is usually English, which may not be a participant's first language. Language problems could have influenced the support rendered as it hampered the transfer of programme content from trainers to parents (McElvany and Steensel, 2009). Third, the amount of resources provided to participants was dependent on the type of literacy skills to be covered in FLP. An FLP that involved reading intervention required researchers to provide reading material and handouts about reading. It also involved researchers spending time to design the activities and program. These challenges would have to be taken into consideration when designing an FLP as it may affect the research findings.

Theoretically, deficits in phonological awareness and cerebellar processing contribute to dyslexia, leading to symptoms of difficulties in reading, writing and spelling (Fawcett and Nicolson, 2008; Spironelli, Penolazzi, and Angrilli, 2008). As phonological awareness is a core deficit observed in those at risk or diagnosed with dyslexia, most interventions

incorporate some of the principles: phonics-based, multi-sensory, cumulative and sequential learning and explicit teaching. It was found that preschool children in Singapore who were at risk of literacy difficulties made literacy gains when they received early intervention at DAS. The longer they were in the intervention programme, the greater the gain in literacy ability (Sim, Wong, Samsudin and Bunn, 2015). Interestingly, however, a study by Fong et al (2016) working with preschool children and parents in Singapore, found that parental support based on reading, spelling or flashcard support, seemed to have a negative impact on pre-schoolers' progress.

A limitation that Fong and colleagues (2016) noted for this study was that no training was given to the parents in how to provide support, and no attempts were made to measure the amount of involvement that parents had with their children's literacy. In order to improve a child's literacy development, an FLP could be introduced at the environmental/home level. FLPs were designed expressly to promote active literacy participation at home, with the goal of enhancing the child's literacy outcomes. The question arises, is support from parents who have received training via an FLP likely to prove more useful than untrained support?

### **Rationale**

The aim of the research was to explore the effectiveness of an FLP on the early literacy achievement of Singaporean preschool children identified to be at risk of literacy difficulties. It was hypothesised that the FLP would lead to improvement in five early literacy areas: letter identification, concepts about prints, word test, writing vocabulary, and hearing and recording sounds in words. Two research questions guide this study:

- ◆ Does an FLP increase the early literacy attainment for preschool children at risk of developing literacy difficulties attending an existing literacy intervention programme?
- ◆ What are parents' perceptions of the effectiveness of the FLP following workshops on the importance of early literacy?

### **Participants**

#### **Preschool Children**

9 Singaporean preschool children at risk of literacy difficulties participated in the study. They were enrolled in the DAS Preschool Programme. The control group consisted of 3 girls and 2 boys. The preschool children's ages range from 4 years 11 months to 6 years 5 months (mean age = 74.25 months). 4 were Chinese and 1 Indian ethnic race.

The combined family monthly income are as follow (see Figure 1), from which it may be seen that these are largely low income families in need of support.

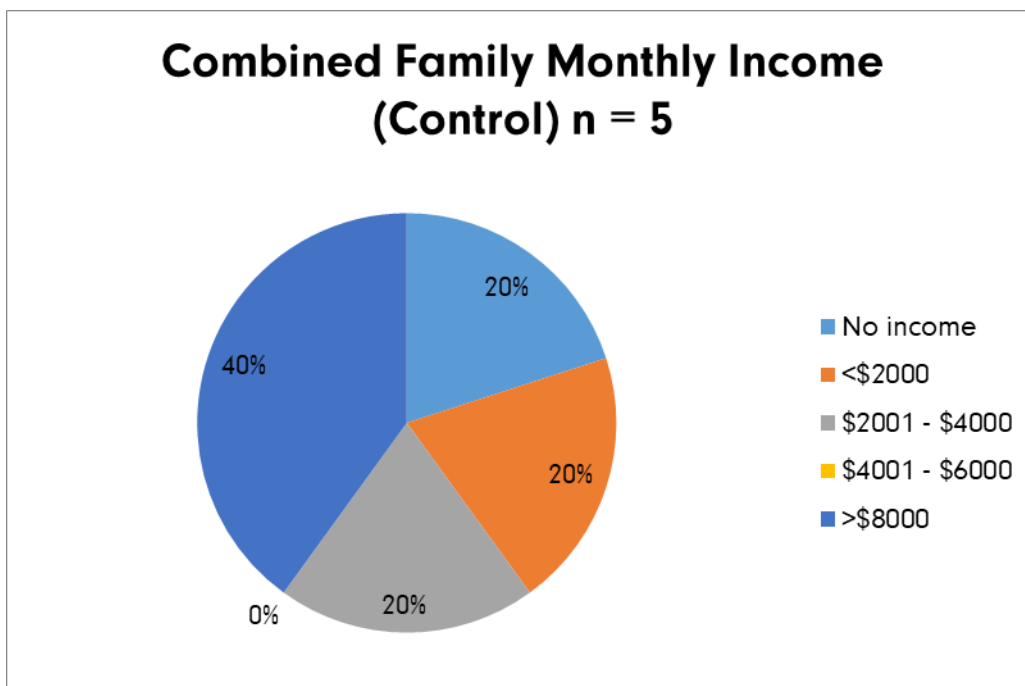


Figure 1: Combined family monthly income for control group n = 5.

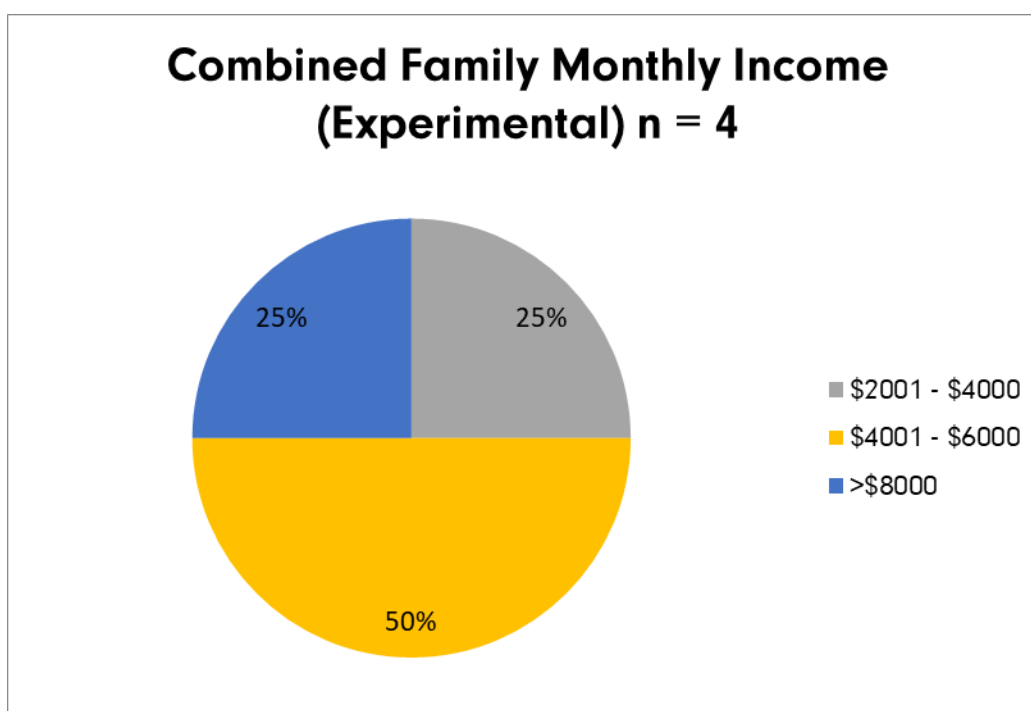


Figure 2: Combined family monthly income for experimental group n = 4.

The experimental group consisted of 4 boys. The children’s ages range from 5 years 3 months to 7 years 1 month (mean age = 71.6 months). 2 were Chinese, 1 Malay, and 1 Indian ethnic race. The combined family income are as follow (see Figure 2).

Parents

A total of 8 parents and guardians had consented to be part of the study. They were all female. Their age ranged from 31 to 50+. 1 of the parents had 2 children who were enrolled in DAS Preschool Programme. Parent’ highest educational qualification are as follow (Figure 3).

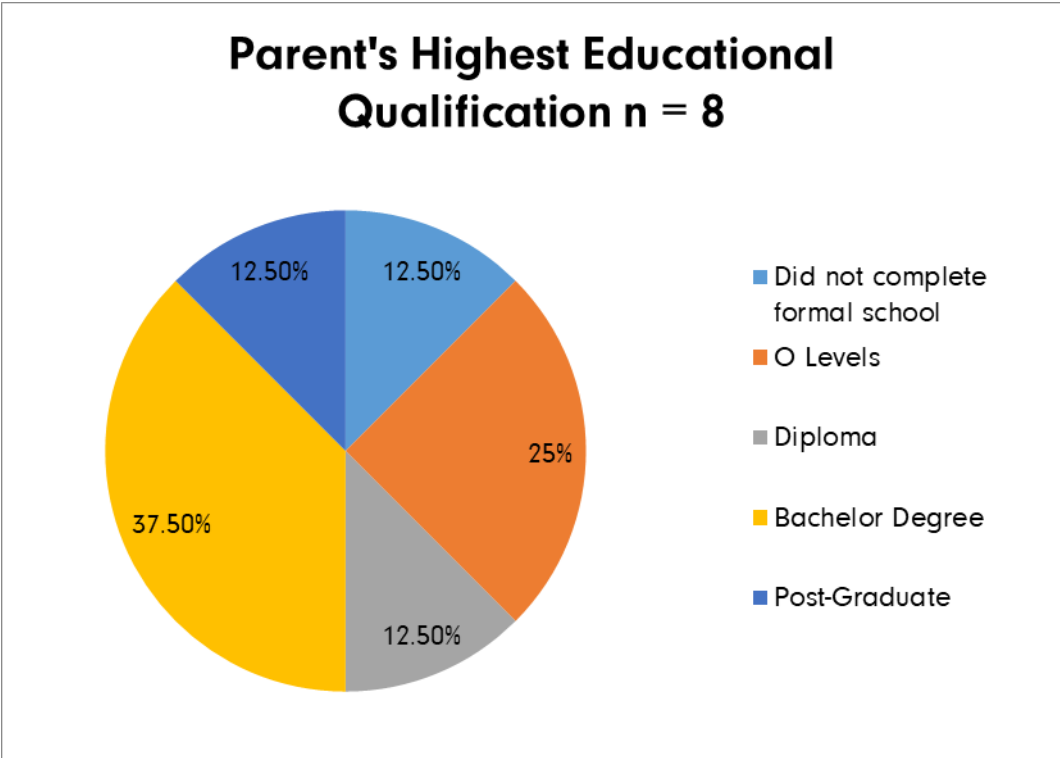


Figure 3: Parent’s highest educational qualification.

Design

Both qualitative and quantitative methods were used in for this study. A pre and post-test quasi-experimental research design, questionnaire and phone interview were used for this study.

## Measures

### Family SES

Parents filled in a questionnaire by checking in the respective boxes to provide details regarding their gender, age group, race, marital status, language spoken at home, highest educational qualifications and combined family monthly income.

### Log sheet

Each parent was given a log sheet to keep a record of the activities that were carried out at home, by recording dates and placing a tick on the respective column headings: recognising letters, recognising sight words, before, during and after reading strategies.

### The Observation Survey of Early Literacy Achievement

The Observation Survey of Early Literacy Achievement was administered to all pre-school participants (Clay, 2002). This was conducted by the researcher. This was consistent at both pre and post-test. It is a standardized assessment tool to assess early literacy skill in young children from 5 years to 7 years old by recording their early reading and writing behaviour (Clay, 2002). The assessment tool had a reliability of alpha coefficient .87; split half .89, and validity of correlations greater than .70 (D'Agostino, 2012). The 5 components used to measure the child's early literacy skills were: Letter identification, concepts about print, word test, writing vocabulary and hearing and recording sounds in words.

### Letter identification

Letter identification determined the letters the child knew and recognised. A list of uppercase and lowercase letters were printed on two individual A4 paper, using Comic Sans font 14pt. The child had to identify and call out the letters as the researcher pointed at each letter, working across the page, starting from left to right, in a non-alphabetical order. The uppercase letters, followed by the lowercase letters were shown to the child. If the child did not respond, the researcher prompted the child whether or not he knows the letter or the sound it makes. If the child does not respond to the first letter, the researcher pointed to the letters in the child's name and then goes back to the first line. A check is placed in the 'A' column for each correct letter response, a check in 'S' column for each correct sound response, and a check in 'I.R.' for each incorrect response. 1 point was awarded for each correct letter named.

### Concepts about print

Concepts about print determined what the preschool child knew about the way spoken language is represented in print. The skills and concepts assessed include knowledge of book orientation, the directional arrangement of print, tracking of sentences, words, and letters, roles, and understanding of punctuation. The book entitled 'Stones' by Marie Clay that was developed for the purpose of this assessment was presented to each child. The child was asked a total of 24 questions from the checklist. 1 point was awarded for each correct response.

**Word test**

The word test determined if the child was building up a personal library of reading vocabulary words. These words are the most frequent words found in the text. The researcher chose List B, out of the 3 lists provided by Marie Clay Observation Assessment. There were 15 words in each list. Starting at the top of the page, the child reads each word, one at a time, as the researcher pointed to the word. 1 point was awarded for each correct response. The same list was presented at pre and post test.

**Writing vocabulary**

Writing vocabulary determined if the preschool child was building a library of known words that can be written in print form. The child wrote down as many words as they could on the paper given. The test had to be completed in 10 minutes. The researcher prompted the child by suggesting categories such as colours, animals, names and sight words when the child displayed difficulties with word writing. Each completed word spelled correctly scored 1 point. Reversed letters were marked incorrect as they could represent a different letter. Words that are written from right to left are marked correct even those containing a combination of reversed letters and correctly oriented letters. Capital letters are accepted as substitutions for lowercase letters. The score generated here is open ended depending on the knowledge of the child.

