

ORIGINAL ARTICLE

# PHONOLOGICAL AWARENESS AND GLOBAL VISUAL SPATIAL ABILITY AMONG MALAY SPEAKING CHILDREN WITH SPECIFIC LEARNING DISORDER WITH DYSLEXIA

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## ABSTRACT

*Children with Specific Learning Disorder (SLD) faces challenges in academic areas and are often negatively labelled. The learning problems in SLD children were mainly due to poor phonological skill but not much was known about the contribution of visuospatial difficulties. Therefore, this study aims to determine the relationship between phonological awareness skills and global visual-spatial abilities among Malay speaking children with SLD, and to compare children with SLD and typical readers on intellectual functioning, phonological awareness and global visual-spatial ability. An equal number of typical readers (n = 36) and children with SLD were recruited. Data were coded and analysed using Kendall's Tau-b, independent samples t-test and Mann-Whitney U test. Results showed phonological skills have strong negative correlation with global visual-spatial ability (r = .55). The typical readers have significantly higher IQ and better phonological skills and better global visual-spatial skills as compared to the group with SLD. However, there is no conclusive evidence due to specificity of more than one area measured by the assessment tools. Nevertheless, it provides a direction for future research to look into global visual-spatial aspects of SLD to aid in educational instruction in the future, in addition to the long-standing phonology deficit theory.*

**Keywords:** Specific Learning Disorders; dyslexia; phonological awareness, global visual-spatial ability, intellectual functioning

## INTRODUCTION

There are various theories attempting to explain the aetiology of Specific Learning Disorder (SLD). However, several studies and meta-analysis suggested that phonological awareness deficits appeared to be the core cognitive impairment experienced by children with SLD in reading<sup>1-3</sup>. The phonology deficit theory states that there is an underlying deficit in the left hemispheric brain of a child with SLD in reading, controlling phonological and orthographical representations<sup>4-6</sup>. The deficit is thus reflected in the poor phonological task performance in terms of grapheme-phoneme segmentation<sup>6</sup>.

Similarly, recent studies using Malaysian samples have also suggested that phonological deficits are among the main contributors of SLD<sup>7-8</sup>. To date, SLD

with impairment in reading is prevalent among 314 000 students in Malaysia<sup>9</sup>. Experiences of being a person with SLD revolved around facing challenges in academic areas and having below average orientation skills and perform well in creative activities like art which may reflect visual abilities<sup>9</sup>. It appears to be that the Malay speaking population with SLD would have a profile with strong correlations among reading, spelling and decoding in which difficulty in one area will affect the other areas. However, the study was only done on the Malay ethnic group and warrants future research to include other ethnic groups who speak the Malay language<sup>7</sup>.

In today's society, SLD has been found to be the most common learning disability accounting up to 80 percent of the learning disabled population in general<sup>10</sup>. According to the DSM-V classification,

SLD is a biologically based, neurodevelopmental disorder that affects a person's ability to take in, process, and/or communicate information<sup>16</sup>. SLD can affect one or more of the following academic domains: reading, as in the case of dyslexia, written expression, and/or mathematics, as in the case of dyscalculia and difficulties in handwriting as in dysgraphia<sup>16</sup>. In the DSM-V, SLD includes the subtypes of learning disorders previously described in the DSM-IV namely dyslexia, dyscalculia, dysgraphia and writing expression. Contributing to such a large percentage of the population, oftentimes, children with dyslexia are labelled as lazy or intellectually challenged, as their deficit in phonological awareness is reflected in their difficulties in reading, writing and spelling. To support the statement, undergraduates with SLD in Malaysia reported that they are forgetful, have difficulties reading, spelling and expressing their ideas in the form of writing which in turn, causes them failure in completing assignments or repeating examinations<sup>11</sup>.

Despite their difficulties in learning, persons with SLD are often perceived as creative thinkers<sup>11</sup>. A longitudinal study by Finucci et al.<sup>12</sup> on boys with dyslexia within a period of 1 to 38 years after they attended school, found that over half of the sample size graduated from college. Among those who graduated, a majority of them were involved in managerial and business positions. The talent in visual thinking is supported by West<sup>13</sup> who found that individuals with dyslexia may have an advantage in this new era of visual technology. This is evidently reflected in the works of people such as the famous physicist, Albert Einstein and scientist, Michael Faraday<sup>14</sup>. However, visual approaches are not commonly emphasized in the Malaysian education system. Instead, emphasis is placed on strategies such as repetition, rote memorization, reading aloud and practice of sample exam questions<sup>15</sup>. It is therefore, important to identify the visual strengths of this population so that more suitable future intervention strategies and education system may be developed.

