مجلة جامعة بني وليد للعلوم الإنسانية والتطبيقية
تصدر عن جامعة بني وليد – ليبيا
Website: https://jhas-bwu.com/index.php/bwjhas/index
المجلد التاسع، العدد الثالث الصفحات (528-545) 2024م

استخدام السبورة التفاعلية لتعزيز عملية التعلم للأطفال الذين يعانون من عسر القراءة

ابتهال نصر الدين عبد الجبار [1] ، طارق فرج الضبيع [2].
[1]قسم الهندسة، كلية تقنية المعلومات، جامعة ملتيميديا، سيبراجايا، ماليزيا
[2] قسم علم الحاسوب ، كلية العلوم ، جامعة غريان، غريان، ليبيا
1131122792@mmu.edu.my

Using Interactive Whiteboard to Enhance Learning Process for Dyslexic Children

Abthal Naseradin Abdajabar[1], Tarik Faraj Idbeaa [2]
[1] Department of Engineering, Faculty of Information Technology, Multimedia University, Siprajaya, Malaysia
[2] Department of Computer Science, College of Science, Gharyan University, Gharyan, Libya

تاريخ الاستلام:01-08-2024 تاريخ القبول: 18-08-2024 تاريخ النشر : 04-09-2024

الملخص:

عسر القراءة (Dyslexia) هو إعاقة تعليمية فريدة تتميز بصعوبات في فك التشفير وطلاقة القراءة والتهجئة بالإضافة إلى المهارات المعرفية الأخرى. تم إجراء هذا البحث للمساعدة في الحد من معوقات التعلم من خلال تحسين المهارات المطلوبة باستخدام السبورة التفاعلية ذات التقنية المساعدة AVA. يتمثل النهج في تعزيز المهارات الدقيقة المطلوبة لتحسين المهارات الأساسية مثل القراءة والتهجئة وبالتالي تسهيل عملية التعلم. تعتبر الأساليب اللمسية والبصرية هي محور التركيز الرئيسي في استخدام السبورة التفاعلية. تهدف هذه الدراسة إلى تطوير نموذج أولي لتعلم السبورة التفاعلية للطلاب الذين يعانون من عسر القراءة. شارك في الدراسة مجموعه تتكون من ستة أطفال ينتمون الى 3 جنسيات مختلفة (الصينية والماليزية والهندية). تم تقديم الأنشطة التي تعمل على تحسين المهارات الدقيقة الأربعة من خلال السبورة العادية وتم تعريض الأطفال للنموذج الأولي للسبورة التفاعلية AVA. كانت الاستجابات باستخدام السبورة التفاعلية مختلفة عند مقارنتها بأدائها مع السبورة العادية. أظهرت النتائج المتحصل عليها و التي تم تحليلها وجود تحسينات في ثلاث من المهارات الدقيقة باستخدام Interactive Whiteboard (IWB).

الكلمات الدالة: : عسر القراءة، السبورة البيضاء، مساعدة المعاقين، السبورة التفاعلية، الأطفال الذين يعانون من عسر القراءة.

Abstract

Dyslexia is a distinct learning disability that is distinguished by difficulties in decoding and reading fluency, spelling as well as other cognitive skills. This research is conducted to assist learning disability by improving the skills required for children with learning disability in reading and spelling using the

assistive technology AVA interactive whiteboard. The approach is by strengthening the micro skills required to improve the fundamental skills such as reading, and spelling thus facilitating the learning process. Tactile and visual modalities are the main focus in the use of the interactive whiteboard. This study aims to develop an interactive whiteboard learning prototype for students with dyslexia. A total of six children from 3 demographics (Chinese, Malay, and Indian) participated in the study. Activities improving the four micro skills were introduced in normal whiteboard and the children were exposed to the prototype AVA interactive whiteboard. Responses using Interactive whiteboard were different when compared to their performance with the normal whiteboard. The analyzed results indicated showed improvements in three of the micro skills using IWB.

Keywords: Dyslexic, Whiteboard, Assisting Disabilities, Interactive Whiteboard, Dyslexic Children

1- Introduction

We all use smartphones designed by Apple but never wondered about the background of the inventor. Did you know that Steve Jobs and many other famous actors, inventors, and businessmen such as Tom Cruise, Bill Gates, and Richard Branson have the learning disability dyslexia? Dyslexia influences education, learning and also influences the development of literacy skills. British Dyslexia Association (BDA) defines dyslexia as combination of abilities and difficulties that affect the learning process in one or more of reading, spelling and writing (British Dyslexia Association, 2006).

Proficiency in reading is quite important in order to learn large part of the subject taught at the school. The BDA provides information that "dyslexia is a hidden disability thought to affect around 10% population, 4% are severely"[1].

After researching according to Liz Weaver when it comes to the reading problem there are basically few micro skills that can hold a person back from learning to read well. With that aim, the development of these micro skills in children is my focal point by using the assistive technology AVA interactive whiteboard.

According to Mohamad and Tan Abdullah as defined by the United States, assistive technology is “any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities” McCoy's diary [1,2]. Dyslexic children can become avid and enthusiastic readers if learning is facilitated. Hence, the goal of this project is using the AVA interactive whiteboard to improve the micro skills in order to aid the improvement of visual perception skills which is required for dyslexic children to fulfill everyday skills such as writing, counting drawing, solving math problems, reading,

differentiation left from right, as well as many other skills. This in return helps improve learning. Furthermore, the prototype will be tested on dyslexic children.

