DEVELOPMENT OF A MULTIMEDIA COURSEWARE AS A TEACHING AID FOR CHILDREN WITH DYSLEXIA

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ABSTRACT

Dyslexia is a language based learning disability resulting in people experiencing difficulties in reading, spelling, writing and speaking. These problems are sometimes compounded by short term memory difficulties, a lack of organisational skills and time management issues which all have an impact on learning. This paper focuses on the planning, analysis and design of an e-learning courseware to teach dyslexics to read using the 'picture thinking' model. The development of this e-learning courseware involves transforming the traditional content of printed books from passive prints and illustrations into interactive multimedia content. The interactive multimedia content will focus on clear presentation of materials, good navigational assistance and a variety of multimedia options to tap into visual, auditory and kinaesthetic skills to support dyslexics. The targeted users will be children with dyslexia and pre-schoolers aged 5 to 7 learning to read Bahasa Melayu. A successful implementation of this courseware will be useful to the dyslexic learners as it will use picture thinking model and multisensory approach to the best of their ability instead of approaching them with the same teaching approaches used to teach their non- dyslexic counterparts.

1.0 INTRODUCTION AND BACKGROUND

In our word – oriented society, dyslexia is an obvious disability. Thus, researchers are constantly searching for remediation for the mostly undiagnosed and misunderstood dyslexic children and adults. The definition of dyslexia used in this research is that put forward by the International Dyslexia Association (IDA) [9] in its website:

> **"**Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede the growth of vocabulary and background knowledge."

It should be noted that dyslexia is a condition that affects more than 300,000 or 10 per cent of schoolchildren, in both primary and secondary schools in Malaysia [7]. These undiagnosed and misunderstood schoolchildren with reading and writing disorder usually end up being ridiculed and have low self esteem. Despite being a lifelong condition; most dyslexics learn to read and write well through appropriate training. However, early intervention is vital.

This paper discusses the preliminary design and development of a multimedia courseware to be used as a teaching aid to teach Bahasa Melayu syllables to children having dyslexia and pre-schoolers aged 5 to 7. The development of this courseware involves transforming the traditional content of printed books from passive prints and illustrations into interactive multimedia content. It is also aimed to create a multimedia environment that will enable dyslexic children to be emergent readers.

The courseware will be developed based on the *Mari Mengenal Abjad* book series written by Sariah Amirin. The series consists of a Master Book and seven other books ranging from Level 1 to Level 7. The level number here does not equate to grade level. It simply indicates the sequence in which the material must be taught. The book series were aimed to nurture the reading interest among children via inquiry learning [2].This is because each picture in the Master book has a book level number next to it. Using this number, the child will know the spelling for the picture by referring to the respective book in the series. The courseware will focus on words in the Level 2 book of the *Mari Mengenal Abjad* series which are four lettered - two syllable Bahasa Melayu words such as *buku, kuda, meja* and so on. The targeted audience will be taught to recognize the letters and pronounce the words correctly through the proposed teaching approaches in the courseware.

Hence, this paper presents the results of an ongoing research project aimed at uncovering the effectiveness of a multimedia courseware environment to teach children with dyslexia to read. Specifically, this paper reports the literature review, analysis and design of the proposed courseware.

2.0 CURRENT LEARNING APPROACH

The specific problems associated with the current learning approach have been identified from the interview with the Subject Matter Expert.

Currently, the learning materials are still in the traditional content of printed books with passive prints and illustrations. Thus, the current learning method also does not allow learner autonomy as the learner needs someone’s guidance to pronounce the words accurately.

The learning activities to follow up the knowledge learnt are easily misplaced sheets of paper and needs to be handled carefully. In addition, there is lack of educational software to teach Bahasa Melayu syllables in the market. It follows that most of the educational courseware available has more elements of entertainment instead of academic value. Hence, children usually enjoy playing the games but there is lesser retention of what they have learnt.

Moreover, because of misconceptions about reading and dyslexia, our educational system is geared primarily towards trying to teach dyslexic children to learn to read by exercising the reading skills used by their non- dyslexic counterparts. Emphasis is placed on developing phonemic awareness and practising reading through phonics, and on drill and repetition [11]. However, these strategies are not that helpful to dyslexic children as they often exhibit weaknesses in phonemic

awareness, meaning they are unaware of the role sounds play in words which is a key factor in their reading difficulties [8].