There are very few researches on SLD in Malaysia. To date, there is little attention being paid on the relationship between phonological awareness and global visual-spatial ability in children with SLD. Although there have been various researches conducted on phonological awareness and visual-spatial ability in other countries, results are inconclusive. Most of the previous studies were conducted separately on the two variables. Hence, there is limited information as to how these two variables relate to each other. The current study

will thus provide a clearer picture as to how these variables correlate with an additional predicted finding that confirms the hypothesis that typical readers and readers with SLD would have similar level of intellectual functioning.

This study will also provide up-to-date information as part of a growing research for parents and teachers to have a better understanding on the underlying characteristics of SLD in the Malay language. It will also provide a picture on how deficits and talents found in previous studies from various countries are reflected in the Malaysian context of Malay language speakers to provide a firmer understanding of the disorder in a local context.

The current study will not only provide insight into future educational strategies/instructions for individual with SLD by using their strengths in global-visual spatial ability (if found) to compensate for the deficit in phonological awareness skills, it can also provide insight into how neurological differences can be used to explain learning disorders in an attempt to decrease societal stigmatization.

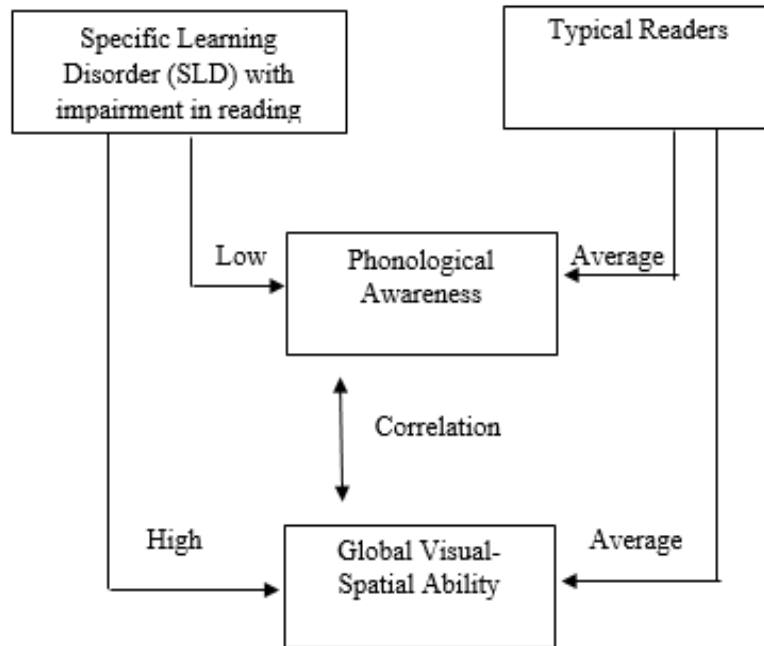
Additionally, the results of the current study will aid in relieving uncertainties about SLD and create awareness that despite deficits, individuals with SLD have strengths that can help them to be successful, if realized, in an attempt to maximise their potentials. In other words, it provides a fair judgement on the weakness and strength in individuals with SLD.

The objective of the study is to determine the relationship between phonological awareness skills and global visual-spatial abilities among Malay speaking children with SLD. Specifically, the study will determine (a) whether there is a significant difference between Malay speaking children with SLD and typical readers on intellectual functioning using Wechsler Intelligence Scale for Children (WISC-IV), (b) if there is a significant difference between Malay speaking children with SLD and typical readers on phonological awareness using the phonemic segmentation subtest of Dyslexia Screening Test Bahasa Malaysia (DSTBM), and (c) if there is a significant difference between Malay speaking children with SLD and typical readers on global visual spatial ability using the Block Design of WISC-IV.

The study is adapted from the Diverging Ability Hypothesis and Phonological Deficit Theory (Figure 1.0). According to the theory, children with dyslexia

would perform better on global task, identifying possible figures compared to their ability on a feature-oriented task, matching figures<sup>5-6,34,37</sup>.