This project conducted to research on dyslexia and how an interactive whiteboard can assist these students, to study an existing system and determine system functionalities, and finally to develop a sample of interactive whiteboard learning prototype for students with dyslexia. The research question in this study is as "Does mastering the activities of the four micro skills using interactive whiteboard help improve leaning in dyslexic children?"

LITERATURE REVIEW

Dyslexia is considered as a neurological condition and is also pointed out as the most common Language-Based Learning Disability. Dyslexia is a reading disorder that impacts word decoding and reading fluency, spelling as well as other cognitive skills. This makes it difficult mastering the skill to read, spell and write. Dyslexia as defined by BDA is "The word 'dyslexia' comes from the Greek. The prefix "dys" means difficulty, and the root-word "lexia" means language. The literal translation is 'difficulty with words. It is a difference in the brain area that deals with language. It affects the underlying skills that are needed for learning to read, write and spell. Brain imaging techniques show that dyslexic people process information differently. Dyslexic people, of all ages, can learn effectively but often need a different approach" [18]. It concerns people of all ages and not only children however this study is limited to only children.

Despite of the challenge of categorizing dyslexia into various categories due to the confusion of the condition, " Dyslexia is classified into various types:

- **Visuo-spatial difficulties**: Persons who suffer this type of dyslexia have problem in distinguishing between letters, syllabus and phrase orders and have problem in reproducing them. They usually try to guess the letter by its shape not by its context so they have a difficulty in identifying the letters. They may also read words backwards and confuse reversible letters.
- **Correlating difficulties**: This type of dyslexia concerns more with difficulties in writing. They are unable to link the individual letter to its appropriate speech sounds especially the words that only have one syllable "monosyllabic".
- **Speech sound difficulties**: people who diagnosed with this type of dyslexia have difficulties in forming sentences and breaking words into syllables due to problems in understanding spoken language." (T,1964)

There are various problems that characterize dyslexic people. [19]"This can be divided into six areas of difficulties, which are Reading, Writing, Speaking, Memory, Organisational, and Mathematics."

Furthermore, good evidence indicates that there are no applications are made tailored fit to these different categories of dyslexia. "E-learning applications are ineffective and/or failing dyslexic learners may be because developers have not put in their minds the different types of dyslexia [21]. Therefore, my focus is on dyslexics with Visuo-spatial difficulties.

Children with dyslexia frequently grapple finishing puzzles or dot to dots activities, recollecting right and left, even sight words as well as observing hidden picture activities. Moreover, reversing letters or numbers while writing and losing place of a page while writing or reading, and differentiating between sizes and colors of the objects.

Subsequent research has shown, however, that children with dyslexia tend to reverse letters or words and that the cognitive deficit responsible for the disorder is related to the language system. In particular, dyslexia reflect a deficiency in the processing of the distinctive linguistic units, called phonemes that make up all spoken and written words.

It has been proposed that defects may exist anywhere along the dorsal stream [18], and deficits at different levels of magnocellular pathway are associated with impaired performance in different aspects of reading (Kevan & Pammer, 2008). Deficits within the visual system could be the core deficit in dyslexia, whereas phonological deficits might be only an effect rather than a cause [18,21].

"The M-dominated dorsal stream may be essential for spotlighting regions of the primary visual cortex for serial processing in the ventral stream. If this is affected by a lesion of the magnocellular pathways, it can lead not only to poorer visual search, but also to difficulty in learning to read"[17].

Children with dyslexia have difficulty in learning to read because they lack an understanding of the phoneme structure of the language which is necessary in order to understand how words are mapped into their written counterparts. In addition to their phonological difficulties and other reading problems, there are other differences in children with dyslexia that separate them apart from typical readers and these behavioral manifestations have been quite diverse and one that has been of great focus is the visual system deficit.

Dyslexics mispronounce common words or reverse letters and sounds in words. Children with dyslexia may as well mix up letters of words and words within sentences while reading.

The experience of dyslexia can vary greatly from one individual to other. Dyslexia varies from mild, moderate to severe and it does not affect one's intelligence. Dyslexic pupils see the letters jumbled while the rest cannot tell the difference between similar looking letters such as "b" and "d" or "p" and "q" on top of that words such as "was" and "saw" or "left" and "felt". They tend to transpose letters (‘was’ for ‘saw’, ‘god’ for ‘dog’) and produce phonologically implausible non-word guesses, which seem to result from visual confusions [16]. However, others see the letters out of order or view the letters fine, but have trouble identifying the sound of the words. Sequencing the sounds in words is considered difficult as they are not capable to connect the letters to the sounds they make and understand them. This occurs due to the problems with short-term memory.

Dyslexics often have extreme short-memory issues and battle to hold the majority of the data without critical support. Dyslexics also suffer coordination issues, Physical issues for example, such that, perusing, clumsiness, issues for expressions pronunciation, and writing problems. These all combine to cause problems with literacy. People with dyslexia on average showed poorer visual statistical learning of simple nonsense letter-like objects than matched typical readers (Sigurdardottir, Danielsdottir, Gudmundsdottir, Hjartarson, Thorarinsdottir, & Kristjánsson, 2017).