**Hearing and recording sounds in words**

Hearing and recording sounds in words assesses phonemic awareness by determining how the preschool child represents sounds in print form. To assess hearing and recording sounds in words, 1 out of 5 alternative sentences was selected to use in this study. A child is awarded 1 point for every phoneme written correctly. A total score of 37 can be awarded. Capital letters were accepted substitutions for lowercase letters. To avoid a practice effect, an alternative sentence was used for the post-test.

**Post-Workshop questionnaire**

Parents from the experimental group filled in a questionnaire to provide feedback for the FLP at the end of the second workshop. Parent had to respond on a 5-point Likert scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Parents were also able to write down up to a maximum of three aspects of the content of the workshop that was most beneficial for them and other topics they would like to be included in future workshops.

**Parents' interview at the end of workshops**

Phone interviews were conducted six weeks after the FLP had ended. Questions focused on family literacy practices, parent's view of the FLP, and difficulties encountered while carrying out the activities with their child. The names of the participants have been changed.

## Procedure

### Recruitment of participants

Parents whose child were enrolled in the DAS Preschool Programme were invited to participate in the study. Only parents who were able to a) communicate in English as their first language, b) have access to internet or data connection, and c) possessed technological devices such as tablets, smartphones, and computers were recruited to ensure the successful administration of home literacy activities, and the ability to answer the online questionnaire. Parents were assured that their consent to participate or withdrawal from the research at any point of the study would not affect their child's intervention at the DAS Preschool Programme. Parents gave their informed consent and acknowledged each pair of children and parents was randomly assigned to control or experimental group. Parents were not made aware of their assigned condition.

### Family Literacy Programme intervention procedures

The Family Literacy Programme intervention comprised of two 2h workshops.

#### Workshop 1—Letter play

The workshop started with a discussion on the importance of recognising letters and sight words. Activities involving identifying upper and lowercase letters, and sight words from Dolch List 1 to 6 were introduced to parents for them to carry out the activities at home.

#### Workshop 2—The importance of book reading

The workshop started with a discussion on the importance of book reading to increase print knowledge, vocabulary and language skills, followed by a demonstration on RAZ-Kids, an online book library made available for all preschool children enrolled in DAS Preschool Programme. Before, during, and after reading, strategies were introduced to parents. Before reading: Point to the front and back of the book, discuss the illustration on the book cover, mention the author and illustrator and identify the title of the book.

During reading: Track the words in each line with the index finger, prompt (who, what, when, where, why and how) questions, prompt and encourage children to make predictions, ask questions to increase knowledge, vocabulary, and comprehension. After reading: encourage the child to associate the story with personal experience, ask how they felt after reading the book, what did they learn, discuss and retell the story, ask their favourite section of the book, and why. A pamphlet containing questions to ask during, before, and after reading was provided for parents to carry out at home.

## RESULTS

The results were collated and are reported in table 1.

Table 1. Table of mean scores for each child at pre and post test

Participants	Age	School Level	Letter Identification (Maximum Score 54)		Concepts about Prints (Maximum Score 24)		Word Test (Maximum Score: 15)		Writing Vocabulary		Hearing and Recording Sounds (Maximum Score: 37)	
			Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
E1	5	K1	51	49	4	8	0	0	0	0	0	5
E2	6	K2	53	53	10	16	13	13	9	16	27	28
E4	6	K2	50	52	12	16	5	8	2	8	15	16
E5	6	K2	52	52	10	11	6	11	10	11	20	17
Percentage			95.37%	95.37%	37.50%	53.13%	40.00%	53.33%	N.A.	N.A.	41.89%	44.59%
C1	5	K1	49	50	9	12	1	1	0	0	0	1
C2	6	K2	54	54	19	18	10	11	6	15	27	23
C3	6	K2	53	53	14	12	5	11	0	4	1	2
C4	6	K2	46	53	7	13	7	9	2	7	8	12
C5	6	K2	52	53	14	12	4	5	1	0	1	0
Percentage			94.07%	97.41%	52.50%	55.83%	36.00%	49.33%	N.A.	N.A.	20.00%	20.54%

A single factor between-subjects ANOVA was conducted on the difference between the scores for both pre-test and post-test to compare the effectiveness of FLP on the early literacy achievement on Singaporean preschool children identified at risk of literacy difficulties. The results for both groups for the pre and post tests were collated and a single factor ANOVA undertaken on the difference between the scores for both pre-test and post-test in order to establish whether there were any significant differences between the groups

Table 2. Table of mean improvement, statistics and effect sizes for experimental and control groups

Test	Group	N	Mean	sD	ANOVA	Cohen's d
Overall early literacy achievement	Experimental	4	10.25	4.99	$F(1,7) = 0.15$ , $p = .71$	0.59
	Control	5	8.2	9.68		
Concepts of prints	Experimental	4	3.75	2.06	$F(1,7) = 2.13$ , $p = .19$	1.64
	Control	5	0.8	3.56		
Hearing and recording sounds	Experimental	4	1	3.27	$F(1,7) = 0.15$ , $p = .71$	0.33
	Control	5	0.2	2.95		
Vocabulary	Experimental	4	3.5	3.51	$F(1,7) = 0.002$ , $p = .97$	0.04
	Control	5	3.4	4.03		
Word test	Experimental	4	2	2.83	$F(1,7) = 0$ , $p = 1$	0
	Control	5	2	2.35		
Letter identification	Experimental	4	0	1.63	$F(1,7) = 1.18$ , $p = .31$	-1.12
	Control	5	1.8	2.95		

There was no statistically significant effect of FLP on early literacy achievement,  $F(1,7) = 0.15$ ,  $p = .71$ . Neither were there any significant results for any of the experimental tasks. The result suggested that FLP did not lead to an improvement in early literacy

achievement for preschool children identified as at risk of literacy difficulties and currently receiving literacy intervention programme.

The small number of participants in each group means that the intervention would need to be very effective in order to make a significant difference in this study. An effect size analysis was therefore undertaken in order to check for the impact of the intervention on the experimental group. An effect size of 0 means that the two groups are the same. An effect size of + or - 1 means that the intervention group is around 1 standard deviation better/worse than the control group. In terms of the statistical significance of effects sizes, 0.20 is considered low, 0.50 is moderate and 0.80 is high (Cohen 1967). If the group used is small with little variability within it, effect sizes will be artificially larger, because the standard deviation – the number used for division - will be smaller. Nevertheless, this approach can provide useful information where results are not significant overall, including identifying which aspect of the intervention has been most successful.

### **Parents' feedback after attending FLP**

All parents had positive feedback after attending the FLP. From the parents' interview at the end of the workshop, it was noted that the hand-outs, materials, discussion and hands on activities helped parents in their understanding. They agreed they were confident in carrying out home-based literacy activities after attending the FLP. All parents agreed they were confident in carrying out before, during, and after reading strategies. The content covered in the workshops were also useful to them.

### **Parents' perception of the effectiveness of FLP**

Three themes were identified through the qualitative data analysis. The three themes were: awareness, knowledge and social support.

#### **Awareness**

Overall, parents who received the FLP had positive feedback on the FLP. They agreed they were confident in carrying out home-based literacy activities. During the workshops, tips and strategies were shared with them. One parent, P1 commented the "strategies were useful and I could apply them at home" and another P2 commented, "teach children how to play with letters and reading". Another parent, P3 commented, "the material given are useful". Parents had a better awareness of how to support their child by applying strategies and using the resources to help support their children.

#### **Knowledge**

Swain et al., (2014) found through FLP, parents gained the knowledge of how to interact and converse with their child. One parent, P1 commented "the workshop provided the knowledge how a child progresses from reading and spelling simple word pattern. It managed her expectations towards her child's literacy". She also mentioned "the list of

sight words acted as a guide and she was able to chart the child's progress in recognising sight words." The activities that she carried out become more purposeful as she "wanted the child to read independently". She was more aware of the intention of carrying out a particular activity.

All parents recommended a repeat of the workshops to other parents because the "workshop can help parents to teach and guide their children", and "increase their awareness of what they can do to help their child improve". One parent suggested to get parents to "share some of their problems at the start or end of the workshops so the workshop can be focused on tackling the issues faced by pointing the parents to the right direction to start the programme depending on child's level and abilities". Another wanted a workshop that focused on behavioural management to "manage their child's behaviour towards and during learning, as he tend to be uncooperative and forgetful".

### **Social support**

During the workshops, it was observed parents shared the difficulties they had encountered with their child and the strategies they had adopted to manage their child's literacy or behavioural issues. It has been noted in other studies that parents learned from and supported each other during the FLP sessions (Swain et al., 2014). Anderson and Morrison (2007) suggested that although parents recognised the role of the teacher in helping to develop their understanding of concepts, parents also learned from each other. It highlighted the importance of providing social support so parents were aware they are not the only ones encountering difficulties in supporting their child in literacy activities.

Three other parents also requested future workshops to include topics on managing a child's behaviour towards learning. During the workshop, one parent, P1 complained that the application of some reading strategies, such as independent reading, would not work for her because her child preferred to have an adult reading to him. Another explained her child would look at the pictures but not the text. Due to the small group setting of the workshops, and the environment created by researcher and parents' participation, parents raised important issues that could influence the effectiveness of applying strategies with their child (Anderson and Morrison, 2007).

## **DISCUSSION**

This exploratory study sought to examine the impact of the FLP on children's progress in literacy, as well as solicit parents views on the usefulness of the approach. It is interesting to note that there are large differences between individual children and between individual tests on the level of proficiency at pre-test. The pre-tests themselves seem to be set at an appropriate level for this age group, with pre-test scores for the experimental group ranging from 37.5% correct, to 95.3% correct. It was notable that the 5 year old children were much more variable in their performance. Overall, the

experimental and control group were well matched, although there were clear differences in hearing and recording sounds, based on scores of 0 or 1 for 2 of the control children.

Even though the findings did not reach statistical significance, these findings had practical value. It seems likely that the small sample size made it difficult to differentiate the two groups on the basis of their progress in literacy. Moreover, individual differences in how children approach literacy at this early age, would be enough to ensure that no significant results would be found. However, it may be seen from table 2 above that overall, the FLP intervention had a moderate effect size on early literacy achievement, suggesting that these results could well have been significant if a larger sample size had been employed. Interestingly, there are extreme differences in the impact of the intervention of different subskills, ranging from very large to non-existent to negative. So, the largest impact is on concepts of print, there is a small effect on hearing and recording sounds, but no effect at all on either vocabulary or the word test and a negative effect on letter recognition, with the controls showing better results. This is because the experimental group showed exactly the same score at pre and post-test (51.5 out of a possible 54), whereas one of the controls had made substantial improvement. These results to some extent reflect the relative difficulty of the tasks, with the word reading and writing vocabulary amongst the hardest. Concept of print is the earliest level in literacy, simply recognising the orientation of a book, and the concept of beginning and end in telling a story.

Interestingly, however, a number of important themes emerged from the questionnaire and interviews with the parents, relating to awareness, knowledge and social support. In the area of specific learning difficulties, these findings could influence the way professionals manage the partnership between Singaporean preschool children and their parents, for those children identified as at risk of learning difficulties.

## IMPLICATIONS OF THE STUDY

First, contrary to earlier research findings that FLP led to literacy improvements (Sheridan et al., 2011; Senechal and Young, 2008), FLP did not lead to improvements in early literacy in this study of Singaporean preschool children at risk of literacy difficulties. This could be attributed to the small sample size. In Senechal and Young's (2008) research, they covered a bigger sample and wider age range, as opposed to a small group of participants in the current research. Second, the duration of FLP intervention was too short as it was only six weeks long. Third, the pre-schoolers here have been identified at risk of literacy difficulties, thus, they required extensive or explicit remediation.

Phonological awareness was one of the core deficits presenting in those at risk of literacy difficulties. Nicolson and Fawcett (2006) found almost all children with dyslexia displayed impairments in phonological awareness, and that children with phonological impairments at five years old will continue to develop difficulties in reading and spelling. As a result, effective intervention should incorporate the following principles: highly-structured and

phonics-based, multi-sensory, explicit teaching, sequential and cumulative learning, with overlearning to achieve automaticity (Reid, 2009). These preschool children were identified to be at risk of literacy difficulties, hence they respond better when teaching and learning adopt these principles. The Orton-Gillingham (OG) approach is a multi-sensory, systematic, sequential and cumulative phonological-based intervention that is used in Singapore. Educational therapists trained in the OG approach use explicit instructions to teach phonological awareness, letter-sound knowledge and other literacy skills. Lim and Oei, (2015) found Singaporean students with dyslexia between the ages of 6 to 15 years old demonstrated improvements in reading and spelling. More useful in this context however, are the findings by Fong, Lim, Alam and Lim, (2016) that found home support did not lead to literacy development in a sample of children and parents in Singapore receiving support at the DAS. By contrast, children in Fong et al's study whose parents provided support made less progress than those who did not. Parents of these children could have their own anxieties that created a negative learning environment based on frustration and angers, thus, the way home support was measured might have different effects on a preschooler's literacy development. In addition, the parents of these preschoolers may have similar literacy difficulties, hence, they may be limited in their provision of support, thus creating a reverse in their child's literacy development (Fong, Lim, Alam and Lim, 2016). This is reflected in the current study by some of the parents who reported difficulty with behavioural issues while undertaking the FLP with their children.

It seems that even the addition of training for parents, as provided by the FLP in the current study was not sufficient to improve literacy outcomes. Nevertheless, it is interesting to note that there is no evidence here for children deteriorating following parental support, unlike the earlier study by Fong et al., with a similar group of children in Singapore. This suggests that there have been subtle positive effects that may be difficult to measure on this group of children in this study.