**Figure 1: Conceptual Framework adapted from the Diverging Ability Hypothesis and Phonology Deficit Theory<sup>4,5,6,34</sup>**



**METHODOLOGY**

**Participants**

The matched group design is employed whereby the experimental group consists of 18 patients from the Health Psychology Clinic, Faculty of Health Sciences, Universiti Kebangsaan Malaysia diagnosed with Specific Learning Disorder whereas the control group consists of 18 primary school-aged typical-reading children attending Jalan Raja Muda School. The purposive sampling method is employed whereby the participants from the experimental group consisting of individuals with SLD are carefully selected based on the inclusion and exclusion criteria of the current study. Participants in the control group consisting of primary school-aged typical-reading children attending Jalan Raja Muda School were also carefully selected based on both inclusion and exclusion criteria, and the matching criteria of the participants in the experimental group. The study period was from June 2016 to January 2017. The study was approved by the ethical committee of the University Kebangsaan Malaysia. Previous studies faced similar difficulties in recruiting suitable participants as in this study<sup>34-36</sup>.

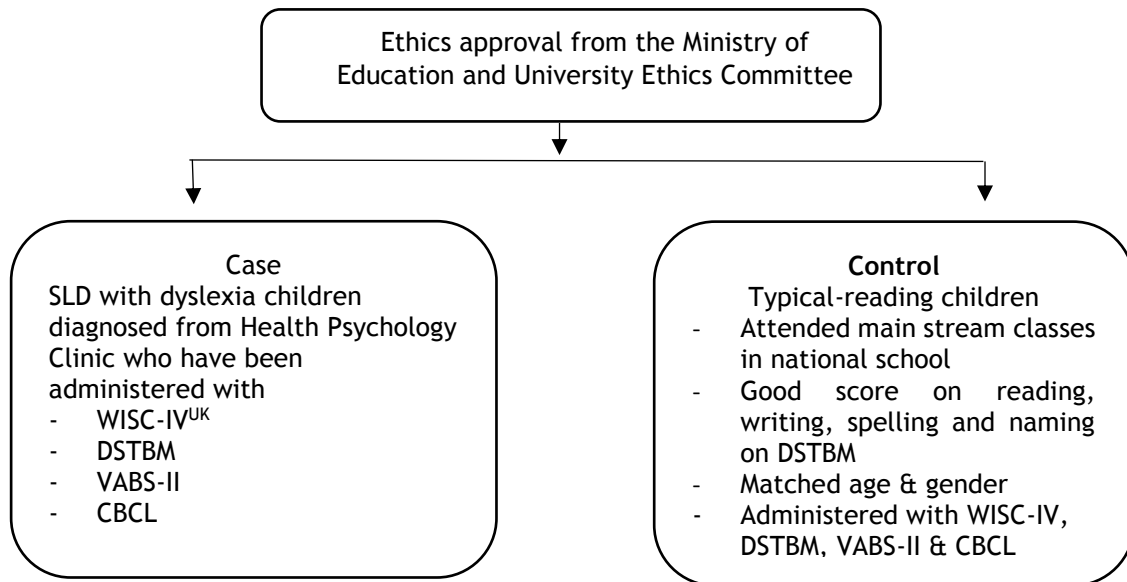
In order to reduce biasness in during the data collection phase, matching of participants in the control and SLD group was conducted. Besides matching the participants in terms of gender and age  $\pm 6$  months, the scores obtained from each of the four assessment instruments administered based on standardized instructions were carefully analysed whereby participants who yielded any elevation in scores that were suggestive of a comorbidity/neurological or psychiatric condition that may affect cognitive abilities were excluded from the research. To reduce the possible limitation of language familiarity, the participants were recruited from mainstream schools where Bahasa Malaysia is used as the main medium of communication, as our research aimed to study Malay-speaking children.

The inclusion criteria include: a) Malay speaking children in the age range of 7-12 years old who are diagnosed with Specific Learning Disorder according to the criteria of DSM-5<sup>16</sup> and b) Malay speaking children attending National School (Sekolah Kebangsaan). The exclusion criteria include the presence of any other neurologic or psychiatric

condition that may affect cognitive abilities indicated by scores within the Significant Problems

range (above *T* score of 66) in any of the CBCL 4-18's scale.