Converging evidence from a number of lines of investigation indicates that dyslexics have problem differentiating between “b, d, p, q”, recalling sight words, completing partially drawn pictures, remembering the alphabet in sequence, and discriminating between size of letters and objects; these problems incorporate difficulties in visual perception. Visual perception refers to the brain’s ability to make sense of what the eyes see. This is not the same as visual acuity which refers to how clearly a person sees (for example “20/20 vision”) [14]. A person can have 20/20 vision and still have problems with visual perceptual processing.

However, living in a literate society this difficulty can cause such a major impact. Current linguistic models of reading and dyslexia now provide an explanation of why some very intelligent people have trouble learning to read and performing other language-related tasks.

The phoneme, defined as the smallest meaningful segment of language, is the fundamental element of the linguistic system. Different combinations of just 44 phonemes produce every word in the English language. For instance, the term bat and cat is different by one sound, the second and third segments are the same vowels and consonant that is /æ/-/t/ yet the two notes are distinctive. Bat begins with /b/ and cat with /k/. Thereby, the fact that these two

words are different words but carry similar sounds when the first letter is replaced is a primary skill that dyslexics lack.

Before words can be identified, understood, stored in memory or retrieved from it, the first step is to break it down into its phonetic units.

A Dyslexic child fails to create an aware mindfulness that those letters on the page representing the sound of the spoken word. When reading those expressions "cat," a dyslexic child must determine those expressions underlying phonological components.

Assistive Technology: “Assistive Technology” refers only to hardware and software designed to facilitate the use of computers by people with impairments [21].

The interactive whiteboard to be used in this research is the AVA interactive whiteboard. It encourages the learning procedure as it essentially combines the multimedia elements such as animation audio, video, text, and picture. The interactive whiteboard creates a surrounding that gives a situation to enables pupils with learning inability to take an interest in the process the learning. The AVA interactive whiteboard has features like spotlight to allow dyslexic students focus on one point since they get distracted. Education can be a tangible transform that includes integrating doing, hearing, & seeing. Visual learners figure out best by perceiving.

Auditory learners learn by hearing. Tactile learners gain best by doing. Eventually, by carrying out assorted educating strategies, instructors can excite learners with diverse learning methods as it increases student engagement which might help a child become adaptable as well as a versatile learner. "The whiteboard can be used to deliver instruction in a variety of ways that may be categorized based on three modalities of learning. The first modality is visual learning. Visual learning through the use of a whiteboard can range from the use of text and pictures to the use of animation and video" [6]. Technology can be utilized to create a motivated classroom environment where students are engaged in learning. "An environment where technology is used in innovative ways leads to improved learning and teaching. Classroom learning is also enhanced through the use of visuals. Visuals promote a student’s ability to organize and process information", Wishart & Blease's diary as cited in [2]. Visuals can also be utilized to challenge students to think on levels that require higher order thinking skills. Visual learners gain best by perceiving since they can easily envision people, places, and texts. Finally, technology provides opportunities for teachers to meet the needs of students with various learning styles through the use of multiple media

It has been deduced, a research was done by William D. Beeland to determine the effect of the use of interactive whiteboard as an instructional tool on student engagement, and deduced that

the results of this study indicated that the use of interactive whiteboards in the classroom does lead to increased student engagement. The primary reason appears to be the visual aspects of using the whiteboard" [23].

Micro skills:

Learning to read and write demands our perceptual abilities as far as possible – far more than talking. It demands better visual, auditory and manual skills over very nearly anything other skill we learn. Identifying and fixing some skills are needed to become a better learner and overcome the reading problem. After researching, by contacted Learning Success and answered the learning difficulty analysis questionnaire and have received an email from a member of the team Liz Weaver on what are the skills to be improved to help dyslexics. These micro skills according to Liz Weaver are the fundamental building blocks of learning. They are not the academic skills thought in school instead of the skills that are needed to learn reading. Reading skills build upon these micro skills.

These little blocks of learning are quite vital as the absence of one of these pieces causes a student to struggle with learning to read. Teachers are thought to teach reading which means teach things such as phoneme recognition or sound recognition and digraphs, work on sight words etc. But as these micro skills are missing it is nearly impossible for teachers to do their job. When these micro-skills are weak, children have to work hard at the words, that comprehension is non-existent. Weak visual memory affects pupil's brain that they can't grasp the meaning of the words.

Improving the micro-skills reduces reading strain. No longer are they bound and held back by the struggle, however, they set free and be able to comprehend what they are reading.

Our ability to learn new things is actually a combination of skills. We call these skills the Learning Micro-skills. These skills fall into three categories. Visual, auditory, and kinesthetic [10] According to Liz Weaver, an expert in motivating kids, teaching coordination and complex body motion, and developing self confidence in children and adults, to be effective in reading you need visual skills. The micro skills are visual memory, visual discrimination, visual closure, visual tracking.

- **Visual Memory**: It is the ability to remember the visual features of an object.

It is an important skill for building things in their memory. Children with dyslexia face challenges in remembering words and recognizing as well as recalling. In addition to that, they also have problems in hearing sounds in words. This is all due to poor visual memory skills.

