The Identification of Dyslexia in Preschool Children in a Multilingual Society

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Given the importance of reading proficiency to literacy performance and beyond, dyslexia has received much attention in recent decades, fuelling vast research elucidating the factors underlying reading difficulties. Research has consistently demonstrated the importance and benefits of early intervention, hence underscoring the need for early identification of dyslexia. However, the existing research and the various early screening instruments developed were largely based on children in monolingual societies. This study examined the early identification of dyslexia in preschool children in a multilingual society such as Singapore. The Dyslexia Early Screening Test – Second Edition (DEST-II), and the Cognitive Profiling System (CoPS) were administered to Kindergarten One and Two preschoolers. In addition, a rating scale on the children's literacy development was also administered to the teachers of these preschoolers. Preliminary results suggest that the DEST-II and the teachers' rating scale are effective and reliable first-line screening instruments in the identification of preschool children "at risk" of dyslexia, albeit with some adaptations for use in the local context.

Keywords: Preschool screening, teacher rating scales

Reading proficiency is essential for educational success in school and into the later stages of life. Given the importance of literacy performance, an extensive amount of research has been conducted over the past few decades to understand and elucidate the factors underlying reading difficulties. In particular, the emergence of greater awareness and attention to dyslexia has fuelled vast research on this specific learning difficulty.

DYSLEXIA AS A SPECIFIC LEARNING DIFFICULTY

Dyslexia is a neurologically-based specific learning difficulty that interferes with the acquisition and processing of language that is not caused by a lack of intelligence or opportunities for learning (The International Dyslexia Association [IDA], 2002). It is characterised by difficulties in reading, spelling and/or writing that typically result from a deficit in the phonological component of language (IDA, 2002). Apart from these cardinal problems, there may be accompanying weaknesses in the areas of language acquisition, phonological processing, speed of processing, working memory, auditory and/or visual perception, sequencing and organisation (The British Dyslexia Association [BDA], 2006). In addition, dyslexia is also associated with poor motivation, impaired attention and academic frustration.

The extent to which dyslexia is apparent in a particular language is a function of the quantity and quality of exposure to that language and other languages. Individuals with dyslexia are likely to have greater difficulty with languages of more complicated orthographic, phonological and/or grammatical systems. The incidence of dyslexia in Singapore is within the international range of 3% to 10% (Snowling, 2000). This translates to about 20,000 children in local primary and secondary schools, and another 3,500 children in preschool education. In other words, an average of one to two students in every classroom of 40 students is estimated to be dyslexic and will need ongoing specialist teaching and support.

IDENTIFICATION AND ASSESSMENT OF DYSLEXIA

There have been a number of different approaches to diagnose dyslexia. Among these approaches, the Discrepancy and the Symptomatic approach emerge as the main ones used in identifying dyslexia. The advantages and disadvantages of each approach are discussed as follows.

THE DISCREPANCY APPROACH

As the mainstream methodology used to diagnose dyslexia, the Discrepancy approach identifies specific underachievement in a child's literacy attainments, in the areas of reading, spelling, writing and/or comprehension, relative to his or her intellectual capacity. Although this method is highly debated (e.g., Stanovich, 1994; 2005), it is nevertheless the diagnostic criteria that is reflective of mainstream definitions of the dyslexia construct (e.g., World Federation of Neurology, 1968) and is the diagnostic criteria set forth by the Diagnostic and Statistical Manual – Fourth Edition (American Psychiatric Association, 2000). In addition to an ability-achievement discrepancy, cognitive deficits including weaknesses in processing speed and working memory are also present.

According to this model, a diagnosis of dyslexia is made if the child's performance on various literacy tasks is significantly below what is expected given his or her cognitive functioning – a diagnostic criteria also known as the "wait to fail" model. Consequently, a child with an average level of intellectual ability yet demonstrates below average literacy performance suggests dyslexia. Likewise, despite age-appropriate literacy attainments, a child with high cognitive abilities may be found to be dyslexic as he or she is not performing up to his or her potential academic ability. Accordingly, this approach provides a clear, direct and straightforward methodology for the identification of dyslexia.