Figure 2.0: Flow chart of the study



**Procedures and measures**

First of all, the approval of ethics was required from the Ministry of Education and University Ethics Committee. The ethical approval was then followed by the approval from the selected school (National School of Jalan Raja Muda) (Figure 2).

Participants in the experimental group were selected from the records of patients who have attended the Health Psychology Clinic, UKM and met the inclusion criteria of the current study. Clients from the Health Psychology Clinic who did not complete all four required assessments namely the Wechsler Intelligence Scale for Children Fourth Edition (WISC-IV), the Dyslexia Screening Test Bahasa Malaysia (DSTBM), The Vineland Adaptive Behaviour Scale Revised Edition (Vineland-II) and the Child Behaviour Checklist (CBCL) were invited for a session to complete them to qualify for the inclusion in this study. Alternatively, self-rating forms such as CBCL and Vineland-II were either posted through mail or e-mail.

The four instruments were routinely administered to rule out the diagnosis of SLD children in the Health Psychology Clinic besides other cognitive tests. WISC-IV and Vineland-II tests are useful to rule out the diagnosis of intellectual disabilities (ID) while DST is used to screen for the risk of dyslexia. The CBCL is used to assess problematic behaviours in the past six months to aid clinical decision or

diagnosis, which in this case, is SLD. SLD children usually have associated internalizing or externalizing problems

After data from the experimental group has been obtained, typical readers from the National School of Jalan Raja Muda, Kampung Baru Kuala Lumpur who matched the participants of the experimental group in terms of gender and age of  $\pm 6$  months were recruited. Typical readers in this study are operationally defined as children who: 1) attended the main stream classes, 2) able to perform in time-limited reading, writing, spelling and naming tasks determined by scores on DSTBM with At Risk Quotient (ARQ) less than 1.0. All four assessments (WISC-IV, DSTBM, Vineland-II, and CBCL) were administered to the typical readers in the school after consent had been obtained from their parents. However, parents who could not attend the assessment sessions due to various reasons (main reason: work) were given an alternative to complete them at home, in a self-rating format. They were then required to hand it over to the researcher where their answers were checked. Only completed forms were collected. Incomplete forms (i.e., incomplete answers) were returned in order for them to be completed and were re-collected at another stipulated day and time. Additionally, participants who needed further clarification were given an opportunity to contact the researchers.

### **Measurement for Phonological Awareness Skills**

A phonological awareness skill in this study is referred to the individual's performance in word and sound segmentations and is measured by the Phonemic Segmentation of the Dyslexia Screening Test Bahasa Malaysia (DSTBM). The score ranged from very poor, poor, below average, average and above average.

### **Measurement for Global Visual-Spatial Ability**

Global visual-spatial ability in this study refers to the individual's ability to look at the picture as a whole instead of its parts; measured by the Block Design subtest of the Wechsler Intelligence Test for Children, Fourth Edition (WISC-IV).

### **The Wechsler Intelligence Scale for Children, Fourth UK Edition (WISC-IV<sup>UK</sup>)**

The WISC-IV<sup>UK</sup> <sup>17</sup> is an individually administered psychological tool to assess the general cognitive ability of individuals aged 6 years to 16 years 11 months old. There are 10 core subtests and 5 supplemental subtests which were categorised into four indexes namely the Verbal Comprehension, Perceptual Reasoning, Working Memory and Processing Speed index. The Verbal Comprehension Index measure the ability to understand and process verbal instructions besides verbal expression. On the other hand, the Perceptual Reasoning Index measures the individual's fluid reasoning through tasks that requires problem solving skills, hand manipulation, hand-eye coordination and speed of task completion. The Full Scale IQ in which scores are totalled up represents one's general intellectual ability. The WISC-IV has a reliability coefficient ranging from 0.88 to 0.97 on composite scores<sup>18</sup>.

In the current version of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition<sup>16</sup>, a specific level/score of IQ is not mentioned as a criterion for diagnosis. However, one important criteria to note for the diagnosis of SLD to be established is that the learning difficulties are not better explained by intellectual disabilities. Additionally, individuals with SLD may have a significant weakness in Verbal Comprehension Index (VCI) and Working Memory Index (WMI) on the WISC-IV <sup>17</sup>. Therefore, the current study takes IQ into consideration so that children with SLD can be distinguished from children with Intellectual Disabilities (ID). At the same time, they can be compared with typical readers as Ferrer and colleagues (2010) has proven that the IQ of typical readers is linked to reading whereas the IQ of individuals with SLD diverge with reading. This means that poor reading is not reflected by poor IQ, which is often misunderstood.