- **Visual Discrimination**: Visual discrimination is the capacity to correctly identify distinctive pictures. A child with sophisticated visual discrimination can easily recognize the similarity and differences of shapes, colors, and size, shapes etc. Dyslexic children can be deceptive and often confuse left with right this is due to poor visual discrimination skills.
- **Visual Closure**: Mind ability to fill in the blanks essential for reading. It is the brains ability to form an object when part of the picture is missing.
- **Visual Tracking**: Important skill as it helps go along the line with their eyes and auditory skills such as auditory discrimination, auditory memory, auditory closure and a strong connection between all of them. This micro skill enhances problems such as losing place on a page when reading or writing.

Framework Methodology

Figure 1 below demonstrates the framework of how four micro skills are necessary to develop Visual Perception. Good visual perceptual skills are important for many everyday skills such as reading, writing, completing puzzles, cutting, drawing, completing math problems, finding your sock on the bedroom floor as well as many other skills. Without the ability to complete these everyday tasks, a child's self-esteem can suffer and their academic potential is compromised. Visual perception represents the capability of the brain in making sense of whatever is seen. These micro skills are the building blocks necessary to develop the visual perception, which in return enhances everyday skills such as reading, spelling, and writing, completing puzzles, counting, as well as solving math problems. Without Visual perception skill children will have difficulties in accessing the curriculum because unable to attend to the appropriate visual information.

Difficulties completing busy work sheets or following visual instructions and hence results in anxiety and stress in a variety of situations leading to difficulty reaching their academic potential. The presence of some tools in the AVA interactive whiteboard, in addition to the features help in learning. The two modalities that will be used to help use the prototype is tactile and visual modality.

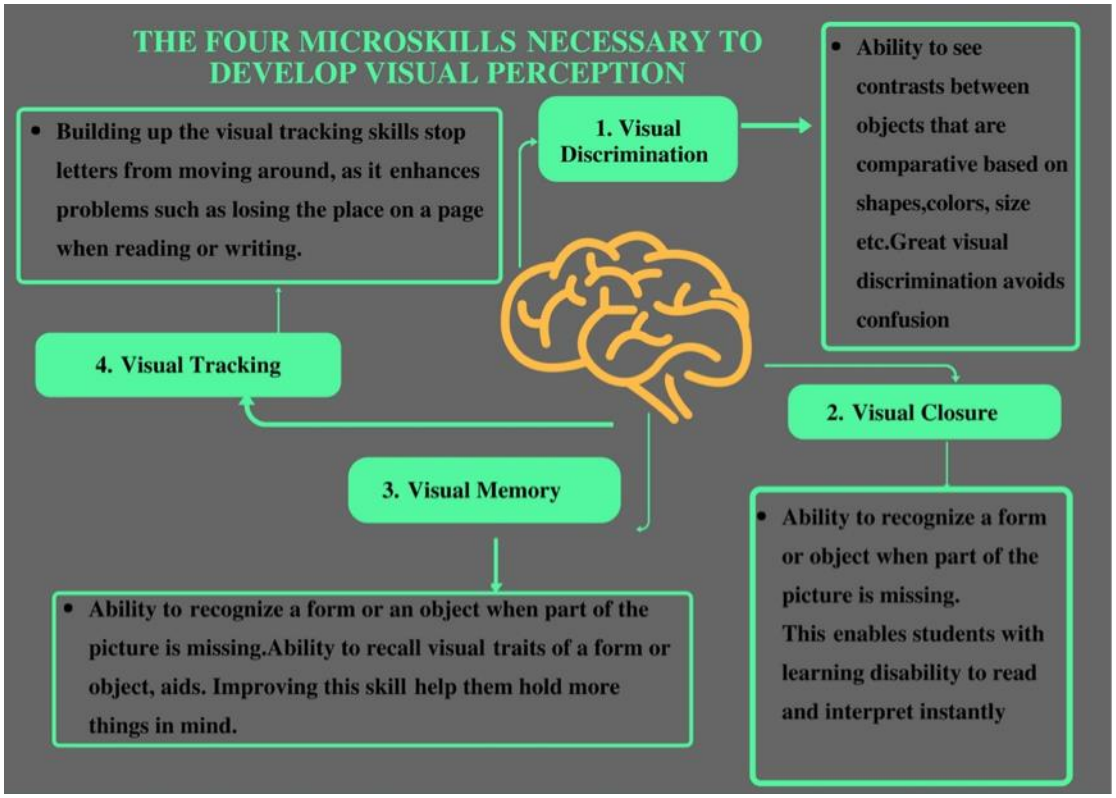


Figure 1. The four micro skills

The prototype

The tools used for this project are Creatly, Notepad++, and the programming languages used are HTML5, CSS, and JavaScript. The language CSS is used as it is easy to adapt the present the layout into different types of large devices such as the AVA Interactive Whiteboard.

This prototype involves sensory activities and has been implemented in such a way that there is only one exercise in a page, eliminate visual distractions. The interface of the prototype is of pale colour as bright and dark colours are irritating to the dyslexics. Moreover, the font Arial is chosen to display the texts.