Using the OG method on individuals with dyslexia or at risk of dyslexia leads to significant improvements in word attack, decoding, reading and spelling (Ritchey and Goeke, 2006). This pattern has also been found in Singapore following intervention at the DAS (Lim and Oie, 2015; Sim et al., 2015). However, implementing interventions based on the principles requires training, and the programmes can be used only by trained individuals (Reid, 2009). This finding implied that as the parent participants in the experimental group were not trained in the knowledge of the OG principles, only in the benefits of literacy support, it could even have hampered the teaching and learning process, and thus was not reflected in the improvement of overall early literacy skills measurement. This finding highlighted the need to look into how to support parents of preschool children with literacy difficulties more effectively. We need to consider whether teaching parents the principles or basic theoretical knowledge of teaching and learning are more effective than conventional participation in workshops.

However, parents had a positive perception of the effectiveness of the FLP. One parent commented it “provided the knowledge” and “materials provided aided in her supporting her child’s literacy”. Parent participation in the experimental group also gave positive feedback about the workshops. Overall, they would recommend the FLP to other parents because it empowered them to “teach and guide their children” and “increase their awareness of what they can do to help their child improve [their literacy skills]”. Even though FLP did not lead to improvement in overall early literacy achievement, parents viewed the FLP as beneficial for them. They gained knowledge, skills and confidence that would help them interact effectively and improve their child’s literacy development (Timmons and Pelletier, 2015). This finding reinforced the fact that parents do want and need to play an active role in their child’s literacy progress. Parents learn best when experiences are meaningful to them (Patel, Corter and Pelletier, 2008). This finding highlighted that educators or FLP developers need to solicit parents’ opinions and needs on the topics of interest with which they needed support, when designing the content of FLP. The FLP can not only meet the parents’ objectives for attending the intervention programme but provide them with the theoretical and practical knowledge to apply in their daily interactions with their child.

Finally, managing a child’s behaviour was a common theme raised while conducting the workshops and was indicated in the questionnaire conducted at the end of the workshop. During the workshop, parents exchanged tips on how they manage to overcome their child’s behaviour while carrying out home-based literacy activities. This finding implied that parents encountered behavioural challenges that could possibly hinder the success of carrying out literacy activities. The results highlight that FLP developers would need to equip parents with a variety of instructional techniques such as effective rewards and praises, to support their child’s literacy development (Terlitsky and Wilkins, 2015). When the child responded positively to their parents during literacy activities, parents experienced more positive interactions with their child (Robinson, 2012). These reciprocal effects fuelled both parent and child’s motivation to engage in home-based literacy activities that contribute to their literacy skills development. In exchange, parents become more engaged in their child’s learning and development. It is important to look into the development of the content of FLP, and to consider teaching both literacy activities and instructional techniques as part of FLP to empower parents.

Hence, the future FLP could be improved by looking into the content that covered theoretical and practical knowledge of literacy development, catering to parents’ needs and topics of interest, and providing instructional techniques to manage challenging behaviour.

## RECOMMENDATIONS

There is a need to provide well-informed training and support for parents. Crosby et al., (2015) proposed teachers and professionals need to help parents learn the necessary

skills should they want parents to carry out literacy activities with their child. In addition, ongoing support must be rendered in their work with their child. Second, teachers and professionals need to look into the topics of interest that will engage parents in FLP participation. Parents want to help their child in literacy development. Hence, there is a need to use evidence-based methods that have been proven to be effective. This was one of the principles proposed by Rasinski, Padak and Fawcett (2009) that promoted effective parental participation in FLP. When parents and children are able to experience positive interaction while implementing home-based literacy activities, parents become more engaged. Both positive outcomes create a cyclical effect that promotes literacy development.

## LIMITATIONS

There were three limitations of this present research. The first limitation was the small sample size of parental and child participation. Due to the small sample size, there was no even distribution of demographic representation of the sample group in both experimental and control group in proportion to the population. It is worth exploring the possibility of conducting research by recruiting participants from different demographics to ensure the representativeness of the sample in DAS Preschool Intervention Programme. Second, there was subject inclusion where only parents who used English as their first language could participate in the research. Singapore is a multi-racial society where bilingualism is practiced. Thus, English proficiency varies among different families. According to the Department of Singapore Statistics (2016), only 23% of the population aged 5 years old and above used English as their first language. 77% of the population used their mother tongue language that includes; Mandarin, Chinese Dialects, Malay, Tamils and others as their first language at home. Bearing in mind there is a large presence of families with English as a second language, these families could benefit from the FLP. Third, more controlled variables for both experimental and control groups could be put in place. These could include the number of weeks the preschool child has been receiving literacy intervention at DAS Preschool Intervention Programme, the other literacy interventions the child receives outside of DAS, and the amount of time spent on literacy activities at home. This would help to control for external factors that could affect the validity of the study.

## FUTURE DIRECTIONS

To conclude, the study seems to suggest that FLP is not effective on the overall early literacy achievement of Singaporean preschool children identified at risk of literacy difficulties. There is some evidence that concepts of print improved for the experimental group, based on a strong effect size, but any improvement in letter recognition was lower for the experimental than the control group. However, the FLP has reversed the negative impact found in earlier research (Fong et al., 2015), when parental support seemed to hinder rather than help children to progress. Moreover, parent participants had a

positive perception of FLP and would recommend it to other parents as it gave them the knowledge and skills to support their child's literacy development. Even though there was no significant improvement in overall early literacy achievement, effective FLP could still be an approach to improve a child's literacy. Parents play an important role in their child's acquisition of early literacy skills. As discussed, there are limitations to the present study. This study can be replicated with greater consideration for larger sample size, involving families from English as a second language background, ensuring an even distribution of demographic representation for both experimental and control group in proportion to the population in DAS Preschool Intervention programme, and more controlled variables to extend the reliability and validity of the research findings. For future research, it is important to look into the content of FLP that emphasise the importance of providing parents with training in literacy development, as well as in instructional strategies and how it impacts early literacy skills development (Capentieri, Fairfax-Cholmeley, Lister and Vorhaus, 2011). Researchers could also consider conducting follow-up interviews every three months, to understand the ongoing changes in parents' perception and practices of FLP. More in-depth and evidence-based research should be implemented over time and evaluated in order to evaluate the long-term effectiveness of FLP.

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## Robots and children learning differently: A brief review of robot applications for young children

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### Abstract

*With technological advancements, children today may learn in ways that can be radically different from how their parents did. Considering the learning differences, the purpose of this review is to explore robot use for its potential benefits in educating today's children who need to be learning differently from the generation before. As children are growing up in an increasingly tech-savvy world, this review would serve to raise the awareness of robot applications developed for young children, so that more people can be sensitized to the adoption of robots for early childhood education. The studies and reports included in this review are a selection of robot applications used with children in the general population of early childhood (0 - 8) years. Based on collaborative efforts in function and design such as the use of puppetry, as well as curriculum design in areas such as behaviour modification, social or motor skills, numeracy, language and literacy through storytelling and/or games, the robot applications reviewed here have been found to present with great potential for a dynamic way to educate the young. Implications for use with children with special needs are discussed.*

**Keywords:** Robot applications, young children, learning differently, general population.

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## INTRODUCTION

Many children today will likely grow up into a world that is radically different from what their parents know and may be in professions that have not even been heard of yet. The idea that traditional professions can be potentially transformed due to the use of robots has lately been highlighted for many people. It is truly amazing how the roles of robots have evolved from traditionally carrying out mundane heavy duty or hazardous work in factories such as those in the automobile industry, to interactive service roles such as those in the education, hospitality and service sectors and even in the home of the man on the street. Driving such changes could be the shift in consumer preferences in an increasingly digital world. According to a recent Forrester Report (see Vitec Inc., 2016), only 28 percent of U.S. online consumers "prefer to contact companies via telephone or e-mail rather than using a company's website to get answers to their questions". As younger generations form the greater part of this market segment, they are likely to drive up the proportion of people who would prefer not to interact with humans for support (Vitec Inc., 2016), but to deal with a computer.

Due to the similarities between the two, virtual agents may be perceived by many as robots; hence, it is necessary to start with a technical distinction between them. According to Looije, van der Zalm, Beun, and Neerincx, (2012), a virtual agent is not a robot but an animated virtual character (usually with anthropomorphic appearance) with artificial intelligence that is generated by a computer. The authors pointed out that embodiment is the key difference between a virtual agent and a robot. The similarity, on the other hand, as pointed out by Vitec Inc. (2016) is that both are embedded in a program with predefined scripts and responses. They can be powered by a knowledge base, which contains a wide-ranging list of possible different questions, answers and gestures, allowing them to respond to human input in a somewhat human way.

Reportedly (see Coninx et al., 2016), robots not only have the core advantage over virtual agents in terms of real world interaction and manipulation (Stiehl et al., 2009; Shibata, 2011), but the physical robot is also more appealing to user perceptions (Komatsu & Abe, 2008; Wainer, Feil-Seifer, Shell, & Mataric, 2007). There is also the unconscious effect of the presence of a physical robot, as studies such as the one by Looije, van der Zalm, Beun, and Neerincx (2012) showed that the frequency and length of gaze of fifth grade children is greater for a real robot than a virtual form of the same robot. Coninx et al., (2016) also reported that when using real robots, the benefit to performance or other outcome is shown in a number of contexts: learning (Bartneck, 2003; D. Leyzberg, Spaulding, Toneva, & Scassellati, 2012), motor skills (Kose-Bagci, Ferrari, Dautenhahn, Syrdal, & Nehaniv, 2009), and long-term behaviour change (Kidd & Breazeal, 2008).

With the advantage of embodiment over virtual agents to suit the context, the use of robots with young children is explored here for its potential benefits in educating today's children who need to be learning differently from the generation before. As children are

growing up in an increasingly tech-savvy world, this review would serve to raise the awareness of robot applications developed for young children, so that more people can be sensitized to the possibilities of adoption of robots for early childhood education. The review of studies and reports here is a selection of those applications used for children in the general population of the early childhood (0 - 8) years. The features of the review besides this brief introduction to robots are the type of robot used in the study and the context of use. The review concludes with a discussion on the implications and limitations found in the studies, as well as the implications for us with children with special needs. A quick overview of the robots discussed here and the research on which the findings are based is tabulated in Appendix 1.

## LITERATURE REVIEW

### Robots as programmable toys

Children learn through play, especially in preschool. Starting with simple robots that young children are familiar with, such as a toy car robot which can be programmed to move in various directions, forwards or backwards, left or right, etc., children can be taught the skills and language of giving directions to a robot. Problem-based learning (PBL) can be woven into the task. This involves problem-solving using executive function skills in planning the steps to take, such as getting to a specific location on a map. Language, literacy, numeracy or other subjects to be taught can be incorporated into the PBL curriculum.

To illustrate, an objective of a lesson may be to program the robot to travel to a spot on a map that has a corresponding alphabet for a letter sound, or a number that is the symbol for a given quantity. The children would therefore need to first find the answer to the question and then identify the number parameters on the map that has it. Then, they can be taught the skills in programming the robot to travel a number of squares in a prescribed direction on the map to the correct location. These ideas are not entirely new, and date back to the seminal work of Seymour Papert, who devised the Turtle, a small robot directed by young children using a simple computer language Logo in the 1970's (Stager, 2016). Clearly, the technical specifications of the current robots have benefitted from an explosion in the capabilities for interaction and application.

Robots such as the Bee-Bots and Pro-bots (from TTS Group Ltd, UK), the KIBO (from KinderLab Robotics, USA) and the KIWI robotics kits (from Tufts University, USA) are examples of programmable robots used in studies on preschool-aged children. In a study by Highfield (2010), Bee-Bots and Pro-bots were used as a catalyst for mathematical problem solving in an Australian classroom. Eleven of the children were aged 3 and 4 years and they were from a metropolitan pre-school. The brightly coloured Bee-Bot on wheels is apparently appealing to little hands and the plastic covering works well for easy cleaning in child care hygiene.

More recently here in Singapore, Play@TP, an experimental kindergarten in Temasek Polytechnic used the KIBO robotics kit as a tool for 35 of its preschoolers to acquire specific learning goals such as using programming skills to solve problems, as well as to tinker with technology (see Ng, 2015). Initially, the children made Chinese New Year cards with LED stickers and copper strips, and connected electrical circuits to power light bulbs and mini fans, to familiarize themselves with the potential of technology in play. In the study, the children created a sequence of instructions by scanning the wooden KIBO blocks to tell the robot what to do as it travels on its wheels, using buttons or an iPad program. This pilot study found that the children's concentration and perseverance in the face of difficult tasks improved with the use of this tool, and their co-operation in problem solving increased. For the KIWI robotics kit, a study on preschool children in the USA was done by Sullivan and Bers, (2016). The robot was also used like a vehicle as it has wheels. The children in the study successfully programmed their robots to go from point A to point B using number parameters on a map. The novelty of some programmable robots such as these is that they can do even fancier moves like dancing, spinning or producing flashing lights, sounds and music.

Learning how to pre-programme a robot to perform tasks autonomously has its advantages over using a remote control to manipulate a robot's actions and movements which is more commonly known. Although a robot response can be elicited more spontaneously with a joy stick or a button control, this may result in unwanted human error or impulsive moves. Such issues can be avoided with careful pre-planning of an autonomous sequence of actions in relation to the environment. While the joystick cannot be shared and children may squabble over who gets the control, programming provides the platform for them to make shared decisions and for the work to be divided into different focal areas to start with, thus curriculum time can be better optimized. Besides, teaching such programming language uses the executive function skills of problem-solving in sequencing, estimating and planning which have been identified as a key factor in successful early learning.