On the other hand, to obtain a clear discrepancy between one's cognitive ability and literacy achievement, the child would have to experience failure and lag significantly behind in school. Relative to other children with no learning difficulties, these children typically receive less practice in reading (Allington, 1984), missed the opportunity to develop reading comprehension skills (Brown, Palincsar & Purcell, 1986), might have acquired negative attitudes about reading (Oka & Paris, 1986) or develop a low self esteem (Humphrey, 2002). Of greater importance is that once these children have delayed the development of critical word reading skills, it may require intensive interventions to improve and restore adequate levels of reading accuracy (Allington & McGill-Franzen, 1989; Vaughn & Schumm, 1996). This is further exacerbated by the large amount of reading practice that is lost with time as these children remain poor readers (Torgesen, 1998). Children who lag behind in the development of early reading skills have fewer opportunities to practise reading.

Recent evidence suggests that due to this loss of practice, it is extremely difficult for children who remain as poor readers during the first three years of elementary school to acquire age-appropriate levels of reading fluency (Torgesen, Rashotte, & Alexander, 2001). Consequently, recent studies have increasingly focused on the identification of dyslexia in early years to facilitate early intervention.

THE SYMPTOMATIC APPROACH

Through the identification of various characteristics and symptoms of dyslexia, the Symptomatic approach provides an alternative methodology to the assessment of dyslexia. According to this model, dyslexia-type symptoms such as literacy errors, phonological processing difficulties, sequencing difficulties, as well as poor working memory and motor skills provide a basis for a positive diagnosis. Using this approach, some early dyslexia screening tools aim to identify children who are "at risk" of dyslexia by examining some of these underlying deficits.

Several studies have documented various factors that strongly correlate with reading ability and reliably distinguish between successful and poor readers. Among these include phonological processing skills (Badian, 1998; Felton & Brown, 1990; Foorman, Francis, Shaywitz, Shaywitz, & Fletcher, 1997), short-term memory for words, digits and other verbally coded material (Fowler, 1991; Sawyer, 1992), and rapid serial naming skills (Wolf & Bowers, 2000). Other issues such as family history, speech development, birth history and socioeconomic status are also significant differentiating factors (Badian, 1988). In addition, research has also shown that a child's language experiences such as rhyming and sound game activities, as well as reading interactions, too influence the development of skills necessary for reading competence (Lonigan, Anthony, Bloomfield, Dyer, & Samwel, 1999; MacLean, Bryant & Bradley, 1987).

Apart from preventing the child from experiencing failure before help is given, the Symptomatic approach is particularly useful for the early identification of (and subsequently, the provision of early intervention for) dyslexia in young children such as preschoolers. This is especially so given that preschool children would have rather limited literacy skills and are thus less likely to demonstrate a discrepancy between their abilities and attainments.

SINGAPORE: A MULTILINGUAL PERSPECTIVE

The identification and diagnosis of dyslexia in Singapore is compounded by multilingualism. With the rise and prevalence of globalisation in the world, multilingualism and linguistic diversity have assumed a global identity. Consequently, the identification of dyslexia in a multilingual society such as Singapore has implications for all multilingual communities in many countries. Multilingual students live in an environment in which they are regularly exposed to, or need to use, two or more languages at home and at school. However, this does not imply that they are fluent in these languages or that they are competent and literate in any of these languages. In contrast, a monolingual student uses only one language at home and at school, but may learn a foreign language (or more) at school.

Within the local scene, the nature of the different languages used among various ethnic groups presents different problems. English and Malay are alphabetic languages; Chinese is a logographic script; and Tamil and Hindi are syllabic scripts. Due to cultural differences and the inherent confusion between different languages, children in Singapore are presented with great challenges as they negotiate between the local working language – English – and their respective Mother Tongues. Furthermore, given that English is adopted as the academic language and the main medium of instruction in school, many children coming from non-English speaking backgrounds, termed English-as-second-language

(ESL), may encounter difficulties learning to read and spell as a consequence of limited exposure to the English language, rather than due to a specific learning difficulty such as dyslexia per se.

On the other hand, the identification of dyslexia in a multilingual society such as Singapore is almost always based on assessment and screening tools which were developed in monolingual societies. There are fundamental differences in linguistic, cultural, social and educational experiences between children in monolingual and multilingual societies. Consequently, it is important to determine if these tools can exercise adequate levels of diagnostic sensitivity and specificity by reliably distinguishing children with dyslexia from children presenting with other confounding issues that also contribute to literacy difficulties (e.g., ESL). The last decade has seen a rising interest in multilingualism and international cooperation and networking in research. This research suggests that dyslexia is a language-based disorder that may manifest itself differently in different language systems (Miles, 2000).