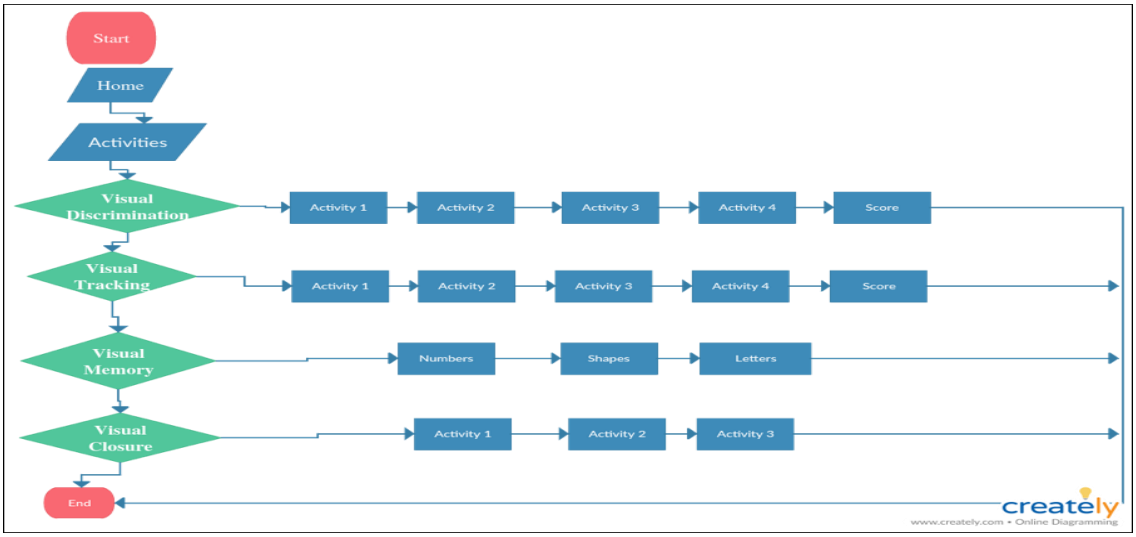


Figure 2. The flowchart of prototype

Visual Memory Number

The activity visual memory trains the children to remember the numbers, letters, and shapes present behind the tiles. The children interact with the interactive whiteboard by clicking on the tiles in order to match the elements behind the tiles and hence implementing the visual and tactile modality. In figure 3 the children must match the numbers, whereas figures 4 and 5 the shapes, and as shown in figure 5 the letters. Time taken to complete each exercise was recorder in minutes.

Figure 3. visual memory (Number)

Figure 4. visual memory (Shapes)

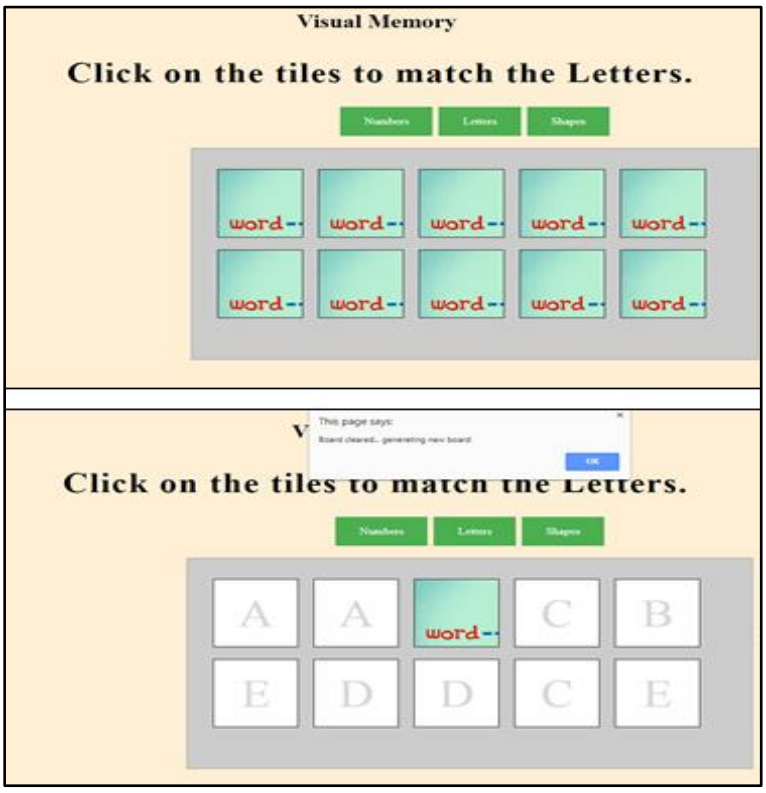


Figure 5. Visual memory (Letters)

Visual Discrimination

In this exercise children are supposed to discriminate between the two images found in one page. The images are different from each other in terms of size, objects. The exact same exercises where drawn on a normal whiteboard and dyslexic children were tested on whether they could spot out the difference or not and hence the results were recorder.