### **The Dyslexia Screening Test Bahasa Malaysia (DSTBM)**

Dyslexia Screening Test (DST) <sup>19</sup> is a screening tool to identify people aged between 6 years 6 months and 16 years 5 months at risk of having dyslexia. There are 11 subtests classified under attainment tests are tests of fluency and accuracy to check an examinee's struggle with reading, writing and spelling as well as to assess the need for extra time in examinations through reading and writing subtests. The screening tests assess the reasons for the problem manifestations. A profile of difficulties can also be assessed through these subtests and acts as a guide for intervention programmes or further assessments. The Dyslexia Screening Test Bahasa Malaysia (DSTBM) was adapted from the Dyslexia Screening Test with a Cronbach alpha coefficient of .792 when tested with 501 Standard Two pupils in the Klang Valley area<sup>8</sup>.

### **The Vineland Adaptive Behaviour Scale - Second Edition (VABS-II)**

The Vineland Adaptive Behaviour Scale - Second Edition <sup>20</sup> measures adaptive behaviour in people from birth to 90 years old. The Vineland-II is characterized by 4 domains in which there are 2 or 3 subdomains in each of them. Communication, Daily Living Skills, Socialization and Motor Skills (optional for individuals aged 7 years and older) make up the Domain which reflects an Adaptive Behaviour Composite. It is widely used to examine behaviours in an individual's everyday life to aid in making a clinical decision or diagnosis. The Vineland Adaptive Behaviour Scale has good internal consistency of .84 to .93 for the Communication domain, .86 to .91 for the Daily Living Skills domain, .84 to .93 for the Socialization domain, .77 to .90 for the Motor skills domain, .85 to .91 for the Maladaptive Behaviour Index and .93 to .9 for the Adaptive Behaviour Composite<sup>21</sup>.

### **The Child Behaviour Checklist 4-18 (CBCL)**

The Child Behaviour Checklist 4-18 <sup>22</sup> is a rating instrument in which parents or individuals who know the child well rate the child's problematic behaviours and competencies in the past 6 months. It can either be self-rated or rated through an interview. Additionally, it can measure a child's behavioural changes across time following a treatment. Eight constructs or syndromes are measured: Withdrawn, Somatic Complaints, Anxious/Depressed, Social Problems, Thought Problems, Attention Problems, Delinquent Behaviour, and Aggressive Behaviour, which can be more broadly categorized into Internalizing Problems and Externalizing Problems. The Child Behaviour Checklist 4-18's internal consistency is



good with the coefficient of .72 to .96 across the scales<sup>22</sup>.

**Statistical Analysis**

Using SPSS version 22, the parametric test was used to determine whether there is a significant difference between readers with SLD and typical readers in the areas of phonological awareness and global visual-spatial ability whereas the non-parametric test was used to determine if there is significant correlation between phonological awareness and global visual-spatial ability. Coding was first done for the raw data of phonological awareness that was analysed in terms of the ‘At risk’ index while the global visual-spatial ability was analysed based on classification scores on the Block Design subtest.

**RESULTS**

The relationship between phonological awareness skills and global visual-spatial abilities among Malay speaking children with SLD showed strong negative correlation ( $r = -.55, p < .001$ ) (Table 1). Kendall’s tau-b analysis indicated that the correlation between Block Design subtest of the WISC-IV measuring global visual spatial ability and Phonemic Segmentation of the DSTBM measuring phonological awareness was strong and negative ( $\tau = .55, p < .001$ ). The negative correlation is due to the opposite direction of the DST At Risk Index scoring whereby higher index score indicates poorer performance while higher score for the Block Design subtest of the WISC-IV means better performance.

**Table 1: Correlation between Block Design and Phonemic Segmentation for Group with SLD**

	Block Design of the WISC-IV
Phonetic Segmentation of the DSTBM	-.546**

\*\* Correlation is significant at the 0.01 level (2-tailed)

Comparison on IQ level between Malay speaking children with SLD (n = 18) and typical readers (n = 18) on intellectual functioning using WISC-IV showed significant differences on Verbal

Comprehension Index, Working Memory Index, Processing Speed Index, and Full Scale IQ (Table 2). Children with SLD scored lower on all indexes compared to typically developing children.