Programming toy robots can thus be a novel way of helping children understand the elementary workings of industrial robots such as the autonomous forklift used in the logistics sector, and other autonomous or self-driving vehicles adapted for use on land, and even air and sea as well. Consequently, children are given early exposure to STEM (Science, Technology, Engineering and Mathematics) education through the use of such robots in their curriculum. This would make them potentially more able to contribute to the development of robotic solutions to overcome constraints in resources in our world.

Robots as teachers

The drive for the research and development of robots has resulted in increasingly more complex robots being developed, so robots do not just perform laborious physical tasks but can become socially interactive as well. Such robots may take on human-like forms, so that young children are less likely to be afraid to interact with them. Robots that take

on human-like forms are known as humanoid robots. The use of remote control with robots can be very helpful when the robot is used to take the role of a teacher. In this role, the robot can be much bigger than a toy bee or car; hence the risk of damage caused by child mishandling is reduced. The other plus factor is that the control of the robot is in the hands of the human teacher instead of the student.

With remote control, humanoid robots can be used as a tele-presence tool to deliver lessons from a remote location, thus becoming like an avatar for the teacher. These robots have more complex abilities than the toy robots designed to be manipulated by children. To alleviate the workload of teachers, additional robot functions have been developed for robots to present learning materials, and even carry out administrative, entertainment, and/or social roles. The EngKey English teacher 'robot' from the Korean Institute of Science and Technology (KIST), South Korea is one such an example. This robot functions as a tele-presence tool that brings English teachers located in the Philippines to the schools in South Korea (see Grzybowski, 2013). Besides its popularity with the children, EngKey has also helped to address the shortage of qualified native-English speaking teachers in South Korea.

### **Humanoid social robots**

Humanoid Social Robots (HSRs) have also been developed to function autonomously. One of the earliest autonomous HSRs used experimentally with children in early childhood is Infanoid (from the National Institute of Information and Communications Technology, Japan), which had worked with a sample of children averaging 5 years old (see Kozima, Nakagawa, and Yano, 2005). This robot is an upper-torso humanoid robot as big as a 3- to 4-year-old human child. Each of its two hands has four fingers and a thumb, just like a real child, for a variety of functions such as pointing, grasping, and other hand gestures. It is also capable of producing various facial expressions, like surprise and anger with its lips and eyebrows. Hence, Kozima et al (2005) pointed out that with Infanoid, children could progress from perceiving the robot as just a mindless moving thing, to realizing that it can operate not only as an autonomous system, but as one that initiates motion based on the attention and emotion it possesses.

Following Infanoid, Robovie (see Kanda, Nishio, Ishiguro, and Hagita, 2009), another HSR, capable of human-like expressions was also used experimentally with a large sample of young children (this time aged 6-7 years old; including 59 boys and 60 girls). Robovie (from ATR Intelligent Robotics and Communication Laboratories, Japan) is an upgrade from Infanoid as it has a much larger repertoire of expressions, consisting of 100 different behaviours (70 interactive, 20 idling and 10 moving) to engage children in daily communications. On top of this, Robovie also has the additional function of recognizing individuals using ID equipment. Reportedly, the children enjoyed interacting with the robot, and some even expressed sympathy for it. Kanda et al., (2009) highlighted that it was one of the first studies that provided evidence of children rapidly adapting to an

interactive humanoid robot and developing relationships with it. The humanoid robot has also been improved to look more life-like, such as the Hanson Robokit Zeno R50 (from University of Sheffield, UK). Compared to Infanoid and Robovie, Hanson which has a realistic silicon rubber ("flubber") face that can be reconfigured is not only more life-like as a peer, but is also more toy-like as a smaller HSR that can be placed on a table. Children were engaged in collaborative play in the game of "Simon Says" and facilitating helping behaviors towards robots in the experiments with this robot (see Cameron, Collins, et al., 2015; Cameron, Fernando, et al., 2015).

Another small HSR that functions more like a peer is NAO (from Aldebaran Robotics, France). It has also been used experimentally with young children, playing various roles in projects around the world. In one study under the ALIZ-E project, NAO was used for engaging children in a quiz game, an imitation game and a dance game. This robot was able to initiate, participate, and collaborate in the interactions (see Belpaeme et al., 2012). In another study under the ALIZ-E project, NAO's role was to act as a peer for a diabetes-related education through play programme in a hospital environment (see Coninx et al., 2016). Apart from the ALIZ-E projects, NAO was also used in the L2TOR project as an early childhood second language tutor (see Belpaeme et al., 2015). Nao is so versatile that it was even used as a dance robot tutor in the context of creative dance as well (see Ros & Demiris, 2013).

Nao has also been used as a teacher-assistant in other studies under the KindSAR project (see Fridin, 2014), where it performed tasks such as assisting teachers by engaging children in educational games and by telling pre-recorded stories to small groups of children while incorporating song and motor activities in the process. In another KindSAR project as a teacher-assistant, Nao was used to collect data on children's development over time with respect to their performance of specific tasks and responses to specific situations (see Keren and Fridin, 2014). More recently, Nao has even been put to work with another larger humanoid robot called Pepper (from Aldebaran Softbank Robotics, France). Pepper, with an embodiment like C-3PO from the Star Wars movies, was used with NAO for experimentation on collaborative play and interactive storytelling in a preschool project in Singapore (Info-communications Media Development Authority, 2017).

Using the learning-by-teaching paradigm, Nao has also played the role of a facilitator to encourage collaboration among young children. Harkening back to the days of Infanoid, only the upper-torso of NAO was used in this study, as it provided more stability for NAO to be placed on a table top in an attempt to showcase the versatility of its use (see Chandra et al., 2015). Young children with handwriting difficulties had also benefitted from the use of NAO as a learner in "Learning by Teaching a Robot: The Case of Handwriting". This study was also based on the learning-by-teaching pedagogy, for the learning of the psycho-motor skill of handwriting (see Lemaignan et al., 2016).

### **Autonomous social robots as child-minders**

Autonomous social robots have also been featured in reports for their role in child-minding and preventing child-care accidents. One such model is the hybrid humanoid H3 robot from Advanced Industrial Science and Technology, Japan (see Simo, Nishida, and Nagashima, 2006). This robot is a hybrid because the robot's autonomous control can be superseded remotely with a combined fish eye camera and the parent's voice (via robot speakers) - used on the basis that it would be more familiar and appeal to the child better. In this way, it can be tweaked to overcome the limitation of the child ignoring the robot's articulated words during the experimentation of interactive storytelling.

For the very young, a small (11 inches tall) yellow snowman-shaped tabletop robot called Keepon (pronounced, "key-pong") has been experimented with 0-year-olds (from 6 months of age), 1-year-olds, and over-2-year-olds. Keepon (from the National Institute of Information and Communications Technology, Japan) is designed to perform emotional and attentional exchanges with children especially, in the simplest and most comprehensive way (see Kozima, & Nakagawa, 2007).

PaPeRo - "Partner-type-Personal-Robot" from NEC Corporation, Japan, is another model of small HSRs (see Osada, Ohnaka, & Sato, 2006). With an embodiment like R2-D2 from the Star Wars movies, PaPeRo has popularly been used in children's groups at day-care centers/homes, kindergartens and elementary schools. This robot is purported to be capable of recognizing and verbally communicating with people, sending images by mobile phone, as well as playing games and singing along with others.

Sized a little larger than PaPeRo is iRobi from Yujin Robots, South Korea. With telepresence functions, iRobi is commonly used as a teacher's aide there (see Palk, 2010). Originally designed as an educational toy, iRobi has an expressive digital face and an interactive LCD screen on its torso. It can be programmed to perform dances, tell stories, take digital photos, and maintain a virtual organizer. According to the CNN report by Palk, 2010, iRobi and a robot dog named Genibo have been helping out pre-school teachers in the city of Daejeon, and South Korea had aimed to introduce eight hundred and thirty of these types of robots into pre-schools by the end of 2010, with the goal of having them in kindergartens nationwide by 2013.

### **Creature-like robots**

Robots that are creature-like, such as Sony's three models of 4-legged robotic dogs known as AIBO, were studied before, with young children by Stanford University, USA (see Okita & Schwartz, 2006). The sample consisted of thirty-two children from a university day care program with an age range of 35-66 months. The Sony AIBO robotic dogs from Japan, which came before South Korea's Genibo, were used in the study which focussed on young children's understanding of animacy and entertainment robots.

Other than taking on the embodiment of a dog, there is a robot with the embodiment of a cat. This should come with no surprise as such animal embodiments would make robots appealing to children as common domestic pets. Genibo was originally invented to play the role of a pet robot, but was redesigned to teach dance moves and gymnastics instead. The cat robot study used a robot known as iCat (from University of Birmingham, UK), which is a social robot that plays the role of a game companion for children using an electronic chessboard (see Castellano et al., 2013). Twenty-six Portuguese elementary school children (8 - 10 years old) took part in the study. It was found that iCat's empathic behavior, generated as a response to the user's emotions, positively affected how the children perceived the robot. They not only perceived the robot as a more engaging and helpful companion, but also provided higher ratings in terms of self-validation.

Other creature-like robots developed and experimented with children had plush features. These include the Show & Tell Robotic Puppets for preschool education (from NTU, Singapore) (see Causo et al., 2015), the DragonBot (from MIT Media Lab, USA) - an 18" dragon-like squash-and-stretch robot covered with a plush skin designed in collaboration with an expert puppeteer (see Kory & Breazeal, 2014) and the Tega robot (also from MIT Media Lab, USA) - a personal robot for social purposes (see Westlund et al., 2016). Both Tega and DragonBot (designed as a social character that interacts with children as a peer rather than a tutor or teacher) take those creature-like robots used experimentally with children to a higher level because of their interactive social features. Tega actually worked collaboratively with a virtual agent in the study, and accompanied the child participant on a pretend trip to Spainto learn new words in Spanish together. The DragonBot on the other hand, was programmed to play a storytelling game, introduce new vocabulary words during the game, and model good story narration skills. Data was also recorded to find out if the children learnt the target words from the experiment, and whether their language ability had improved overall after playing with the robot. The children's language was also transcribed and analyzed for content and structure. This included measures such as the number of words spoken and the language complexity.

## DISCUSSION AND CONCLUSION

In this review, there are robot applications for the following uses: a) to teach children how to program a robot to execute physical movements and/or producing light and sound effects (e.g. KIBO and BeeBots); b) to administer a service (e.g. physical/social companionship, entertainment, teaching and/or child-minding). For the latter, the robots can be pre-programmed to autonomously respond to stimuli in both the physical and social environments. Such robots may be fitted functional hardware such as a camera for emotional recognition, playback for text to speech, motors for motion execution and microphones for speech recognition for its interactive functions. Although the repertoire of such robots can be limited, the development of hybrids with remote control to override the programmed functions is one way to overcome certain limitations.

Yet, hybrids may not be a fail-safe option as the social context for interaction can be unpredictable; hence, their adaptation to the child’s needs can still be inadequate. For instance; a child-minding robot may still fall short of recognition and active responding in situations where it’s job it so prevent imminent accidents (Osada, 2006). Therefore, even with remote control over-riding options, collaborative human efforts are still needed to ensure that children can remain engaged with the use of the robot so that the objective(s) set can be met.

With the advantage of embodiment over virtual agents, robots can be human-like or creature-like in form, and be constructed with hard coverings, human-like skin or animal fur-like covering. Hence, as with product design, the form, size and material used are factors to be considered for practicality of use in terms of durability, hygiene maintenance, context and appeal. For instance, the Bee-bot with its bright yellow hard covering is attractive and easy to clean. In addition, it is small enough for young children to manipulate it like pressing the buttons with their little fingers. With respect to the appearance of the robot, there is considerable potential to work in collaboration with experts. For example, the DragonBot was designed in collaboration with an expert puppeteer.

Generally, the robots reviewed here have proven to be popular with the children. An expert at KIST reported that “Children feel the robot is their friend. Robots are very helpful to enhance the concentration capability of children in class” (see Palk, 2010). As for teachers’ feedback, some of the key takeaways are from those found in the TEGA robot study (see Figure 1 below - Westlund et al., 2016): “Consider how the study activity can complement curricular goals; teacher experience with the robot matters; be prepared early; identify and involve stakeholders from the beginning; make time to pre-pilot with stakeholders; involve teachers while respecting constraints on their time and attention; teachers are the experts in their classrooms; minimize disruptions; one-on-one and small group robot interactions can add value to the classroom; share with the whole class; promote curiosity.”



Figure 1 - Lessons we learned during research in preschool classrooms, and where this advice applies to the research cycle (Westlund et al., 2016)

In choosing an appropriate robot application for teaching, other than considering an appropriate robot size and appearance to appeal to children or prevent misuse, the functionality of the robot needs to be aligned to one's objectives in using the robot. A robot's functional abilities may be limited in toy robots such as the KIBO or Bee-bot as they are not social robots and the repetitive nature of the activity can cause the novelty of the robot to wear off. Mishandling of small robots by children is a factor to consider as the damage can be costly and lessons may need to be cancelled or modified in replacement.

In comparison, social robots are more versatile than toy robots that are just for children to tinker with programming, as social robots have a repertoire of social interactive behaviours. Besides considering the social repertoires, another factor to consider is the size appropriateness for children's use, especially the very young. For example, in the study *Personalizing robot tutors to individuals' learning differences*, Keepon, the small tabletop robot, was chosen because of its size and the fact that it was particularly well suited to expressive non-threatening social communication (Leyzberg, 2014). To illustrate the latter - if the puzzle-solving strategy lesson in the experiment needed to be repeated, Keepon would start by apologizing for repeating itself by saying, "I'm sorry to repeat this hint but I think this will help." (Leyzberg, 2014, p3).