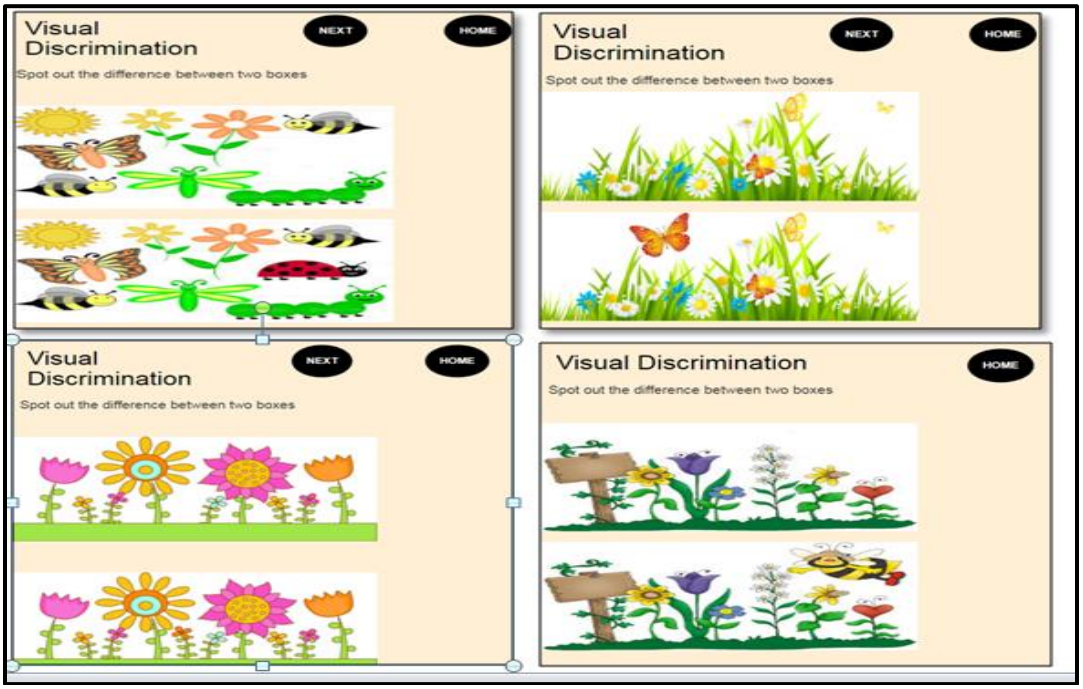


Figure 6. Visual discrimination exercise

Visual Tracking

This exercise is designed in such a way that once the children click on the button with the letter, the button is hidden. If the children chose all the correct buttons without a mistake a picture pops up indicating they have clicked on all the correct buttons. In this activity children are tested on whether they are able to click on the right letter when there is a lot of buttons to distract them from choosing the correct letter. Similarly, this activity was tested on the children using normal whiteboard and the results were recorded.

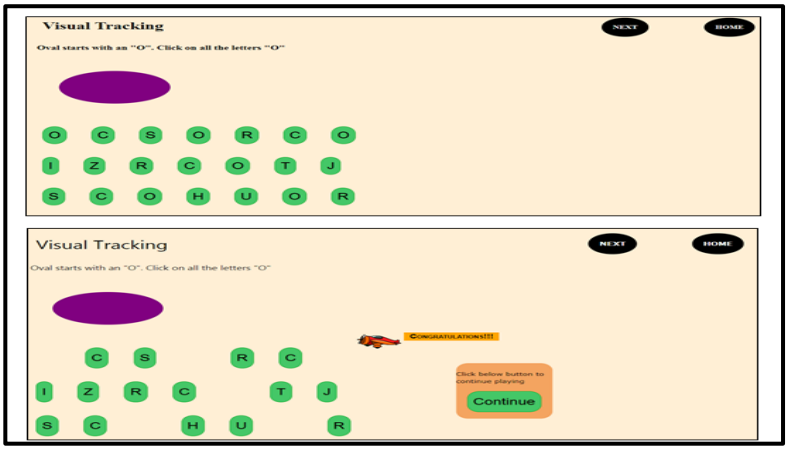


Figure 7. Visual tracking excercise (oval)

Visual Closure

The exercise below was to test whether they can identify the picture in dotted lines when snippet of the image is displayed. Most of the participants were able to recognize the images drawn both on the normal board as well as the interactive whiteboard.

Figure 8. Visual Closure

RESULTS

Testing of the prototype has been done on dyslexic children from Pusat Dyslexia PDM Ampang. Six participants were chosen 3 girls and 3 boys. The children were of beginner level. The following table shows the results in each of the activity for the six participants. The children's identity shall not be reveled hence they shall be addressed as participants X, Y, Z and participants A, B, C. The children are Malaysians and their demographic is Malay, Chinese and Indian. Table 1 displays the results of the activities performed by each participant using the normal board and the interactive whiteboard. To test this activity on a normal white board, the same exercise was drawn on a white board and the students were asked to open the covered images behind a card one at a time. The time taken for each participant to complete the three exercise was recorded manually.

Exercise	Participant X		Participant Y		Participant Z	
	NB	IWB	NB	IWB	NB	IWB
Numbers	00:00:31s	00:00:23s	00:00:19s	00:00:16s	00:00:30s	00:00:24s
Shapes	00:00:22s	00:00:19s	00:00:15s	00:00:12s	00:00:17s	00:00:13s
Letters	00:00:50s	00:00:41s	00:00:20s	00:00:18s	00:00:22s	00:00:16

***Table 1. The results of the activity Visual Memory for participants* X, Y, Z**

Table 2. The results of the activity Visual Memory for participants A, B, C

Exercise	Participant A		Participant B		Participant C	
	NB	IWB	NB	IWB	NB	IWB
Numbers	00:00:16s	00:00:12s	00:00:14s	00:00:011s	00:00:09s	00:00:07s
Shapes	00:00:12s	00:00:11s	00:00:18s	00:00:15s	00:00:12s	00:00:08s
Letters	00:00:21s	00:00:19s	00:00:32s	00:00:27s	00:00:16s	00:00:11s

From table 1 and table 2 we can deduce that time taken for all the participants to get the letters match was longer when compared to shapes and numbers. It is also noticeable that the time taken for participant X was greater than all the other participants. The reason behind this could probably be that each student is unique whether dyslexic or not and every individual has different capabilities even if they are from the same background. We can also see how participant Y takes less time compared to the others.