3.0 CURRENT TEACHING APPROACHES

Researches are constantly identifying effective methods of teaching for students with learning disabilities. However, the selection of the appropriate teaching approach is not a "one-size-fits-all" situation but rather is based on a more detailed and evaluation which involves a thorough assessment of the needs of dyslexics. The most common teaching methods for treating dyslexia currently are as follows:

3.1 Multisensory Teaching

Multisensory teaching is simultaneously visual, auditory, and kinaesthetic-tactile to enhance memory and learning. Links are consistently made between the visual *(what we see*), auditory *(what we hear*), and kinaesthetic-tactile *(what we feel)* pathways in learning to read and spell [8]. Simply put, the multisensory teaching instruction uses multiple media that allows dyslexics to develop links between what a word looks like, sounds like and means. Multisensory teaching also employs all pathways of learning at the same time, seeing, hearing touching, writing and speaking. The rationale behind multisensory approach is dyslexics may be unaware of the role sounds play in words. They may also have difficulty rhyming words, blending sound to make words or segmenting words into sounds. Being taught using the multisensory approach, dyslexics will be trained in phonemic awareness that uses direct, explicit teaching of letter-sound relationships, syllable patterns, and meaning word parts. A multisensory approach can be valuable to any individual but it is often essential to the dyslexic person [13].

3.2 Orton-Gillingham

The Orton-Gillingham approach is language-based, multisensory, structured, sequential, cumulative, cognitive, and flexible. Its breadth, perspective, and flexibility prompt use of the term approach instead of method [1]. It has been designed to create a sequential system of teaching phonemic structure of English in an almost 3-dimensional way. The approach teaches how sounds and letters are related and how they act in words. It also shows how to attack a word and break it into smaller pieces. It is taught using a multisensory approach as dyslexic people learn best by involving all of their senses: visual, auditory, tactile, and kinaesthetic [6].The elements of the language are introduced in a systematic, structured and cumulative way. Reading and writing sounds are done in isolation in the beginning. Next, sounds are blended into syllables and words. Learners will learn language elements, e.g., consonants, vowels, digraphs, blends, and diphthongs, in an orderly fashion. They then proceed to advanced structural elements such as syllable types, roots, and affixes. As learners learn new material, they continue to review old material to the level of automaticity. Vocabulary, sentence structure, composition, and reading comprehension are taught in a similar structured, sequential, and cumulative manner.

3.3 Ron Davis Dyslexia Correction Method

Ron David's theory is based on dyslexics' picture-thinkers quality. Dyslexics think through mental or sensory imagery and looking at the 'big picture' rather than using words or sentences. The most significant aspect of the Davis Theory in resolving dyslexia is the observation that disorientation and mistakes occurs when dyslexics deal with a word that lacks a mental picture and meaning. Hence, the approaches employed to resolve disorientation are an auditory approach called Auditory Orientation and a kinaesthetic approach to teach learners to mentally move their 'mind's eye' to a different vantage point, until they find the optimum point for focusing attention, called the orientation point. Next step is to create the letters of the alphabet in clay as it is a three-dimensional medium and also involves a creative, participatory act by learners. The next approach would be to put pictures into words. The learner models an object or set of objects which accurately represents the meaning of the word, as well as the letters of the word in clay after looking up the word in a dictionary and discussing a definition with a helper. In a nutshell, it produces comprehension and long term retention of the spelling and meaning of a word without the need for phonetic decoding or memorization. It stops the word from causing any future disorientation to the dyslexic learner [10].

4.0 PROPOSED TEACHING APPROACH

It is obvious that there is no a single method to teach dyslexic children to read. Thus, a combination of techniques and a variety of technology will be integrated into a range of instructional methods. Hence, this courseware will be designed to teach the dyslexics in a way they can learn and extend their abilities.

4.1 Techniques

- **Multisensory** - Multisensory methods for teaching will be employed and the children will use multisensory ways for practising and learning via the different modules in the courseware shown in Figure 1. This means using as many senses as possible at a time to make learning easier - looking, listening, saying and doing. In this way strong channels of learning are used for optimal learning.

- **Picture Thinking** - People with dyslexia tend to think in pictures rather than words [14]. Referring to Figure 1, the Learn to Read module of the courseware will enable dyslexic children to learn to read using picture- thinking model. Children will click on pictures and listen to the pronunciation of the word that describes the picture. At the same time, there will be colour coded text to differentiate the syllable division in the word. The text will be animated as it is pronounced in the voice over. Consequently, the reader first figures out the story content from the picture. Then, the reader makes the transition to the printed word and the sound the word makes. Once the reader understands the material, words become more meaningful.