In designing the curriculum for subject areas such as behaviour modification, social or motor skills, numeracy, language and literacy through storytelling and/or games, there is the potential for collaboration with parties (storytellers, game designers, dance choreographers, etc.) who have the relevant expertise as well. With the structured, consistent and non-threatening or non-judgmental style of robot behavior, special-needs children, such as those with dyslexia or autism, would stand to benefit as well from a customised curriculum developed in collaboration with specialists. Hands-on activities such as programming a toy robot to travel to find an answer, dancing, playing games, quizzes with a robot or teaching a robot how to write would very likely pique their interest in learning! What's more, robots such as Nao can collect developmental data on changes over time, the DragonBot can analyse speech and language to investigate spoken communication. The future potential in reinforcing learning in an effective and appealing fashion could well be limitless.

Almost a decade ago, it was reported that technology curricula were unavailable and specific technological tools for special needs education was scarce in Finland (see Virnes, 2008). This was even as special needs education recipients made up almost a third of the school children between the ages of 7 and 16. The researcher implored: "The increasing number of special-needs children and the need for early intervention challenge teachers and researchers in this field to discover new and more effective solutions to the problems of special-needs children. Robotics, in the form of programmable construction kits and social robots, could make as great a contribution to improving the quality of special needs education. Technologies of this kind could enable

educators to recognize children's individual needs at an early stage of education and to compensate for their diagnosed disabilities. Robotics could also empower special-needs children to experience success in the learning of those technical skills that are central to our technology-oriented society" (Virnes, 2008, p30).

There appears to be much interest in the use of robots for educating children by authorities around the world now. Under the Infocomm Media 2025 Plan in Singapore, technology-enabled toys have been introduced progressively to 160 pre-school centres to foster creativity and problem-solving skills among children, through its Playmaker programme (see Info-communications Media Development Authority, 2017). Back in 2010, CNN had reported that the South Korean government was pressing ahead with plans to expand its "R-learning," (robot learning) program. Should we fear that governments would attempt to substitute real teachers with robots? The report mentioned that the South Korean government has no such intentions but plans to develop robots that provide assistance to teachers that meet expectations. Besides, the experts mentioned in the report expressed doubts that a robot will ever be better than a person. The reason given was that teaching is probably the most challenging role for artificial intelligence as it is a creative role and to teach well, one really has to understand the person being taught. Therefore, it was reported that a real fundamental leap in ability would be required before robots are capable of leading a classroom on their own.

To conclude, the studies reviewed here show that all over the world, there is a myriad of uses for robots for children in the early childhood years. As with other disruptive technologies, the adoption of robot applications may be challenging, but users' feedback would be helpful to help researchers improve the functionality of robots in by meeting the objectives set for children's learning. Therefore, the contribution from existing studies and the on-going pursuit of knowledge in child-robot interaction (CRI) is expected to continue to drive research and development of robots for children to greater heights.

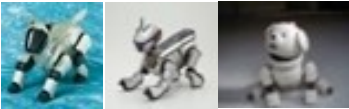


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APPENDIX 1: ROBOTS




FUNCTIONS	FINDINGS	AGE GROUP
1. AIBO ERS-210, ERS-220A, ERS-311A†).		
3 behaviors the dogs could complete; Kick, Dance, Stand Still. Used on young children's understanding of animacy and entertainment robots.	The results showed that the children would not confer animistic properties evenly. Also, the children attributed intelligent behavior more than biology and agency.	32 children from a university day care program. Range 35-66 months 
2. BEE-BOT AND PRO-BOT		
Used to perform 3 different types of tasks: structured tasks (teacher-directed tasks designed to develop particular concept or skills); exploratory tasks (structured to allow application of knowledge, exploring concepts and skills more freely); and extended tasks (open ended and child-directed tasks with which children engaged for an extended period of time, and with limited teacher scaffolding.	A combination of structured and exploratory tasks allowed students to develop and apply skills in programming and controlling the robotic toys. Extended tasks provided opportunities for students to attend to multiple mathematical focuses simultaneously.	33 children, of whom 11 were aged 3 and 4 years from a metropolitan pre-school. 22 Year 1 children from a nearby state school. 
3. DRAGONBOT		
The robot It is designed as a social character that interacts with children as a peer, not as a tutor or teacher. It will play a storytelling game, during which it will introduce new vocabulary words, and model good story narration skills, such as including a beginning, middle, and end; varying sentence structure; and keeping cohesion across the story.	Children learn more from a robot that adapts to maintain an equal or greater ability than the children, and they will copy its stories and narration style more than they would with a robot that does not adapt (a robot of lesser ability).	20 children ages 4-6.  <small>Figure 1: Two social, interactive robotic characters, called dragonbots, used as language learning companions for young children.</small>

FUNCTIONS	FINDINGS	AGE GROUP
4. ENGKEY		
<p>A tele-presence tool that brings English teachers located in the Philippines to the schools in South Korea.</p> <p>The instructors in the Philippines communicate using embedded microphones and speakers.</p>	<p>The robot controlled by teachers abroad was used to communicate using embedded microphones and speakers. The EngKey’s small display with a woman’s face mimics the facial expression of the teacher, who has cameras in his/her room.</p>	<p>A pilot pre-school class.</p> 
5. GENIBO QD - AN AUTONOMOUS PET ROBOT		
<p>The Genibo QD can identify itself and the surroundings using its sensors, camera, and voice commands and share feelings with the user. With input information, it forms Emotion/Mood/Intelligence/Character/Intimacy' to feature unique character and AI.</p>	<p>Nil.</p>	<p>A pilot pre-school class.</p> 
6. HANSON ROBOKIND ZENO R50		
<p>Used for collaborative play - Simon Says. Hanson Robokind Zeno R50 has a realistic silicon rubber ("flubber") face, that can be reconfigured, by multiple concealed motors, to display a range of reasonably life-like facial expressions in real-time.</p>	<p>The results provide new evidence that life-like facial expressions in humanoid robots can impact on children’s experience and enjoyment of HRI. The presence of expressions could be seen to cause differences in approach behaviors, positive expression, and self-reports of enjoyment.</p>	<p>37 male and 23 female; M age = 7.57, SD = 2.80</p> 

FUNCTIONS	FINDINGS	AGE GROUP
<b>7. HYBRID HUMANOID H3 ROBOT</b>		
To prevent child accidents with “on demand” interaction between the robot and the child in the relevant context that the robot is used (preventing child accidents). This is achieved through an active attraction of child attention as well as passive interaction.	The combined fish eye camera in the sensorized environment and a robot onboard camera made it possible to override remotely robot’s autonomous control and allowed a very high accuracy of control. We noticed that the child was ignoring sometimes robot’s articulated words, and therefore thought that the parents’ voice (via robot speakers) would be more familiar and appeal to the child better.	1 girl aged 3 years, and her mother,  
<b>8. ICAT</b>		
A peer or co-learner, which adopts empathetic behaviours towards the child [19 - where children play chess two hours per week as part of their school curriculum.	The results showed that children perceived the robot as more engaging and helpful and also provided higher ratings in terms of self-validation.	26 Portuguese elementary school ages between 8 and 10 years old.  
<b>9. INFANOID</b>		
Infanoid has two hands, each of which has four fingers and a thumb that are capable of pointing, grasping, and a variety of other hand gestures; it also has lips and eyebrows to produce various facial expressions, like surprise and anger.	The children changed their ontological understanding of Infanoid in recognizing the robot as a moving thing, then as an autonomous, subjective system that possesses attention and emotion as an initiator of the motion. They also recognize the robots as an intersubjective companion with which they can exchange or coordinate their attention, emotion, and actions.	14 normally developing children (about 5 years old on average).  

FUNCTIONS	FINDINGS	AGE GROUP
10. IROBI		
Irobi robot is a commercial robot which can offer different services including remote interactive communication and guarding for children.	iRobi marked the students' attendance and used a face recognition program to ask children about their mood.	Pre-school children in the city of Daejeon, South Korea. 
11. KEEPON		
The creature-like robot, Keepon (pronounced, "key-pong") is designed to perform emotional and attention exchange with human interactants (especially, children) in the simplest and most comprehensive way.	0-year-olds: The interaction was dominated by tactile exploration using hands and mouth. The babies did not pay attention to Keepon's attention. 1-year-olds: The babies showed awareness of Keepon's attentional and emotional expressions. Some mimicked the robot's emotional expressions (by rocking and bobbing their bodies). 2-year-olds: They socially interacted with Keepon by showing toys. When the robot's response was meaningful to the babies, they often soothed the robot by stroking its head (See Fig.).	23 normally developing babies in three different age groups, namely 0-year-olds (from 6 months of age), 1-year-olds, and over-2-year-olds, 
12. KIBO ROBOTICS KIT		
A tool for children to acquire specific learning goals such as programming skills to solve problems and tinker with technology.	The children displayed greater concentration in completing their tasks and would persevere even on difficult challenges. They also were keener to problem-solve using the toys and tried to help their friends to find solutions.	35 children from Play@TP, an experimental kindergarten in Temasek Polytechnic, Singapore. 

FUNCTIONS	FINDINGS	AGE GROUP
<b>13. KIWI ROBOTICS KIT</b>		
A tool for children to acquire specific learning goals such as programming skills. On a basic map on the floor, children programmed their robots to go from point A to point B using number parameters	Results show that beginning in pre-kindergarten, children were able to master basic robotics and programming skills, while the older children were able to master increasingly complex concepts using the same robotics kit in the same amount of time.	N = 60 children in pre-kindergarten through second grade from an urban, public, early education school that serves children in Pre-K through third grade in Boston, Massachusetts 
<b>14. NAO</b>		
NAO as a dance robot tutor with children in the context of creative dance	In general, the children responded in a very positive way. They liked the robot and the way it moved. They engaged with the robot copying or creating movements and they understood the movement concepts.	17 children divided in four groups between 8 and 9-years-old 
<b>15. PAPERERO - "PARTNER-TYPE-PERSONAL-ROBOT"</b>		
Paperero. It is capable of recognizing and verbally communicating with people, sending images by mobile phone to persons far away, as well as playing games and singing along with others.	Nil	Nil 
<b>16. PEPPER</b>		
Used in collaborative play and interactive storytelling	A report documenting the usage scenarios, challenges and considerations, as well as the benefits for preschoolers and teachers will be produced. This will provide insights on how we can extend and scale the use of robots to more pre-schools in the future.	2 pre-school centres; My First Skool Jurong Point and MY World @ Bukit Panjang 

FUNCTIONS	FINDINGS	AGE GROUP
17. ROBOTIC PUPPETS		
Robotic puppets as playtools found inside a classroom that would be able to (1) rotate its body horizontally, (2) rotate its head vertically and (3) open and close its mouth by rotating the upper jaw.	The results of the study indicated that when playing with the robotic puppets, the performance of the children with respect to thinking and learning, creativity and imagination, and social interaction and independence, is comparable to other traditional playtools.	52 children aged 5 to 6 years, from 2 community-based kindergartens in Singapore, 20 from the first (9 girls and 11 boys (same class) and 32 from the second (16 girls and 16 boys (3 separate classes). 
18. ROBOVIE		
A humanoid robot capable of human-like expressions and recognizes individuals using ID equipment (robot peer and partner - 2 interactive humanoid robots that only speak English in a Japanese elementary school to imitate the arrival of an international transfer student to encourage foreign language study	Children enjoyed interacting with the robot, and some even expressed sympathy for it. The authors believe that this is one of the first studies that provides evidence of children rapidly adapting to an interactive humanoid robot and developing relationships with it.	6-7 years old, 59 boys and 60 girls); 11-12 years old, 53 boys and 56 girls. 
19. TEGA ROBOT		
A social robotic learning companion created for a particular learning task - The robot and the virtual agent each took on the role of a peer or learning companion and accompanied the child on a make-believe trip to Spain, where they learned new words in Spanish together.	The key lessons learned about conducting child-robot interaction research in children's preschool classrooms were as reflected in the teachers' feedback. For e.g. Consider how the activity can complement curricular goals.	3 "special start" preschool classrooms at a public school in the Greater Boston Area; 34 children ages 3-5, with 15 classified as special needs and 19 as typically developing. 

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## Should 'developmental dyslexia' be understood as a disability or a difference?

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### Abstract

This paper questions current views of the phenomena of 'developmental dyslexia', and offers a discussion of the various models of disability that are currently used in society, and whether they are suitable to use when discussing 'dyslexia': The Medical model, the Social model, the Affirmative Model, the Psych-Emotional model, the Psych-Social/Bio-Psycho-social model, the Social-Relational model are all discussed, each with their own perspectives. Valeras's model (2010) is offered as an alternative to understand 'hidden disabilities' like dyslexia, diabetes and epilepsy etc. The term 'bi-abilities' is introduced to understand how such groups can have strengths in both the disabled and non-disabled worlds, and that such groups often reject any affinity with disability as they argue they are 'able-bodied'. The paper then investigates how dyslexic individuals whilst experiencing trauma at school can also experience growth from such experiences, through a discussion of 'Post-Traumatic Growth-PTG' to understand positives coming from experienced trauma e.g. school-based trauma, arguing Valeras's 'bi-ability' model to be more relevant to the dyslexic experience. The paper concludes by applying the 'bi-ability' model to dyslexia. The main themes are:

- ◆ Disability is a strong word – rejecting an infinity to a term that has negative public perceptions
- ◆ I'm more than in the middle – falling in the middle of two identities but rejecting both
- ◆ We don't have a box – traditional social groups do not describe who they are
- ◆ I didn't want to be different – it wasn't their choice to be born this way
- ◆ Not even consciously. But it's so hardwired – survival instincts naturally kick in
- ◆ To Tell or not to tell, it's the elephant in the room – the stress of not disclosing to others
- ◆ It's a piece of my identity, but it's not my identity – being different is not all consuming

**Keywords:** Dyslexia, Disability, Ability, Success, Post-Traumatic Growth, Bi-ability

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## INTRODUCTION

This paper investigates the phenomena of 'developmental dyslexia' (specific reading disability), defined by Rose (2009) as a specific learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling. Whilst there are many characteristic features of dyslexia, these focus on difficulties with phonological awareness, verbal memory and verbal processing speed. As dyslexia occurs across the range of intellectual abilities, it is best thought of as a continuum, not a distinct category, with no clear cut-off points. A good indication of the severity and persistence of dyslexic difficulties can be gained by examining how the individual responds or has responded to well-founded intervention. Whilst there are many theories to the cause of developmental dyslexia, many believe phonological deficits are a core function (Snowling, 2000; Thomson, 1996).