Overall, time taken to match the numbers using the Interactive whiteboard is short when compared to the interactive whiteboard. This is consistent as "Allowing students to physically interact with the board can assist with meeting the needs of tactile learners."[2]. Additionally, as mentioned by [6] visuals promote a student's ability to organize and process information. This can be seen from the results.

Table 3. The visual tracing results

Exercise	Participant X		Participant Y		Participant Z		Participant A		Participant B		Participant C	
	NB	IWB	NB	IWB	NB	IWB	NB	IWB	NB	IWB	NB	IWB
Circle	4/5	5/5	5/5	5/5	4/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5
Star	5/7	6/7	6/7	6/7	6/7	7/7	6/7	7/7	6/7	7/7	7/7	7/7
Rectangle	5/6	5/6	5/6	5/6	6/6	6/6	6/6	6/6	6/6	6/6	5/6	6/6
Oval	6/6	6/6	6/6	6/6	5/6	5/6	5/6	5/6	6/6	6/6	6/6	6/6

In the visual tracking activity, the children are to click on the letters to be hidden. Participant Y chose all the letters correctly, when using both the boards. And from the result we can also see that participant X could only choose 5 correct letters out of 6 when introduced to the rectangle exercise. However there as improvement when using the IWB in the exercise circle as well as Star. Participant Z could point all the letters correctly, in contrast to the normal whiteboard. Furthermore, participant B had better results when using the interactive whiteboard, in the exercise Star. Participant C could answer all exercises using the both interactive whiteboard and the normal board correctly and showed no difference. As noticed most of the children except participant C were not able to get it correctly as dyslexics face the problem of skipping letters or words and positive result is seen when using interactive whiteboard.

Table 4 Visual Discrimination results

Exercise	Participant X		Participant Y		Participant Z		Participant A		Participant B		Participant C	
	NB	IWB	NB	IWB	NB	IWB	NB	IWB	NB	IWB	NB	IWB
Image 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Image 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Image 3	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Image 4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 5 Refernce to visual Discrimination results

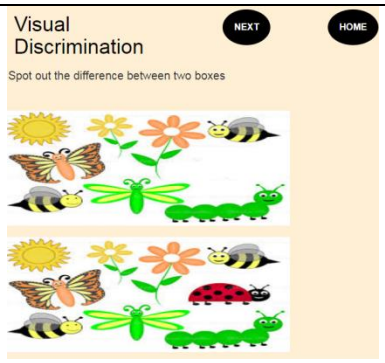
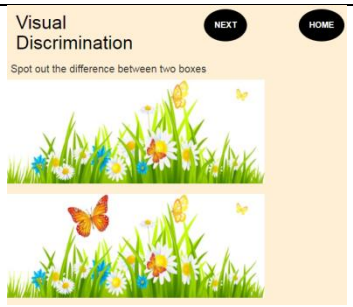
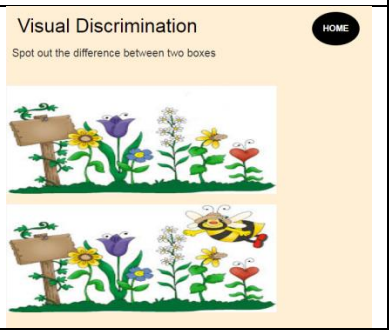
Name	Pictures used in the activity		
Image 1		Image 3	
Image 2		Image 4	

Figure 4: Refernce to visual Discrimination results

Most of the participants were able to spot the difference except for some participant A and participant X. This could be due to the exercise being too simple for their level. Although the children are of the same level, with similar educational backgrounds. Even from the same school, the difference in the results between them could be due to the uniqueness of every individual. As every child whether dyslexic or not, have different capabilities.

For the visual closure activity children had to just use the interactive whiteboard and draw on the dotted images. Results could only have been observed if the test was repeated to notice the difference. From the results we can see that activities involving visual tracking and visual memory showed a positive result when using the interactive whiteboard.

CONCLUSION

In this paper, I tend to improve the micro skills by focusing on the modalities visual and tactile. Strengthening these micro skills is fundamental for a child to read and spell fluently. The four micro skills are visual, visual memory and visual tracking, discrimination, visual closure. This is by building a prototype of that involves exercises on the use of visual and tactile to assist children in learning. A total of six children from three races were involved in this study. Activities improving the four micro skills were introduced in normal whiteboard and then children were exposed to the prototype AVA interactive whiteboard. Responses using Interactive whiteboard were different when compared to their performance

with the normal whiteboard. The analyzed results indicated that visual tracking and visual discrimination does improve learning by using IWB. When we intervene early in life, we help avoid problems that are much more challenging to address in adulthood.