THE BENEFITS AND IMPORTANCE OF EARLY IDENTIFICATION OF DYSLEXIA

There is an extensive amount of research demonstrating the benefits and importance of early identification and intervention of reading difficulties. Early reading failure has been shown to have a broad impact on general cognitive development (Cunningham & Stanovich, 1998) and the demand for literacy in our technologically advanced society is increasing (Snow, Burns, & Griffins, 1998). Generally, the earlier the intervention, the easier it is for a child with dyslexia to learn to read, and the lower the incidence of psychological issues associated with reading difficulties. Research has demonstrated that children who were unsuccessful readers in first grade almost invariably remained as poor readers (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Juel, 1988; Torgesen & Burgess, 1998). Due to the fact that it is increasingly difficult to remediate reading difficulties as the child progresses into the later school years (Fletcher & Foorman, 1994), the gap between successful and poor readers widens over the elementary school years (Stanovich, 1986). The situation is further exacerbated by the persistence of reading difficulties throughout school and into adulthood (LaBuda & DeFries, 1988).

In contrast, children who are successful readers at the start of school are likely to experience academic success, graduate from high school and college and subsequently, seek employment after school (Slavin, Karweit, & Madden, 1989). Studies have consistently documented the benefits that early intervention yield in the acquisition of reading skills and on measures of reading and spelling (e.g., Ball & Blachman, 1991; Felton, 1993; Foorman, Francis, Fletcher, Schatschneider,

& Mehta, 1998). Given the pivotal role of reading in a child's success in school and thereafter, and the benefits of early literacy intervention, the early identification of dyslexia in preschool children is essential.

There are also some advantages of early screening tests. A screening assessment is a relatively short evaluation aimed at identifying children at risk of dyslexia, as compared to a detailed psychological assessment which usually occurs over two sessions. Accordingly, the former assessment is usually relatively inexpensive and may be administered by school professionals (e.g., teachers, special needs officers). This is in contrast to the latter assessment which requires a trained professional to administer. In addition, a screening assessment can also serve as a filter to identify children who demonstrate greater risk of dyslexia so that these children who require a detailed diagnostic assessment can go on to receive it.

AIM OF CURRENT RESEARCH PROJECT

Taking into the consideration the complexities involved in the identification of dyslexia, it is both important and beneficial to ascertain the suitability and applicability of contemporary assessment tools to the local multilingual population. This is particularly so for those children who are not native English speakers. In addition, early identification of dyslexia in preschool children leads to the possibility of early intervention aimed at preventing prospective failure in school during later years. Consequently, the aim of the present research study is to investigate and review the best way to identify preschool children in Singapore who are "at risk" for dyslexia. Two contemporary screening tools developed for preschool children of this age range would be examined and compared: the Dyslexia Early Screening Test – Second Edition (DEST-II; Nicolson & Fawcett, 2004) and the Cognitive Profiling System (CoPS; Singleton, Thomas, & Leedale, 1996). These assessment and screening instruments were chosen due to their comprehensive coverage of the various symptoms of dyslexia, as well as their extensive use in the United Kingdom.

In addition, a rating scale of behavioural characteristics developed for use by teachers will be used to obtain information about the child's learning behaviour and performance in class. Teachers' ratings of behaviour and learning progress of a child in the classroom setting may play an important role in the early identification of children "at risk" for dyslexia. Such reports have been frequently used as part of comprehensive diagnostic procedures such as that for children with general learning difficulties (e.g., Myklebust Pupil Rating Scale; Margolia, Sheridan, & Lemanowicz, 1981) and Attention-Deficit Hyperactivity Disorder (e.g., Conners' Teacher Rating Scales – Revised; Conners, Sitarenios, Parker, &

Epstein, 1998). Through the administration of these instruments and rating scale, the present study aimed to examine and elucidate the effectiveness of these tools in identifying preschool children who are "at risk" for dyslexia, including the consistency in identification outcomes among these different instruments.

METHOD

Participants

Kindergarten One and Two preschoolers, aged between 4 years 6 months and 6 years 5 months, from one kindergarten and four childcare centres in Singapore were included in the study: (1) St. James' Church Kindergarten; (2) Learning Vision @ Punggol Field Walk; (3) NTUC Childcare Bukit Merah; (4) NTUC Childcare Bedok; and (5) NTUC Childcare Jurong West. These centres were selected to obtain a representative sample and include children from diverse backgrounds. With the assistance of these selected centres, letters of consent including information about the study and some questions about the child's background information were sent to parents. A total of 136 children participated in the study upon parental consent. However, the final sample of children who completed the study was reduced to 119 following the language screening test.