4.2 Contents Layout

Figure 1 shows the flow of the contents in the proposed courseware. There will be four modules which are Concepts, Activities, Word Bank and User Manual.

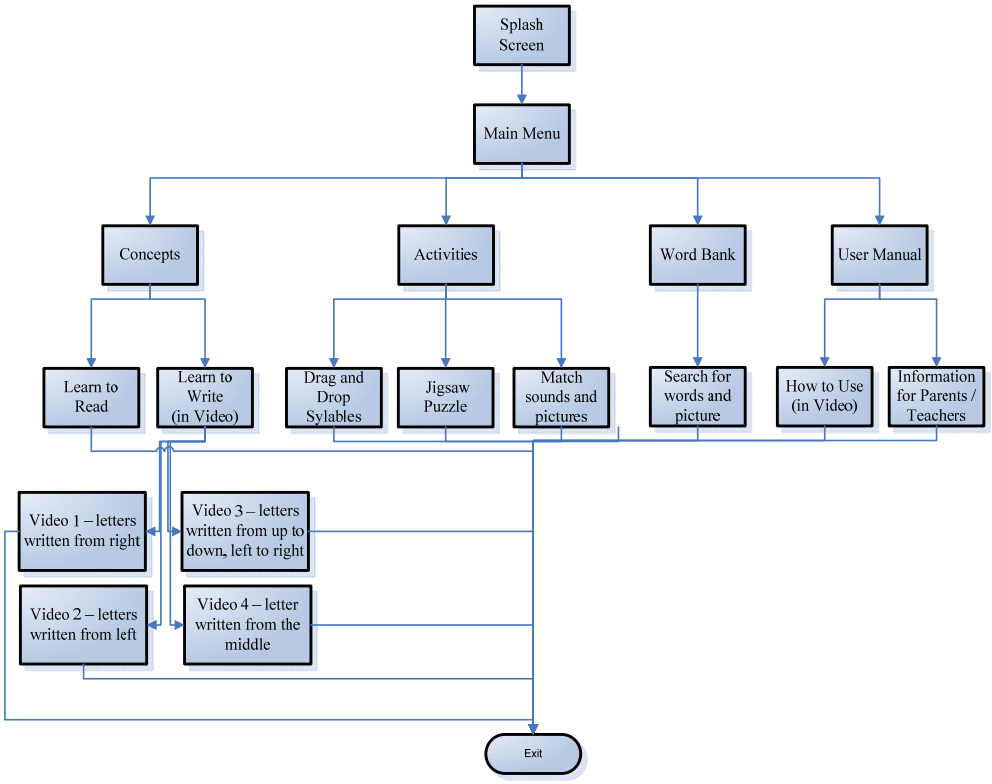

Figure 1: Flow of the contents in the courseware

The Main Menu module will have all the navigation icons which link it to every other screen in the courseware. The other module will also have the same navigation icons found in the Main Menu. However, certain icons will be dimmed or not clickable to give the user a clue as to what screen they are currently on. This is essential as dyslexics have difficulties with sense of direction [5].

Concepts module will have two sub modules: Learn to Read and Learn to Write. Learn to Read module will consist of the *Mari Mengenal Abjad* book series approach of learning through pictures. Learn to Write module will consist of handwriting tutor videos that will teach learners the concept of writing small case letters according to the method used by the Subject Matter Expert when handling dyslexic children. There will also be a printed worksheet available to enforce the knowledge learnt in the lesson.

Activities module will have three learning activities which are as follows:

- Drag and Drop syllable activity that requires the learners to drag and drop either the first or the last syllable that forms the word of the picture.
- Jigsaw Puzzle activity will require the learners to complete jigsaw puzzles of letters and parts of the picture.

- Match sounds and pictures activity where learners will be required to match the sounds of the words with the pictures.

Word Bank module will have a list of words introduced to the learners in the courseware. Learners will be able to search for words and its respective picture will appear.

User Manual module will have a helpful video on how to use the courseware. It will also have text based information for parents and teachers.

4.3 Organization of lessons

- **Structured** - The courseware will introduce letters and groups of letters in specific order. The child will only be working with the part that has been covered during lessons. This builds confidence to tackle longer words.

- **Cumulative** - Each part of the courseware leads on to the next and the child can be confident that he is only expected to do work for which he has been well prepared.