The author questions how this phenomenon should be defined in society, whether it is a disability and by understanding this question, how it should be understood in society. Later parts of this paper introduce both a 'bi-ability' (Valeras, 2010) model to argue that those with 'hidden disabilities' can reject a disability model, and use 'Post-Traumatic Growth-PTG' (Calhoun, Cann & Tedeschi, 2010) to understand that post-school success can come 'despite' and not 'because' of mainstream educational experiences.

### What is a Disability? What is 'Normal'?

The World Health Organisation's International Classification of Disease (WHO, 1980, p.29) separates the concepts of Impairment and Disability as follows:

**Impairment:** Any loss or abnormality of psychological, physiological or anatomical structure or function.

**Disability:** Any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.

Individuals are perceived to be 'normal' in society when they are: male/female, able-bodied, heterosexual, and these are believed to be the default membership for all in the absence of any visual/behavioural cues that would alert them otherwise (Abberley, 1993; Davis, 1995). Goffman (1963) has called this 'virtual social identities', however some individuals do not fit into this category and are the subject of this investigation.

### Disability in UK Schools

Education systems in the UK and most western countries are based on standardisation and whilst this may be suitable for the great majority of children, for groups of Special Educational Needs and Disabilities-SEND, estimated by Warnock (1978) to be 20% of

children (who will experience impairments at some point in their school career), it is argued is not. National Statistics (2017a) indicate the level of SEND in mainstream education has fallen from 21.1 to 14.4% in the last 7 years (2010 to 2017), however this must be understood to reflect the 'level of provision and funding by schools' not the actual 'level of need' (SEND Code of Practice, 2015). Such groups are perceived as being 'abnormal' and according to the 'Medical Model of Disability' (World Health Organisation, 2002), where individuals are defined as having 'impairments' causing barriers to their learning and limiting their access to services, they are segregated and provided with interventions to achieve according to their peers.

Runswick-Cole and Hodge (2009) argue the SEND term is an administrative label in current educational policy and legislation, and continues to locate the problem within the child, using the Medical Model of Disability. Cole (2004), Hodge (2006) and Runswick-Cole (2007) argue that SEND pupils are excluded within school practices and that the 'SEND' term contributes to such exclusion, as they are classed as the 'other' group supported by professionals and specialists; and thus, other children perceive children with SEND being 'different and deficient' (Rorty, 1989). Cole (2008) counters this by arguing pupils are only limited by the abilities of their teachers to adopt teacher and school flexible approaches to learning, teaching and assessment, rather than the child being expected to fit into pre-existing structures. Recent UK government reports highlight an 'unfit for purpose' SEND educational policy in schools resulting in a 'postcode lottery' of inconsistent support for pupils with SEND in mainstream schools (OFSTED, 2010; Bercow, 2011; Scott, 2016).

### **'Medical' vs 'Social' Models of Disability**

The 'Medical' model suggests that those with a disability have dysfunctional bodies that require medical intervention to return to society's concept of normality (Finkelstein, 1980). By contrast, the 'Social' model suggests that it is the environment that causes any disability and this needs to be modified to be inclusive to all needs (Oliver, 1996; Barnes, 2003). Interestingly Barnes and Oliver (1993) suggest that the 'medical' model was created by non-disabled researchers to understand abnormal populations and the 'social' model was created by disabled researchers to make sense of 'normal' populations as part of 'social oppression theory', as it is argued that *'non-disabled researchers have consistently failed to address the question of disability as perceived by disabled people whether young or old'* (p.3). Lang (2001) notes the 'Social' Model was born out of the disability movement finding a means to create a political platform to secure the 'rights of disabled people in society. Lang goes on to suggest the 'Social' model *'should not be considered as a monolithic entity, but rather as a cluster of approaches to the understanding of the notion of disablement'* (p.2). Lemert (1962) and Goffman (1963) talk about disability as a social deviance causing a stigma, mark or blemish to describe a 'moral inferiority'.

The empowerment and politicisation of disabled people is a defining principle in the social model, making it a force for 'social action' (Finklestein, 1996; Oliver, 1997; Swain, Griffiths and Heyman, 2003), as it emphasises social oppression and barriers which limit what a disabled person can 'be' and 'do' (Thomas, 1999; Reeve, 2004), in a society that discriminates against people with impairments and excludes them from involvement and participation. Additionally, that all people have a unique set of strengths and weaknesses that society needs to recognise, empower and utilize (Union of Physically Impaired against Segregation, 2009). This is also reflected in the 'Positive Dyslexia' model advocated by Nicolson (2015), making use of the 'Positive Psychology' movement (Seligman, 2011).

Charlton (1998, p.27) argues that the oppression experienced through the medicalisation of disability; has '*prevented people with disabilities from knowing: their real selves, their real needs, and their real capabilities and from recognising the options they in fact have*'. Barton (1996, p.8) furthermore suggests disabled people have historically been oppressed through institutional discrimination by: '*horror, fear, anxiety, hostility, distrust, pity, over-protection and patronizing behaviour*'. However, there are other models of disability that should also be considered.

The 'Affirmative Model of Disability' (Swain and French, 2000) develops the 'Social Model', from a deficit to a positive stance, to be '*essentially a non-tragic view of disability and impairment which encompasses positive social identities, both individual and collective, for disabled people grounded in the benefits of lifestyle of being impaired and disabled*' (Swain and French, 2000, p.569). The 'Affirmative Model' argues that '*far from being necessarily tragic, living with impairment can be experienced as valuable, interesting and intrinsically satisfying. This is not to deny there can be negative experiences resulting from impairment, but to make the point that this is not all that impairment is about*' (Cameron, 2011, p.110).

Lastly, the 'Psycho-Emotional Model of Disability' (Thomas, 1999) offers an understanding of the emotional impact of disability, '*being made to feel of lesser value, worthless, unattractive or disgusting*' (Thomas, 2004, p. 38), that the oppression individuals with impairments experience from society is internalised/absorbed, and this affects their self-belief about what they can do - a form of 'learned helplessness' (Seligman, 1991), defined as a condition in which a person suffers from a sense of powerlessness, arising from a traumatic event or persistent failure to succeed. It is believed to be one of the underlying causes of depression.

The above definitions of disability have been argued to be largely based around those with physical disabilities (as expanded versions of the Social' model), however as will be discussed, dyslexia and other conditions such as Diabetes, ADHD, and Epilepsy, are not based on physical barriers, and this can create a perceived hierarchy to the term disability in both disability groups and in the public arena (Reeve, 2004; Shakespeare and Watson, 2002).

### Critics of the 'Social' Model of Disability

Morris (1991) suggests the 'social' model effectively denies any physical, emotional pain, and suffering experienced by disabled people due to their impairments having an impact upon their practical daily living, hence the model is perceived as 'lacking' by commentators in the disability community (Hughes and Paterson, 1997; Crow, 1996).

Adding to this, Shakespeare and Watson (2002) argued that the 'social' model is outdated as it was created in the 1970's, and nearly 50 years later society has developed, and *'by arguing against the social model we are not denying that for much of the time the priority remains to analyse and campaign against social barriers, merely that we require a more sophisticated approach to disability'* (p.24). They offer three reasons why it is outdated:

- (1) Impairment and disability are not dichotomous, but
- (2) Disability should not be reduced to a medical condition. It should not be overlaid with negative cultural meanings. Neither should it be reduced to an outcome of social barriers alone, however important these might be in people's lives.
- (3) Intervention at physical, psychological, environmental and socio-political levels is the key to progressive change, yet one cannot be a substitute for the other. Social change remains the most expedient measure to remove the problems presented by impairment and its consequences.

Lastly, arguing any *'failure to follow a social model line, or join with the disability movement, may be less of a failure of particular individuals, and more a limitation of the model or movement itself'* (p.25).

Lang (2001) notes that Crow (1996) and Morris (1991) along with Hughes and Patterson (1997) argue that the 'Social' model has focussed on social change over that of the experience of those with disabilities, and 'denies' the physical and emotional pain, and suffering experienced by disabled people in their daily lives. Reeve (2004) argues that there is a public perception of what a disabled person 'looks like' and how they should 'act', focussed on physical impairments, and that those individuals 'without' physical impairments are frowned upon if they try to gain allowances for their needs: leaving them *'feeling ashamed, vulnerable and invalidated'* (p.87). Morris (1991) argues that disabled people are surrounded by myths and stereotypes which underpin prejudices, with terms such as 'too blind to see', 'out of your mind', 'words falling on deaf ears', 'haven't got a leg to stand on' that support the concept to be of value one must be physically, psychologically and mentally fit (Thomas, 1995).

Regarding individuals without physical barriers, who could be classed as having 'hidden/invisible impairments'; they constantly risk their disability status being publicly revealed,

forming the basis for their *'negative psycho-emotional reasons for concealment'* (Thomas, 1999, p.55). Reeves (2004) found that those who *'passed'* disclosing their impairment were seen as *'traitors by others within the disabled people's movement'* (p.92) as they were actively rejecting their disabled identity (Kanuha, 1999). It suggests there is a perceived *'hierarchy of impairment'*, as found by Reeve (2004, p.92) *'one of my participants did not feel she was seen as a 'real' disabled person because she was not a wheelchair user and did not have one of 'the biggies' like cancer, arthritis, multiple sclerosis or visual impairment. Consequently, her identity as a disabled person was challenged by other disabled people in the organisation'*.

Grewal, Joy, Lewis, Swales and Woodfield (2002) identified that just over half of people with impairments surveyed did not identify themselves as disabled. Reasons varied: they did not think they were ill or incapacitated enough to count as disabled, their health problems were part of an illness or getting older. The negative images they associated with disability caused many to be too embarrassed to identify as disabled, as they felt it was believed to be connected with a physical impairment: typically affecting mobility, was visible, led to dependency, incapacity issues, and was a permanent condition. They also dismissed their own impairment as they felt they were mobile and capable, and they saw themselves being *'normal'* (Watson, 2002). It is argued by Reeve (2004) that the *'Psycho-Emotional Model of Disability'* offers a more sophisticated tool to understand the breadth of experiences from disability and any associated issues of disability identity.

The *'Psycho-Social/Bio-Psycho-social Model of Disability'* (interactional) proposed by Erikson (1959), talks about a psycho-social crisis in the development of the identity in a disabled person, which causes them to recognise and face the barriers of their impairment through their interaction with their social (e.g. cultural understanding of *'normality'*), biological (e.g. having an impairment that needs medical intervention e.g. insulin) and psychological factors (e.g. the stress or anxiety caused by bullying at school by peers or being misunderstood by teachers).

The *'Social-Relational Model of Disability'* (Shakespeare and Watson, 2001; Crow, 1994) asserts that *'to accurately comprehend disabled people's experiences, there needs to be a focus on how both disabling barriers and impairment interact with each other'* (MacDonald, 2017, p.11). That individuals are disabled by their bodies and social barriers, and by recognising/focussing on the impact of one alone (e.g. their bodies) without the other (e.g. their environment) would be wrong. Shakespeare (2013) argues that *'reality'* exists in four domains (sociological, psychological, biological and molecular) and any theory of disability must acknowledge all four domains. Thus the *'Social Relational Model of Disability'* refers to disabling barriers from structural exclusion, social oppression, and impairments that affect a person's life course.

As the Medical, Social, Affirmative, Psycho-Emotional models of disability could be argued as focussing on the negative aspects of impairment and disability (oppression in

society and their impacts), it is such concepts which are problematic for many with invisible disabilities/differences such as those with dyslexia who question if they are actually disabled, and reject a disabled identity.

As Sutherland (1981) argued, *'a more radical approach is needed: we must demolish the false dividing line between 'normal' and 'disabled' [meaning impaired] and attack the whole concept of physical normality. We have to recognise that disablement [impairment] is not merely the physical state of a small minority of people. It is the normal condition of humanity'* (p. 18). A new paradigm shift is needed to understand those with hidden disabilities/differences such as dyslexia.

To conclude, it could be argued that neither the 'Social' or 'Medical' models of disability encapsulate the experience of those with non-physical and non-visible differences/disabilities, therefore such groups may reject a 'disabled' label, as they would find it hard to argue that the environment (e.g. school, workplace, society) is disabling to them.

### A New Perspective

Valeras's (2010) paper 'We don't have a box: Understanding hidden disability identity' offers a new perspective to understand those with 'hidden disabilities', which dyslexia falls into along with individuals with Diabetes, Coeliac Disease, Juvenile Rheumatoid Arthritis, Epilepsy etc. Her paper investigates individuals that might look normal but also have impairments that can affect their lives, investigating six individuals with borderline identities that contradict, interact, inform and implicate each other; as they have the ability to transcend and travel between two worlds - the disabled and the non-disabled. *'They live on the edge of social, cultural, and political lines and adapt to any situation that they encounter to emphasise or de-emphasise various aspects of their identity depending on the pressures of the social context'* (p.16). Whilst her sample is small, other researchers support this concept (Yee, 2013; Burke Valeras, 2007; Gillespie, 1996; Roman, 2009; Stone, 2005; Sturge-Jacobs, 2002). As Gabel (1999) suggests *'If... I experience my body as a disabled body, regardless of what others think of me, then I am disabled. In contrast, if I do not view my body or myself as disabled, then I am not disabled, even though others may disagree'*. (p.42).