MATERIALS

Rating Scale. A rating scale was constructed based on the major characteristics of dyslexia commonly displayed by preschool children. At the pilot phase, feedback was collected from a few kindergarten teachers and principals to ensure that all items are comprehensible. A few changes were made to the wording of the items and the revised version of the rating scale comprised 21 items covering the following area of difficulties: (i) phonics; (ii) reading/spelling/ writing; (iii) speech; (iv) motor skills; and (v) general. Teachers were instructed to rate the child on the respective dimensions based on his or her performance relative to same-aged peers, using a 5-point frequency scale anchored at the ends with 1 = Never and 5 = Always.

British Picture Vocabulary Scale – Second Edition (BPVS-II). The language screening procedure was conducted through the administration of the BPVS-II (Dunn, Dunn, Whetton, & Burley, 1997). The BPVS-II is designed for use with children from age three to 15 years and is used to measure a child's level of English receptive vocabulary. Each item has four simple black and white illustrations on a page arranged in a two-by-two array. The child is simply required to select the picture that is considered to best illustrate the meaning of a target word presented orally by the examiner.

In order to exclude the confounding influence of language comprehension on task performance, an exclusion criterion was adopted to screen out children who may have problems understanding and following the instructions on subsequent test instruments. In particular, children with BPVS scores of less than 70 (more than two standard deviations away from the mean of 100) were excluded from the study.

Dyslexia Early Screening Test – Second Edition (DEST-II). The DEST-II (Nicolson & Fawcett, 2004) is a dyslexia screening instrument intended for use with children aged between 4 years 6 months to 6 years 5 months. It was designed to identify children "at risk" for reading failure early enough so that they can be given extra support in school.

The DEST-II comprises 12 subtests which assess the child's ability in the areas of phonological awareness and discrimination, pre-reading skills, motor skills, rapid naming ability, working memory, spatial sequential memory, balance ability, receptive vocabulary and verbal reasoning. These tests were based on a review of the literature on dyslexia and chosen to include a sufficiently comprehensive range of skills found to be impaired in individuals with dyslexia (e.g., Bishop, 1985; Denckla & Rudel, 1976; Fawcett, Maclagan, & Nicolson, 2001; Wolf & Bowers, 1999). Performance on each subtest is reflected by an "At Risk Index", which is used to compute an overall "At Risk Quotient" (ARQ) ranging from 0 to 2. An ARQ of 0.9 or greater is strong evidence of being "at risk" of dyslexia, and an ARQ of 0.6 to 0.8 is mild evidence of being "at risk".

For the purpose of this study, only 10 out of the 12 subtests were administered. The Postural Stability subtest was excluded due to concerns about the administering procedure – blind-folding and touching the child's body – which may be intimidating to the child. In addition, the Vocabulary subtest as a measure of receptive vocabulary and verbal reasoning was excluded as the BPVS-II was already administered. Furthermore, given that some children come from a non-English speaking background, including the Vocabulary subtest may not provide as adequate an indication of dyslexia in Singapore as in other monolingual societies.

Cognitive Profiling System (CoPS). The CoPS (Singleton, Thomas, & Leedale, 1996) is a computer-based standardised assessment instrument intended for use with children aged between 4 years 0 months to 8 years 11 months. It is designed for use by individuals trained in the field of education or psychology to identify children's cognitive strengths and weaknesses. The gathered information can assist in the identification of dyslexia, various developmental difficulties and other special educational needs so as to recognise the child's learning style and provide them with individualised and differentiated teaching.

The CoPS consists of nine tests delivered in the form of games to assess the following areas of cognitive ability: visual/verbal sequential memory; visual/spatial sequential memory; auditory/visual associative memory; auditory/verbal sequential memory; visual/verbal associative learning; phonological awareness; auditory (phoneme) discrimination; colour discrimination; information processing speed; and motor processing. Each test is preceded by verbal instructions delivered by the computer, followed by a practice phase in which the child is told by the computer how to play the 'game'. A mouse practice activity is incorporated into the program to provide an opportunity for the child to practise moving and clicking the mouse. This is especially important for children with no experience using a computer mouse.