**Table 2: Independent t test for IQ composites between group with SLD and group with typical readers**

	SLD		Typical Readers		t	p
	M	SD	M	SD		
VCI	74.89	12.14	95.89	11.78	-5.21	0.000
WMI	71.94	14.95	93.11	11.37	-4.78	0.000
PSI	81.89	16.66	104.94	11.50	-4.83	0.000
FSIQ	71.89	15.39	97.50	9.23	-6.06	0.000

VCI = Verbal Comprehension Index; WMI = Working Memory Index; PSI = Processing Speed Index; FSIQ = Full Scale Intelligence Quotient

Comparison between Malay speaking children with SLD and typical readers on phonological awareness using the phonemic segmentation subtest of Dyslexia Screening Test Bahasa Malaysia (DSTBM)

showed that typical readers had better performance ( $U = 16.50, z = -4.84, p = .000$ ) (Table 3).

**Table 3: Mann-Whitney U test for Phonetic Segmentation between group with SLD and group with typical readers**

	Phonetic Segmentation
Mann-Whitney U	16.500
Wilcoxon W	187.500
Z	-4.837
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>b</sup>

a. Grouping Variable: Group, Not corrected for ties

Comparison between Malay speaking children with SLD and typical readers on global visual spatial ability using the Block Design of WISC-IV showed

that children with SLD had lower performance than typical readers ( $t = -4.26, p = .000$ )(Table 4).

**Table 4: Independent t test for Block Design between group with SLD and group with typical readers**

	Group				t
	SLD		Typical Readers		
	M	SD	M	SD	
<b>Block Design</b>	6.50	3.01	10.22	2.16	-4.26

**DISCUSSION**

The results suggest that there was a tendency for Malay speaking children with SLD who have good score at phonological awareness skills (lower risk of dyslexia) to have higher scores on the Block Design which reflect good performance on visual spatial abilities. This supports the hypothesis of the current study and is consistent with the magnocellular theory<sup>23</sup> whereby children with dyslexia have main difficulties with phonological awareness and defective processing of visual processing. Children with dyslexia tend to displace letters within a word which invert them and making words appear distorted, overlapping and moving.

The findings of the current study may be due to the specificity of the Block Design subtest which is not just simply measuring one specific area of visual processing. Therefore, poor performance on the Block Design subtest may be due to a weakness in other areas such as visual-motor coordination, nonverbal concept formation, visual perception, organization, observation and matching abilities. It is also important to note that the relationship between phonological awareness skills and global visual spatial abilities is not a causal relationship but rather, a correlation. Therefore, the current findings indicate that individuals with SLD have a primary deficit in phonological skills with possible underlying visual deficits.

Typical readers scored higher in general intellectual functioning (FSIQ) and the four composites of the IQ test (VCI, PRI, WMI, PSI) in comparison to children with SLD. This finding does not support the hypothesis of the current study. However, it is important to note that the FSIQ is uninterpretable when there is a significant discrepancy in VCI and PRI which is often the case for individuals with SLD as they may have a significant weakness in Verbal Comprehension Index (VCI) and Working Memory Index (WMI).<sup>17</sup> Therefore, FSIQ solely does not accurately reflect the IQ across both groups especially the group of children with SLD. The four

composites, are thus, more specific measures of the components of general intellectual functioning.

In comparison to typical readers, the group with SLD had lower IQ scores across the four composites which may be due to various factors and not a cognitive deficit alone. Therefore, it is important to note that the findings do not directly imply that a child with SLD is associated with low IQ. Instead, the low IQ scores can be better explained by the deficit in skills needed to perform the type of tasks on the IQ test. First of all, children with SLD face difficulties in one or more areas of learning which may be reflected in poor academic performance. This may be due to various factors. Among them are the vicious cycle of initial poor performance in academics that may lead to the belief that he or she is unable to understand and do well, thus leading to the lack of interest and further underperformance in academics. Therefore, this lack of motivation to engage in tasks that require mental effort may have been reflected in the current findings.

Additionally, many children with SLD face difficulties in reading fluency due to a weakness in working memory, which further contributes to the difficulty of learning and retaining the amount of word-knowledge acquired to perform on the VCI. They are also believed to have poor auditory working memory as it involves retaining and manipulating sounds of words. The poor performance can be affected by motor coordination as certain individuals with SLD are believed to have poor motor coordination. Therefore, findings of the PSI may provide a direction for future research to look into the processing speed deficit theory. Poor performance on the PRI, on the other hand, may reflect poor visual processing which also warrants future research to look into the more subtle view of Dyslexia as consisting of visual deficits.