Higgins, Raskind, Goldberg, & Herman (2002) found any labelling for a disability was for many individuals a lengthy process that often resulted in conflicting diagnoses, with individuals confused as to which labels to accept and which to reject. In response, some individuals simply reject any label as inaccurate, offering their own explanation for their challenges (e.g. emotional problems that interfered with learning). Furthermore, Santuzzi, Waltz, Rupp and Finkelstein (2014) argue that a clinical diagnosis of a condition may not be sufficient to warrant a legal definition of disability in the employment contexts; therefore, even if you identify with a disability you may not be covered by disability/equality legislation.

According to Valeras's (2010) 'bi-ability' model, such individuals found:

'Disability is a strong word' and isn't a term they feel encapsulates them, as they are more than a disabled person. They believe they are able-bodied, and that *'disability has negative connotations'*.

'I'm more in the middle' defines more of what or who they are, and that they can empathise with both groups equally. This is based on a perception that the need by society for clear demarcation between people with visual markers (perceived as disabled) and people without visible markers (perceived as non-disabled) is a defensive strategy and denies the human frailty that we all have (Davis, 2005). This denotes a perceived stigma towards those with physical disabilities, as having a greater human weakness than they have (Nussbaum, 2004).

'We don't have a box' describes that they feel that they are an 'other' group, but there isn't an 'other box' featured on forms. They believe they have the ability to tick both boxes if they felt like it - having the ability to 'pass' and look normal to those around them. This ability to 'pass' can be found in many instances of race, class, gender and sexual orientations. (Ginsberg, 1996; Schlossberg, 2001; Leary, 1999).

'I didn't want to be different' describes that they want and do look 'normal' but in their need for accommodations they also need to disclose a disability, something they do not recognise being a part of their identity, resulting in others questioning their 'disability-ness'. The requirement to be alert to the 'impressions and reactions' to others means that they are hyper-alert to avoid situations that would highlight any behaviours or situations that might reveal a symptom of any disability.

'Not even consciously, but it's so hardwired' describes the ability to pass or disclose their ability to others that can be both a 'blessing and a curse', resulting in a constant private struggle to sustain both a private and public self (Cavet, 1998). This means that such individuals may be reluctant to access accommodations, people, places, situations because they might draw attention to their disability (Cavet, 2000; Fitzgerald, 2000) and at times suffer pain and impairment to uphold an identity of the 'non-disabled' person (e.g. by polio sufferers walking).

'It's always that elephant in the room' argues that many such individuals are reluctant to disclose their disability to maintain their self-esteem/self-identity, and any needs are constantly forgotten by others as they maintain zero visual clues to remind others that they might need accommodations. Goffman (1963, p.57) describes the dilemma *'to display or not to display, to tell or not to tell, to let on or not to let on, to lie or not to lie'*. The sharing of such information means that their invisible condition become visible and so would be their 'differentness' to others.

'It's a piece of my identity, but it is not my identity' describes the dilemma many experience as having an impairment but not recognising it as a disability; and that such an impairment is only a small part of who they really are. Likened to wearing glasses, they argue that they are *'a person with a disability or a disabled person'*. Many choose the former as it describes *'a part or piece of their identity, not who they are'* (p.15).

These individuals have flexible identities which are argued cannot be *'squished into a box....they exist in the space between, travelling in and out of two juxtaposed identity categories'* (p.16). Valeras along with Darling (2003) argues that a *'bi-ability'* exists because of such individuals that can exist in both disabled and non-disabled worlds, and that neither category is a perfect fit.

### **The Social Model of Dyslexia and Neurodiversity**

A question can be posed, is *'bi-abilities'* the same as *'neurodiversity'* (Cooper, 2008, 2009, 2011; Pollak, 2009; Walker, 2014), what are their similarities and differences? It could be argued that *'neurodiversity'* embraces disability and whilst it aims to diversify labels so that an individual could be *'dyslexic with ASD ADHD traits'*, the author argues it is very much centred on the biological elements of disability. In locating the many aspects of a person's difficulties or disabled profile, as an educational professional (a SENCO in a mainstream primary school) it makes planning targeted interventions extremely hard and whilst teachers are now finally gaining a handle on what dyslexia is, to bombard them with a multiple of sometimes conflicting impairments, best conceptualized as a *'fruit salad'* of impairments can make their jobs much harder.

Neurodiversity like the concept of bi-abilities promotes the strengths of individuals, however Neurodiversity differs from bi-abilities in its biological basis that aims to combine many learning difficulties into a collective force for political gain, with strong support from the *'Autism Rights Movement'* (Soloman, 2008; Autistic UK, 2017) to advance the needs of autistic individuals. Therefore, it is argued by the author that the Neurodiversity movement is a *'social'* model concept that aims to deliver environmental change, whereas the *'bi-ability'* concept rejects the concept and label of *'disability'* as they see such individuals as neither *'dis-abled'* or *'abled-bodied'* as no label currently exists that best describes them, but able to use a number of strategies to work successfully in many environments.

### **The Dyslexic Experience and Hidden Disability**

In the case of the dyslexic individuals encapsulated in the authors previous works (Alexander-Passe, 2010, 2012, 2015a, b) one finds that many do not recognise they have a disability and try very hard to camouflage any difficulties to promote a sense of *'normality'*. The constant hyper-alertness for situations that might highlight any deficiency is seen as highly stressful and adds a secondary stress to that of their primary difference/impairment.

The school-aged young person with dyslexia recognises they look normal but are impaired at school (e.g. reading, writing, spelling), however many also recognise their strengths (e.g. drawing, drama, debating) which is confusing, an oxymoron, as if they were actually disabled they would firstly according to society have a physical indication of disability and secondly such an impairment would affect all areas of their life with no apparent strengths.

This dilemma or paradox causes many young people with dyslexia to question their place in their families and see themselves as being 'abnormal', as their parents, sibling and peers do not have this strange selection of strengths and weaknesses. This causes them to question their identity and their 'otherness' causing them to isolate themselves as a form of self-protection, some relate to the 'Spock' character in Star Trek (Alexander-Passe, 2010).

Schools are generally bemused by students who can look and act normally, but struggle in learning settings. As they show strengths/focus in many subjects (commonly vocational), many teachers believe such a student is being lazy and not applying such strengths/focus to their subjects (commonly core subjects of English, Maths and Science). The lack of substantial impairment means many such students are overlooked for diagnosis of underlying difficulties, however the examination access arrangements (Joint Council of Qualifications, 2016) for formal school examinations (e.g. GCSE) adds to this confusion by allowing students to receive allowances (e.g. extra time, use of a laptop to overcome handwriting difficulties) without any need for a formal diagnosis. This demonstrates an 'other' group who have impairments but are not disabled at school.

This dilemma is also seen in UK schools where children are added to the school's Special Educational Needs-SEND Register when they are receiving additional interventions, however without the actual diagnosis of a disability or a SEND (SEND Code of Practice, 2015), this change reflects the provision being provided by schools rather than the actual needs of pupils. Therefore, children with a known disability (e.g. high functioning autism) are not added to the SEND register as they are not actually receiving any intervention/provision. Also, if a school is unable to fund enough SEND provision, then they will only record the frequency of SEND in school that they can actively provide, which could be argued to camouflage the actual frequency of SEND need.

The young dyslexic adult is faced with leaving school lacking the academic results of their siblings and peers. Their lack of perceived impairment (commonly perceived as physical) means they are misunderstood as being lazy and unfocused, rather than struggling with 'hidden impairments'.

The ability to look and act 'normally' means they are overlooked as having underlying difficulties. However, they are faced with a dilemma, the application forms they must complete ask about disabilities, ask a range of questions: Do you have a disability?

Do you believe you have a disability? Do you have a disability covered under the United Kingdom's Equality Act (2010)?

This causes them to question if they actually have a disability, do they believe they have a disability, and what advantage/disadvantage a disclosure might bring? It also poses other questions: Will I have a better chance to get through the first round of sifting of applications if I disclose or not? At what point should I disclose their dyslexia or difficulties? At the application, interview, when offered the role, or after starting the role? (Alexander-Passe, 2015, 2017, Scott, 2004)

As mature adults, many adults with dyslexia have developed a sense of their strengths and weaknesses, and use these to develop careers that are fulfilling, but interestingly they do not recognise such strengths as a disability but a learning or working difference. In these situations, using the term disability would be alien to them and might have negative connotations.

To conclude, it is argued that using a 'model of disability' to describe the experiences that many dyslexic and individuals with 'hidden disabilities' undergo may be inappropriate, as they can be argued to be negative and deficit models, focussing on what individuals 'can't do, rather than what they can'. The 'bi-ability' model (Valeras, 2010) offers a positive model that many 'hidden disability' individuals can relate to, while allowing the conceptualization of an identity that is both 'disabled' and 'non-disabled' and the internal emotional struggle that come from sitting in both camps and not truly being comfortable in either.

### **Successful Dyslexics – Where does this fit into 'Bi-abilities'?**

Alexander-Passe (2016a, b) investigated successful individuals with dyslexia and two theories were suggested 'The Disability Paradox' and 'Post-Traumatic Growth-PTG', to understand individuals who were successful in their post-school careers achieved through:

- ◆ Demonstrating strengths that others do not have (many found as children/teenagers).
- ◆ Not indicating their dyslexia to others – passing.
- ◆ Demonstrating exceptional resilience and motivation.
- ◆ Developing a healthy attitude towards failure – that it is part of the journey towards mastery or success.
- ◆ Success came post-school, and after facing adversary, trauma and negative schooling

All the above could be argued to fit into the 'bi-ability' model as they all indicate the ability to take strengths where they exist, some coming from their dyslexia and others from their non-dyslexic abilities. Again, being dyslexic is only part of who they are, so the

ability to harness the strengths from each part of their personality means they can bring unique skills and abilities to problems and the workplace.

Exceptional resilience and motivation could be argued to come from always being on the lookout (having sensors) for situations that might highlight their difficulties, and the ability to bounce back from set-backs (forced disclosure of difficulties) and the motivation to avoid such forced disclosure in the future.

Interestingly, the ability to see 'failure as part of the journey to mastery' is part of their unconscious coping or defence mechanisms developed at school, and linked with resilience, the ability to play the 'long-game' and recognise that they will need longer to gain certain skills, and that knowledge learnt through failure can be as good or better than that learnt first time (as argued through the 'Growth Mindset' by Dweck (2012). If a machine never fails, there would be no need to develop a better model, so if one always gets things right first time there would be no motivation to question if it's the best model for the job. The inquisitive mind is more likely to make leaps of faith to solve problems, asking the 'what if' questions.

### **Growth from Shattered Lives**

For many decades, the concept of trauma derived from incidents related to neurosis and negative manifestations requiring interventions as per the 'Medical Model of Disability' (World Health Organisation, 1992) e.g. stays in mental asylums and electric shock treatment (Mind, 2016). More recently the 'positive psychology' movement spearheaded by the esteemed Professor Martin Seligman has aimed to rethink trauma. This movement aimed to understand any positive manifestations that might come from trauma, and several theories have developed under this umbrella (Seligman, 1991, 2011). Nicolson (2015) is now developing such themes within the realms of dyslexia, called 'Positive Dyslexia' along with other researchers who campaign for the recognition of the strengths that can come from dyslexia (West, 1997; Alexander-Passe, 2016a, b).

Post-Traumatic Growth-PTG (Calhoun, Cann & Tedeschi, 2010) argues that growth can be triggered by a single or multiple highly stressful life event/s that poses a significant challenge to an individual's assumptive belief about the world. Beliefs that the world is predictable, controllable, and ordered that to that point have been relied upon to guide behaviour and to make sense of the world. PTG is argued to come from the impact of these 'shattered' beliefs and how individuals choose to piece them together or interpret them. It is argued that using an analogy of a shattered vase, individuals can try and piece together their shattered pieces but will fail as they can't return to how it originally was (perfection), and develop depression/withdrawal when they see their efforts are pointless; alternatively, they can reuse the pieces to construct something new and different - not trying to replicate the former vase's beauty, but to create something new, maybe a sculpture or a mosaic. The 'growth' comes from using a trauma positively and the

motivation to become more engaged in life e.g. being resilient to future trauma, to help others who have been through trauma, change careers, take a trip or course that was always put off, or to have a new lease of life etc. Thus, making sense of the trauma and developing new characteristics and strengths as a result.

Organismic Valuing Theory-OVT (or adversarial growth) is a more developed PTG theory (Joseph & Linley, 2005). It argues that following a significant trauma, humans have an inherent tendency to try and comprehend and integrate such experiences in a meaningful way while striving towards emotional and psychological well-being. The theory proposes three outcomes:

1. 'Assimilate' the trauma-related information by 'integrating' the experience into their beliefs they held before the trauma – they recover but return to their pre-trauma state
2. 'Accommodate' the trauma-related information by 'modifying' the beliefs they held before the trauma: (a) if accommodated in a negative way (e.g. bad things happen and there is nothing I can do about it) then they can develop helplessness/depression.
3. But (b) if they accommodate in a positive way and modify their beliefs appropriately (e.g. life is unpredictable, so it should be lived to the fullest) then they can experience psychological growth following adversity.

In this model, positive benefit-finding and psychological growth is facilitated by many factors (the need for affiliation, autonomy and competency) along with supportive social environments.

### **Pulling the Discussion Together**

Pulling the two aspects together (models on disability and models from trauma) to form a theoretical basis for this paper. The concept of 'bi-ability' (Valeras, 2010) stands out in offering an explanation of the following: how individuals with dyslexia can function and succeed in both the dyslexic and non-dyslexic worlds (disabled and able-bodied worlds), why individuals with dyslexia suffer from mental health issues and self-doubt, and how they can choose when, where and with whom they disclose their dyslexic difficulties, which allows them to develop successful careers despite suffering in educational environments.