PROCEDURE

Stage 1: Pre-testing & Pilot

All the researchers went through a period of training to familiarise themselves with the administration and scoring procedure for the BPVS-II, DEST-II and CoPS. Each researcher then conducted a trial run and administered these instruments to a volunteer.

Stage 2: Checklist & Screening

Teachers' Rating Scale. Rating scales were distributed to the teachers through the principals of the selected centres. With the exception of those children whose parents had opted to be excluded from the study, teachers were requested to rate each child individually using the rating scales provided.

Screening Procedure. All children with parental consent to participate in the study were administered the BPVS-II during the first session of testing. Those who scored exceptionally poor (BPVS < 70) were excluded from the next stage of the study.

Stage 3: Experimental Testing (Sessions 2 to 5)

The final sample of children was then administered the DEST-II and CoPS. Due to the rather long administration time needed for the COPs (approximately 45 minutes to an hour; as compared to the DEST-II which takes about 20 to 30 minutes), and the relatively shorter attention span of young children, the CoPS was subdivided into CoPS1, CoPS2, and CoPS3 to be completed in three separate sessions in that order, as shown in Table 1. Each sub-session comprised a combination of visual and auditory/verbal tests. In addition, all

children were required to complete the mouse practice activity before commencing any of the actual tests.

Table 1. Breakdown of CoPS into three different sessions

CoPS1	CoPS2	CoPS3
(Mouse Practice)	Toybox*	Rabbits*
Clown‡	Rhymes†	Zoid's Letter Names†
Zoid's Friend*	Zoid's Letters*	Races†
Wock†		

**Visual Tests; †Auditory/Verbal Tests; ‡Colour Discrimination*

RESULTS & DISCUSSION

Prior to any analysis, the collected data from the various instruments were screened. For the purpose of preliminary analysis, children with missing data from any of the instruments administered (i.e. teachers' checklist, DEST-II, CoPS) were excluded from data analysis. These included one child who was consistently absent from school and another who withdrew from school and thus, did not participate further in the study. Consequently, the final sample size used for data analysis was reduced from 119 (following language screening using BPVS-II) to 97.

PARTICIPANT CHARACTERISTICS

Table 2 provides a summary of the demographic characteristics and level of receptive vocabulary of the children from the five preschool centres. There were no significant differences in age (at first testing), $F(4, 92) = 1.70$, ns, nor gender distribution, all $c2(1) < 0.90$, ns, between the children from the five preschool centres.

However, at the centre level, these children were significantly different in terms of their level of receptive vocabulary reflected by the BPVS-II scores, $F(4, 92) = 7.49$, $p < .001$ (see Figure 1). A further analysis of these scores revealed that children from preschool centres 1 and 2 scored significantly higher than children from the other three centres[1]. In retrospect, while the five preschool centres

Table 2. Age, Gender Distribution, BPVS scores and Race Composite by Preschool Centre

Characteristics	Centre 1 (n = 13)	Centre 2 (n = 12)	Centre 3 (n = 14)	Centre 4 (n = 40)	Centre 5 (n = 18)	Total Sample (N = 97)
Age at 1st test (years)						
M	5.43	5.09	5.60	5.32	5.34	5.35
SD	0.47	0.48	0.53	0.52	0.50	0.52
Gender						
Male	6	5	8	23	8	50
Female	7	7	6	17	10	47
BPVS-II Score						
M	99.77	102.25	85.86	88.23	91.17	91.71
SD	11.28	13.78	8.09	9.57	9.78	11.55
Race Composite						
Chinese	13	11	10	33	13	80 (82.5%)
Malay	0	1	1	6	5	13 (13.4%)
Indian	0	0	3	1	0	4 (4.1%)

were recruited from five different regions in Singapore, there may arguably be differences in the socioeconomic status of its residents.

Specifically, preschool centres 1 and 2 are situated in Holland Village and the new estate of Punggol respectively. In comparison, centres 3, 4 and 5 are situated in more mature and established housing estates. Almost all tested children from the former group of centres came from an English-speaking background (92% to 100%) as compared to a lower percentage of such children from the latter group centres (50% to 66%). On the other hand, preschool centres 3, 4 and 5 saw a relatively greater proportion of children from a non-English speaking or ESL background (more than 70% in these centres versus 46% in preschool centres 1 and 2).