In support with the hypothesis of the current study and consistent with the phonology deficit theory, there is a significant difference on phonological awareness between typical readers and children

with SLD where, children with SLD showed poorer performance in this area, as compared to typical readers which is also consistent with previous findings.<sup>24-26</sup> Therefore, this study provides further support and evidence to the phonology deficit theory. It is also important to note that the phonology deficit in this study more specifically reflects a deficit in phonemic segmentation where the participants with SLD had difficulties with providing correct responses when syllables, vowels and/or consonants of certain words were taken out. Given this finding, future early educational instruction may include phoneme segmentation training as Ball and Blachman<sup>27</sup> found that it was effective in improving performance in this area.

It was found that there is a significant difference between Malay speaking with SLD and typical readers on global visual spatial ability where typical readers performed better on the Block Design subtest as compared to children with SLD. This does not support the hypothesis of the study but is consistent with few previous studies<sup>28-33</sup>.

The result of the current study may be due to the accuracy of the test used in this study to measure global visual spatial ability. The Block Design does not specifically measure global visual spatial ability alone. Instead, it measures a combination of local and global visual information processing as it involves the examinee to analyse and synthesize abstract block patterns. Therefore, poor performance on the subtest is not solely attributed to a deficit in global visual spatial ability. Their test scores may also be influenced by many other areas and skills measured by the subtest. This includes nonverbal concept formation, visual observation, perception, organization, visual-motor coordination, attention, learning ability, simultaneous processing, and the ability to separate figure and ground in a visual stimuli. In relation to this, global visual spatial ability can be more accurately reflected in the method of block construction as participants who employ global or local information processing may differ in the way they arrange the blocks, such as block-by-block arrangement or arrangement as a whole image.

In order to reduce biasness in a small sample, matching of participants in the control and SLD group was conducted. However, there were still a number of limitations in this study. First of all, using the matched group design proved to be a challenge as it was time-consuming and effortful in finding participants who matched the criteria of participants in the experimental group. Even so, no two participants were exactly the same which may

have affected the internal validity of the findings. In relation to this, using the existing data from the Health Psychology Clinic, FSK UKM, there was no equal distribution of gender. The small sample size also decreases generalization of the findings and lack external validity although they provide a direction for future research and educational instructions especially for children with SLD.

It is also important to note that only a participant of a single ethnicity was included in this study as most of the existing data belonged to the Malay ethnic group. This pattern of ethnic distribution may be affected by the research area as certain regions have varying degrees of ethnic distribution. Other limitations include the measures used to assess phonological awareness and visual spatial ability. Phonetic segmentation, as measured in this study, represents only one specific part of phonological awareness and may not fully reflect an individual's level of phonological awareness. Additionally, Block Design measures both local and visual information processing. Therefore, the data obtained from observing the strategies used to construct the block patterns in addition to the subtest scores may provide more information into visual spatial ability.

The assessment tools employed in this study were also translated versions of the original English version which was developed in foreign countries. Therefore, cultural factors may have an impact of the findings where certain items were not familiar to individuals of a different culture. Last but not least, the examiners consisted of various ethnicities and had a background of different mother tongues. However, during the assessment, only one medium of language-Malay was used. Although there were standardized instructions to be read by the examiners, the fluency of each examiner in the Malay language may have an indirect impact on the outcome of this study in terms of the level of understanding of the language.

## CONCLUSION

Generally, the current study shows that there is a correlation between phonological awareness and global visual spatial ability among Malay speaking children with SLD, where better performance on phonological awareness is associated with better performance in global visual spatial ability. Besides that, it was found that the group with SLD had lower IQ as compared to the group of typical readers. Phonological deficit is present in the group with SLD. However, strength in global visual-spatial ability among children with SLD was not found. The



findings are bound by several limitations and thus, warrant future research to consider using a more accurate assessment tool to measure global visual-spatial ability in a larger sample size population and equal gender distribution. Nevertheless, the current study does provide a direction to look into the possible visual difficulties individuals with SLD may be facing and the processing speed deficit theory.

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