Limitation

One of the limitations encountered was getting consent from the parents as less number of parents wanted their children to volunteer for the study. In addition to that there was inconvenient bringing the dyslexic children to the campus more than once. For this reason, the process of repeating the test more than once was a difficulty.

REFERENCES

1. British Dyslexia Association. What is Dyslexia, 2006? www.bdadyslexia.org.uk/whatisdyslexia.html. Accessed 05/12/06.
2. Mohamad M, Abdullah S. Tactile letters as an assistive technology in teaching alphabet for dyslexic children. The International Scientific Conference eLearning and Software for Education; Bucharest, Vol. 1, (2017). DOI:10.12753/2066-026X-17-025
3. Learning Success. (2017). https://www.learningsuccessblog.com/analysis/reading
4. McCoy K. F., Arnott, J. L., Ferres L, Fried-Oken M., & Roark B., 2013. Speech and Language Processing as Assistive Technologies. Computer Speech and Language, 27(2013), pp. 1143-1146.
5. Beeland, W. D. (n.d.). Student Engagement, Visual Learning, and Technology: Can Interactive Whiteboards Help? Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.135.3542&rep=rep1&type=pdf
6. Taylor, A. (2016, May 13). Helping children with dyslexia: Improving visual closure. Retrieved from http://www.fundamentallychildren.com/2016/05/13/helping-children-with-dyslexia-improving-visual-closure/
7. E., EVANS, D., & BLENKHORN, P. (2007). Use of assistive technology by students with dyslexia in post-secondary education. Retrieved March 2007, from http://www.academia.edu/23856057/Use_of_assistive_technology_by_students_with_dyslexia_in_post-secondary_education
8. Pandey, S., & Srivastava, S. (n.d.). Tiblo: A tangible learning aid for children with dyslexia. Retrieved 2013, from http://dl.acm.org/citation.cfm?id=2079247&dl=ACM&coll=DL&CFID=811348727&CFTOKEN=76983383
9. Fan, M., Antle, A. N., Hoskyn, M., Neustaedter, C., & Cramer, E. S. (2017). Why Tangibility Matters: A Design Case Study of At-Risk Children Learning to Read and Spell. Retrieved May 11, 2017, from https://www.researchgate.net/publication/316651293_Why_Tangibility_Matters_A_Design_Case_Study_of_AtRisk_Children_Learning_to_Read_and_Spell.

10. Rello, L., & Yates, R. B. (2013). Good Fonts for Dyslexia. Retrieved from http://dyslexiahelp.umich.edu/sites/default/files/good_fonts_for_dyslexia_study.pdf
11. White, D. H., & Robertson, L. (2015). Implementing assistive technologies: A study on co-learning in the Canadian elementary school context. Retrieved from http://www.sciencedirect.com/science/article/pii/S0747563214007171
12. Geiger, G. Poggio, T. (2005). Preventing dyslexia? Early enhanced hand-eye coordination activities reduce reading difficulties.http://jov.arvojournals.org/article.aspx?articleid=2132604
13. Kid Sense Child Development Corporation,2017 https://childdevelopment.com.au/areas-of-concern/fine-motor-skills/visual-perception/
14. Braddick, O., Atkinson, J. & Wattam-Bell, J. Normal and anomalous development of visual motion processing: Motion coherence and "dorsal-stream vulnerability. Neuropsychologia. 41, 1769-1784 (2003).
15. Sigurdardottir, H. %., Danielsdottir, H. B., Gudmundsdottir, M., Hjartarson, K. H., E. A., & Kristjánsson, Á. (2017, April 4). Problems with visual statistical learning in developmental dyslexia
16. Stein J, Walsh V. To see but not to read; the magnocellular theory of dyslexia. Trends Neurosci 1997;20:147-52.Stein, J., & Walsh, V. (1997). To see but not to read; the magnocellular theory of dyslexia. Retrieved from https://www.sciencedirect.com/science/article/pii/S0166223696010053.
17. Vidyassagar, T. R., & Pammer, Impaired visual search in dyslexia relates to the role of the magnocellular pathway in attention(1999) https://www.ncbi.nlm.nih.gov/pubmed/10363940
18. BDA, 2013. An Overview of Dyslexia, 2013. http://www.bdadyslexia.org.uk/about-dyslexia/adults-and- business/an-overview-of-dyslexia.htm (Accessed date: 22 April, 2013).
19. T. Ingram, "The dyslexic child", The Practitioner, Vol 192, pp. 503- 516, 1964.
20. V. Sekovani, DP. Vukovac, and Z. Podbojec, "Usability Case Study of Adapted E-Learning Course for Dyslexic Students". Madrid, Spain, the 5th International Conference of Education, Research and Innovation. 2012.
21. Alsobhi , A. Y., Khan, N., & Rahanu, H. (2014). Toward Linking Dyslexia Types and Symptoms to The Available Assistive Technologies. Retrieved from http://ieeexplore.ieee.org/abstract/document/6901550/
22. Kid Sense Child Development Corporation,2017 https://childdevelopment.com.au/areas-of-concern/fine-motor-skills/visual-perception/
23. William, J., Euler, C., Christensen, S., & Shlomchik, M. J. (2002). Evolution of autoantibody responses via somatic hypermutation outside of germinal centers. *Science*, *297*(5589), 2066-2070.