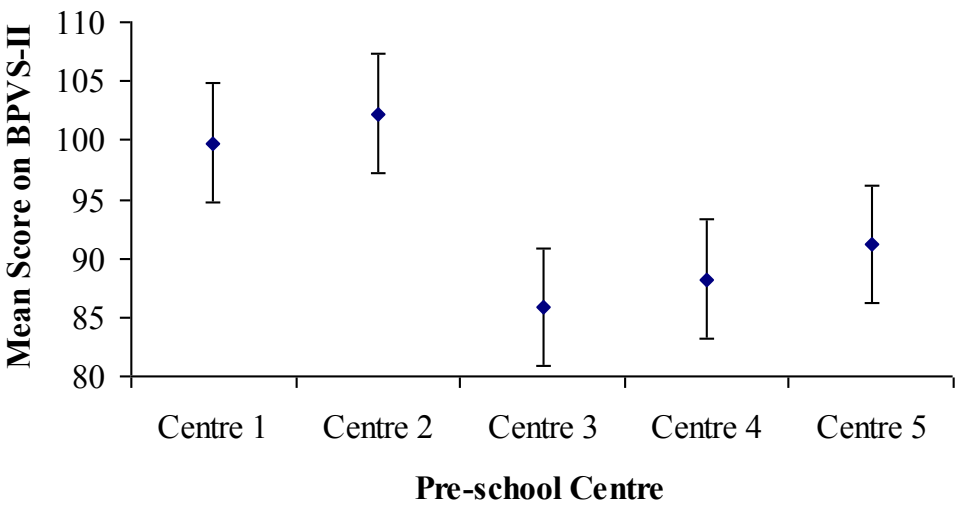

Figure 1. Mean scores on BPVS-II by preschool centre. 5% error bars are shown.

CoPS

Taking into consideration the short attention span of preschool children, each of the five sessions of testing was limited to twenty minutes. In addition, the original CoPS was divided into CoPS 1, 2 and 3 to be administered over three shorter sessions. Nevertheless, it was observed that many children required close supervision when completing the CoPS and they had to be constantly reminded to remain focused on the task at hand. Their inattention and distractibility appeared to have affected their performance on the various tasks. Although almost all children were fascinated by the attractive pictures and sounds presented using the laptop during the initial presentation of each sub-test, they lost interest quickly as the items presented were getting more difficult, or as the target stimuli that they should remember increased.

In addition, the nature of the CoPS is such that on the main test items, the child is required to produce a response on the computer mouse and subsequently, he/ she can then proceed to the next item regardless of whether the answer is correct. On the other hand, the practice items required the child to produce a correct response, upon which the failure to do so would see the practice items being repeated over and over again until a correct answer is recorded. Many children were observed to engage in random responding when unsure or when their attention drifted.

Table 3. Total Rating Scale Score by Preschool Centre

	Centre 1 (n = 13)	Centre 2 (n = 12)	Centre 3 (n = 14)	Centre 4 (n = 40)	Centre 5 (n = 18)	Total Sample (N = 97)
M	25.92	33.25	69.57	40.05	33.11	40.29
SD	8.21	9.63	16.77	11.01	18.36	18.3
Percentile						
10th	20	21.9	44	25.2	21.9	22
25th	20.5	24.5	57	30	22	24.5
50th	23	29.5	69.5	38.5	23.5	37
75th	28.5	44	84.25	49	40	50.5
90th	42.8	44.7	92.5	54	66.8	65

Table 4. "At Risk Quotient" on DEST-II by Preschool Centre

	Centre 1 (n = 13)	Centre 2 (n = 12)	Centre 3 (n = 14)	Centre 4 (n = 40)	Centre 5 (n = 18)	Total Sample (N = 97)
M	0.1	0.18	0.62	0.23	0.36	0.23
SD	0.1	0.16	0.38	0.17	0.23	0.26
Frequency(%) of:						
Strong risk (ARQ>0.9)	0	0	5 (35.7)	0	0	5 (5.2)
Mild Risk (0.6<ARQ <0.8)	0	0	1 (7.1)	1 (0.025)	4 (22.2)	6 (6.2)
No Risk (ARQ<0.6)	13 (100)	12 (100)	8 (57.1)	39 (99.075)	14 (78.8)	86 (88.7)

Consequently, the results on the CoPS are not reported as they did not appear to be reliable and preliminary analyses of the collected data revealed several inconsistencies that question the validity of the results. In general, at least at the preliminary level of analysis, the CoPS does not appear to be as an effective tool for the purpose of identifying preschool children "at risk" for dyslexia, in view of the aforementioned issues.