The Psycho-Emotional Model of Disability is useful in expanding the dyslexia experience, in how the public perception of disability (being mobility and incapacity-based) has meant that many individuals with dyslexia reject a 'disability label' and this causes problems when accessing services designed to assist them in gaining employment, causing secondary stress and anxiety.

However, the 'Organismic Valuing Theory' (Joseph & Linley, 2005), an advanced version of PTG is also very helpful in understanding the reasoning dyslexics make from their experienced school-trauma/educational neglect and their personal journeys using 'assimilation' or 'accommodation' in changing their values and beliefs, and how this has allowed many to find new meaning in what they do, embracing risk, and creating successful careers as a result. However, others have accommodated their school-trauma negatively and have developed helplessness leading to depression and withdrawal as a result.

### **Applying the Bi-Ability Model to Dyslexia**

The 'Bi-Ability' model has the following main themes which will now be discussed to see if they are relevant to the dyslexic samples as found in this research. The main themes are:

- ◆ Disability is a strong word – rejecting an affinity to a term that has negative public perceptions.
- ◆ I'm more than in the middle – falling in the middle of two identities but rejecting both.
- ◆ We don't have a box – traditional social groups do not describe who they are.
- ◆ I didn't want to be different – it wasn't their choice to be born this way.
- ◆ Not even consciously. But it's so hardwired – survival instincts naturally kick in.
- ◆ To Tell or not to tell, it's the elephant in the room – the stress of not disclosing to others.
- ◆ It's a piece of my identity, but it's not my identity – being different is not all consuming

### **Disability is a Strong Word**

When it comes to dyslexic individuals whilst many will associate their dyslexia with difficulties in reading, writing, spelling, organisation and short-term memory, they do not see themselves as disabled by their dyslexia. They do not see dyslexia as a disability, and thus will reject this label. However, they do realise to gain certain allowances at work and at university provide them additional rights, accessible software and training they must identify with a difficulty that is covered under the 'Equality Act' (2010) and US 'Disabilities at Work Act' (Equal Employment Opportunity Commission, 2008). It could be argued that individuals with dyslexia and those with other 'hidden disabilities' reject a disability label, however will claim under such allowances when it is advantageous to them. Thus, a paradox exists.

### **I'm more than in the middle**

It could be argued that many individuals with dyslexia reject a 'disability' label, but many

of them also reject a 'dyslexia' label. They see their difficulties or differences as being 'just how they are' and they feel they don't fit into a 'dyslexia' label as they have learned to read and write, and can function in the workplace with a meaningful job - thus many believe they are cured of their dyslexia as they look and act normally. However, in rejecting their dyslexia, they are also rejecting any help on offer or employment protection. Alexander-Passe (2010, p.250) noted a participant regarding a late diagnosis *'If I managed to gain a degree and a job without diagnosis, how much more could I have gained with a diagnosis and the help it would offer'*. This suggests their own rejection was confirmed by others around them, in that teachers at school and lecturers at university had seen them as 'needing more time and effort to achieve' rather than fighting against a 'hidden disability'.

### **We don't have a box**

According to many job applications and the UK census, you are either disabled or you are not. The questions posing 'do you believe you are disabled' suggests that the person completing the form must take ownership of any difficulties. Answering yes to 'are you disabled under the Equality Act (2010)' would mean that you are covered by such legislation, however it pains many individuals with dyslexia that they need to say yes. To say no, be offered the post and then have difficulties could be argued that you withheld information that might have meant you might not have been offered the post.

The absence of an option 'are you covered by the Equality Act 2010 but do not perceive this will affect your ability to do the role' means a possible employer might shy away from even offering the individual an interview. Alexander-Passe (2015a) found that many individuals with dyslexia avoid disclosure of their dyslexia in the workplace, and those that do are hit by experiencing misunderstanding and unfair treatment/discrimination in the workplace.

### **I didn't want to be different**

It is believed that only a third of dyslexics are diagnosed at school, another third at university or in the workplace, and the last third go through life undiagnosed (Alexander-Passe, 2017). Many individuals go through school being told 'they are slow, lazy or immature, they need more time to get things'. They just need to get used to their siblings and peers overtaking them at school and in the workplace; and they will need to be 'contented' with manual vocational jobs that offer a low salary. They were told early on that this is 'just how they were made' and that it was okay to be different, and in some cases a second-class citizen.

Recent UK government statistics (National Statistics, 2017a, b) found Specific Learning Difficulties, a common educational term to include dyslexia (Rose, 2009) rose from 10.8% in primary school to 23.3% in secondary school, suggesting that their learning difficulties

had been dismissed in primary school as substantial enough for a diagnosis. Alternatively, there is a tendency for teachers to assume that 'it will come' given time, and only in secondary school is it accepted that there is a continuing problem. However, inside most dyslexics are individuals with dreams and passions to 'show the world they have value' and that those around them e.g. parents, teachers, and peers have got it wrong about them. This motivation to prove others wrong is a feature found in successful dyslexics (Alexander-Passe, 2016a, b) and is extremely powerful, however it is only outside the confines of mainstream education that many such individuals can shine.

The countless individuals with dyslexia found in the creative professions (e.g. actors, designers, artists) are able to bring unique skills to the workplace, but are these skills or compensations? Have they developed these skills as a coping strategy or are they hot-wired with them at birth? Are they more kinaesthetic as they can learn 'vocational' education faster than by reading and writing? This was investigated by the author (Alexander-Passe, 2010b) in an edited work with many leading educationalists and artists, however no definitive verdict was reached.

### **Not even consciously. But it's so hardwired**

Alexander-Passe, (2006, 2008, 2010, 2016b) discusses the educational trauma that many teenagers and children with dyslexia experience in mainstream education and the many strategies developed to cope at school, from avoidance or passing, that allow them to survive in mainstream mixed-ability classrooms. This changes school into somewhere to survive, rather than enjoy or demonstrate their potential. Before long, sensors to possible dangers are developed and finely tuned to avoid any form of detection of their difficulties, so that they are spared humiliation at school for their inability to read, write and spell as well as their peers. These become unconscious and they serve the dyslexic well to survive, but at what costs? The cost may be the ability to develop their potential?

### **To Tell or not to tell, it's the elephant in the room**

As mentioned above, individuals with dyslexia develop finely tuned sensors to avoid all situations that will expose them to humiliation and embarrassment in the hands of their peers. However, the need for such sensors make living with a difficulty such as dyslexia very exhausting, as the author (Alexander-Passe, 2010) found in a study of twenty-nine adult dyslexics. This makes many dyslexics believe they are living a double life, like that of a spy, in that they are always keeping up a pretence, and lying constantly to come up with decent reasons to avoid doing many chores (e.g. I have forgotten my glasses so I can't read the menu; I can't find my diary so please tell me the date, sorry; I have a bad memory; did I lock the door, could you go and check please etc.) (Alexander-Passe, 2010; see also Scott, 2004)

In the same study, the author (Alexander-Passe, 2010) found that many participants noted

they had been the most truthful about their dyslexia and difficulties in their interviews, not even telling their parents, siblings and partners the truth. Living a 'double-life' meant living a 'double-lie' and on top of having a poor short-term memory as part of their dyslexia, they were likely to be found out, and this was highly embarrassing. Moreover, some also linked the experience of being dyslexic with that of experiencing being gay in society, where both are stigmatised in the workplace.

### **It's a piece of my identity, but it's not my identity**

Speaking with adults with dyslexia one finds that their dyslexic identity was a contentious issue. Those who disclosed their dyslexia early on in the dating process, normally in the first date, do so to explain why they choose certain paths and why they might do a few quirky things (Alexander-Passe, 2012). However, it is framed as one part of who they are, as per wearing glasses or being tall, short, thin or overweight.

However, those who are reluctant to disclose their dyslexia in the dating process, which also reflected their reluctance in the workplace, perceive their dyslexia as affecting all aspects of their life, and something that can be blamed for their difficulties gaining a long-term partner, employment and a family.

In the case of successful individuals with dyslexia (Alexander-Passe, 2016a, b) they perceive their dyslexia bringing them great strengths and they embrace these as coming from living with dyslexia in mainstream education. The 'chip on their shoulders' developed as a reaction to their experiences, and they use these powerful motivations to bring about career change and enhancement. They have 'dyslexia' but are not 'dyslexic', so could be argued as having the traits without being all-consumed by it.

It could be argued that much that is presumed to stem from dyslexia are the reactions to how society has made them act (as per the 'Medical Model of Disability'). If their workplace is not inclusive, then they must work harder to achieve their goals.

What is important is to compartmentalize any dyslexic difficulties and view these in the arena of an individual's strengths and weaknesses. Only through this can dyslexia be seen as a 'part' and not the 'whole' of a person's identity.

### **CONCLUSION**

This theoretical paper takes an interesting look at dyslexic experience, and asks if the highly politicised 'social model of disability' is valid in understanding the needs of such a group.

Mainstream education is clearly centred on the 'medical model of disability', in that all individuals are taught the same curriculum, expected to attain to the same level, and if

one is found to be unable to achieve this, interventions are given to overcome any deficiencies (in essence so they are fixed or cured). UK and international schools are judged with league tables, which are designed to demonstrate to current and prospective customers (parents) the school's ability to 'add value' to a child, no matter their educational starting points.

Due to the changes in the SEN Code of Practice (2015), the change to record SEND in school from 'provision' to 'need' has resulted in most schools reporting a significant decrease in SEND in pupils over the last 7 years. This is argued to have resulted from many schools only listing pupils on a SEND register when they are actually receiving 'provision', therefore if a school is unwilling to provide sufficient provision for 'vulnerable' pupils, then such pupils simply disappear from school records. This view is supported by Scott (2016), Bercow (2011), OFSTED (2010) and the Audit Commission (2002) of a 'postcode lottery' with 'piecemeal' inconsistent provision in schools.

Whilst schools can be applauded for their aims to be inclusive to all learners through differentiation of lessons and making sure buildings are accessible to those with physical difficulties, there is much to be done to improve the teacher's ability to both screen for learning difficulties and offer effective differentiations. UK teacher standards will next year make differentiation and SEND awareness core elements mandatory in Initial Teacher Training courses following the Carter Review (2015), confirmed by Department of Education (2016).

The 'social model of disability' is often found in the workplace, with schemes such as the UK's 'Access to Work' helping to make workplaces more accessible through assisted software and hardware. However, whilst 'social models' are implemented in the public sectors, this is not often found in the 'private sector', forcing many dyslexic individuals to hide their dyslexia and their ability to 'pass' as non-disabled is essential to their career development.

Various models of disability were discussed and these help to understand the interaction between society and those with disabilities, however arguments against the 'social model' emphasise that it lacks cultural and experiential dimensions, in essence how the disabled individual feels (the 'lived' experience) as a reaction to society's perception of them. It is argued that it is hard to relate aspects of these models to those with 'hidden disabilities' as many with dyslexia and other hidden disabilities reject the concept that they are disabled.

Valeras's Bi-ability model (2010) offers an understanding of the 'hidden disability experience', in that they reject any disability identity and the ability to 'pass' as normal in society means they can achieve more in society. The use of passing has been used by many groups (race, gender, sexual, disability) who feel they would gain more by blending into society (e.g. Polio sufferers walking despite intense pain, a gay person pretending to

be heterosexual, a mentally ill person acting without any symptoms to be accepted by the public). Many powerful examples can be seen over the last few centuries of passing to gain certain freedoms, and it can be argued that the dyslexic child avoiding certain tasks at school (reading and writing) can be identified with 'passing' and this means dyslexic groups can be discussed in a wider disability, gender and race context. It could be also argued that the ability to pass by dyslexic individuals allows them to be successful in industry and entrepreneurship.

This paper finishes by looking at the various elements of the 'Bi-ability' model in the context of dyslexic individuals: Disability is a strong word – rejecting an affinity to a term that has negative public perceptions. I'm more than in the middle – falling in the middle of two identities but rejecting both. We don't have a box – traditional social groups do not describe who they are. I didn't want to be different – it wasn't their choice to be born this way. Not even consciously. But it's so hardwired – survival instincts naturally kick in. To Tell or not to tell, it's the elephant in the room – the stress of not disclosing to others. It's a piece of my identity, but it's not my identity – being different is not all consuming

The strength of Valeras's paper comes in its ability to cross race, gender and disability, and improves understanding the dyslexic experience for both dyslexic and non-dyslexics groups, and it could be argued that 'passing' allows the dyslexic through the 'workplace' front door, and this allows them space and security to demonstrate the strengths and skills which will make them successful.

## **LIMITATIONS**

The author notes that whilst the study of Valeras (2010) was only based on 6 research participants, and therefore conclusions should be treated with caution. However, other researchers have reported similar themes, which the author believes gives weight to Valeras' theory. The author also notes that the field of study that looks at the 'Social' model of dyslexia is extremely broad and only a summary of the arguments can be included in this paper.

## **IMPLICATIONS FOR ASIA**

The author of this article is writing in the UK, where support and recognition for dyslexia is well-established, and there is legislation in place to provide good outcomes, despite recent changes in SEND that have impacted on this. How far is this article relevant for the Asian context, where some countries have no legislation, no provision in education, little public awareness and dyslexia may be seen as a stigma, making the issue of disclosure even more pertinent? Even in Asian countries where dyslexics are now supported within the education system, identification and provision remain patchy and

the numbers identified are far below the predicted levels for the population, suggesting untapped cases that require support. At the same time, there is a growing interest in the region in the strengths of dyslexia, and how these strengths should be understood within the context of disability. The concept of dyslexia as a difference rather than a disability outlined in this article resonates more readily with this movement and with the aims of this journal.

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