TEACHERS' RATING SCALE

The rating scale was completed by each participating child's school teacher to obtain an understanding of the child's day-to-day performance in school. It was noticed that some checklists contained missing data as the teachers did not complete every item. This could be due to the possibility that some items were not applicable to the school curriculum or that the teachers had no chance of observing the child carrying out certain activities. Alternatively, the teachers might have accidentally missed out some items.

A preliminary analysis of the distribution of scores on each item suggests that a number of items had a very positively skewed distribution. In general, about 10% of the scores lie within the extreme high end of the distribution. However, considering that dyslexia occurs in about 3% to 10% of the population, the results from the rating scale appear to be in accordance to prevalence statistics. Given a 5-point rating scale with 21 items, possible total scores on the rating scale range from 21 to 105, with higher scores indicating a higher frequency of the stated difficulty. Table 3 presents the descriptive statistics for total rating scale score by preschool centre. Reliability analysis revealed high internal consistency (Cronbach's $\alpha = 0.956$) of the items on the rating scale.

One-way ANOVA revealed significant differences between preschool centres on total rating scale scores, $F(4, 92) = 23.39$, $p<.001$. Post-hoc analysis demonstrated that children from preschool centre 3 scored significantly higher on the rating scale relative to children from all the other preschool centres. Notably, children from preschool centre 4 scored significantly higher than children from preschool centre 1.

DEST-II

On the DEST-II, the distribution of scores on some of the subtests was rather skewed. In addition, it appeared that Singaporean preschool children generally performed better on tests assessing motor coordination skills, digit span, letter naming and digit naming. In contrast, they did significantly poorer on tests that assessed their phonological awareness, especially rhyme. Consequently, the ARQ, which was calculated based on the child's overall performance on the

DEST, may not be a valid representation of the child's abilities in these areas in which many dyslexic individuals have difficulties. Table 4 presents the descriptive statistics of the DEST-II ARQ by preschool centre.

One-way ANOVA revealed significant differences between preschool centres on ARQ scores on the DEST-II, $F(4, 92) = 12.78$, $p<.001$. Post-hoc analyses demonstrated that children from preschool centre 3 scored significantly higher ARQs relative to children from all the other preschool centres. Children from preschool centre 5 scored significantly higher ARQs than children from preschool centre 1.

RELATIONSHIP BETWEEN INSTRUMENTS

To examine the consistency in identification outcomes across the different instruments, and the influence of children's language backgrounds on their level of performance, scores on the rating scale, DEST-II and BPVS-II were compared and examined. Pearson correlations revealed a significant relationship between scores on the rating scale and DEST-II, $r(97) = 0.63$, $p < .001$, and this correlation remained significant when differences in BPVS-II scores (i.e. the influence of receptive vocabulary) were partialled out of the relationship, $r(94) = 0.58$, $p < .001$. This suggests that a child who is found to be "at risk" on the DEST-II was also rated as demonstrating more difficulties by the teacher. This is a genuine and direct association that is not mediated by the child's receptive language.

It could be argued, that the teachers' teaching experience of preschool children might have affected their responses on the rating scale and hence mediated the association between total rating scale scores and ARQ on the DEST-II. However, correlational analysis suggest that this relationship remained strong when the teachers' teaching experience was partialled out of the association, $r(89) = 0.56$, $p < .001$. Taken together, it appears that there is consistency between a child's ability as reflected by the teachers' rating scale, and the child's performance on the DEST-II. At least at the preliminary level of analysis, there appears to be between-instrument reliability in identifying children "at risk" of dyslexia.

A scatterplot was obtained using the total rating scale scores and DEST-II ARQ. Regression functions were then calculated to determine whether a linear or quadratic function could significantly account for the data. Figure 2 illustrates both the resulting scatterplot, and regression lines.

There is a clear effect of teachers' rating scale on the child's ARQ on the DEST-II, which was significantly accounted for by a moderately strong linear function, $R2 = 0.39$, $F(1, 95) = 60.93$, $p < .001$. This revealed that the teachers' rating of the child's performance and behaviour in class is a significant and moderately

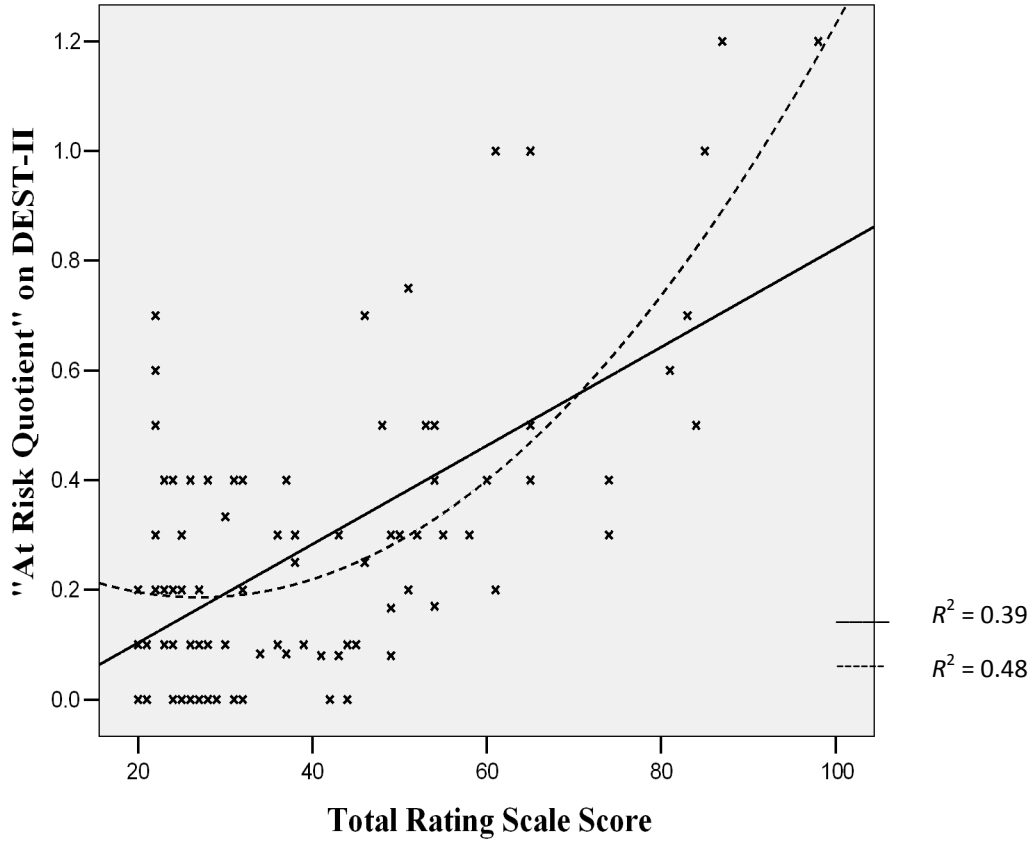

Figure 2. "At Risk Quotient" on DEST-II plotted against total rating scale score. Linear and quadratic regression functions are fitted to the data.

strong predictor of the child's "at risk" index on the DEST-II. Interestingly, a quadratic regression function significantly accounted for more variance of the ARQ on the DEST-II, R2 = 0.48, F(2, 94) = 43.00, p < .001. However, more research and data is needed before any inference can be drawn from this finding.

In general, the DEST-II appears to possess great potential for use as a screening instrument to identify preschool children "at risk" of dyslexia. The DEST-II requires a relatively short administration time and has a straightforward scoring and interpretive procedure. Also, given that it is intended for use by school professionals such as teachers and special needs coordinators, it provides a cost -effective method of conducting large-scale screening projects. Finally, preliminary results suggest the effectiveness of DEST-II in identifying Singaporean preschool children "at risk" of dyslexia, albeit with some adaptations for more applicable use in the local context.

FUTURE DIRECTIONS & AVENUES FOR RESEARCH

More research is needed to look into further modifications of the DEST-II for effective use within a multilingual society. With the increased prevalence of multilingual communities in many countries as a result of globalisation, the potential and implications of this research are far-reaching and significant. Given that preschool children in Singapore appear to perform better on some subtests and worse on others, future research can examine the best combination of subtests that produces the greatest ability to identify "at risk" children. Subsequently, it is important to establish the ease and reliability of the administration of the DEST-II as an initial screening instrument by teachers in preschool settings. The same applies to the teachers' rating scale which requires modifications based on the preliminary analyses and observations from the current study. Eventually, it is envisaged that the revised DEST-II and teachers' rating scale will serve as first-line screening instruments that are effective and reliable in the identification of dyslexia in preschool children in a multilingual society such as Singapore.

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