4.4. How multimedia elements affects contents

The usage of multimedia elements such as text, graphics, audio, video, animation and interactivity will be an integral part of this courseware as dyslexics can profit from a variety of technologies integrated into a range of instructional methods. Efficient use of multimedia can be used to reduce the amount of effort placed on working memory especially for dyslexic children who tends to 'lose' information easily. It is also becoming increasingly important to be aware of the barriers dyslexics face in learning electronically. Thus, designing for the accessibility of dyslexics is essential. The usage of multimedia elements in the courseware contents is summarized in Table 1.

Table 1: Multimedia elements affect courseware contents

Multimedia elements	Contents
Text	- Blue and red colour coded text to differentiate syllable division. - Usage of Lexia font, 12 pt, a sans serif to promote readability for dyslexics [12]. - All non – text content will have text equivalent. - Italics which are usually used in books to emphasize will not be used as dyslexics find italics hard to read on screen [5] [12]. - Icons that will be used to navigate the courseware will have text equivalents when the mouse is hovered on the icons. - Videos will have captions that provide auditory information for dyslexics who have lowered the sound or are in a noisy environment.
Audio	- All text on screen can be seen and heard with voice overs of instructions. - Icons that will be used to navigate the courseware will have text and audio equivalents when the mouse is hovered on the icons.

	- Able to repeat instructions - Learners do not feel embarrassed when they repeat to listen to verbal instructions. Moreover, the repetition helps the dyslexic student, who tends to "lose" information quickly. - Audio descriptions will also provide visual information for children who are temporarily not looking at the video presentation. For example, while following an instructional video to write the letters they must look down at their hands and away from the screen.
Graphics	- Images that most closely represent the respective words used in the courseware will be used. - Icons that most closely represent the meaning of the icon in the view of the targeted audience will be used. - User Interface Design with simple instructional navigation with an uncluttered screen with a clear focus on the task.
Animation	- 2D animation created with Flash authoring tool. - There will be no flickering text in the courseware as it creates problems for dyslexic users and users with other visual impairments [12]. - Minimize learners cognitive load, recognition rather than recall by the usage of icons to navigate in the interface.
Video	- Handwriting tutor using videos – An engaging experience to teach learners the key concept of writing alphabets according to the method employed by the Subject Matter Expert in handling dyslexic children. - User Manual in video to show to use the courseware instead of text based.
Interactivity	- Language learning practice such as Drag and Drop syllables, Jigsaw Puzzles, Match Sounds and Pictures, and Word Bank. - Instant feedback - Learners will perform better with computer based feedback that reinforces positive learning, and provides them a supportive, patient environment especially in areas where they lack understanding. - Flexibility - Learners can choose background colours of the screen using a background colour changer [5].This is to provide options in support of dyslexic children's reading preference and use of technology. - Self paced– Students have the option to go back to the different portions of the learning material to enhance their understanding of any lesson at any time. - Printable worksheets.

Consequently, the three basic advantages that technology offers learners with learning disabilities are more individual attention and feedback, interesting, engaging tasks and greater control over learning [4]. The amalgamation of multimedia elements in this courseware is hoped to open up a whole new world to dyslexics, one that they understand and feel part of [3].

4.5 Value added features

A significant effort will be put into delivering unique features that will increase the way the courseware will cater to the needs of the dyslexic children. Among the value added features in the courseware are:

- **Success** -The children will use their reasoning power to learn new words and use the most efficient ways for them to learn. Lessons are driven by inquiry learning and given in friendly surroundings through positive computer based feedback. Short, varied activities throughout the lesson help effective learning. Thus, children will be actively involved throughout the lesson.

- **Extends Abilities** - Once the reader understands the material, words become more meaningful. The visual and meaning-based approach is much easier for dyslexics to learn and use.

- **Gives Practice** - Varied and interesting activities in the courseware will give essential practice. Dyslexic children can use the courseware for regular revision and *"overlearn"* until they automatically use sounds and letters in reading and writing. The level of work will be planned so that progress is made while the child enjoys success as work that is too hard merely reinforces failure.

- **Lays Foundations -** Research for reading and spelling stresses the importance of children being aware of the sounds that make up words (phonological awareness). This is an area of particular difficulty for dyslexics and the courseware will be able to develop this ability for children through full audio support.

- **Greater control over learning** - Using multimedia allows some form of hyperlinking which will enable children to determine their own paths or follow persona interests through a lesson, rather than follow a linear path which can be found in textbooks. Since dyslexics are unable to automate some tasks because they have problems with sequencing , multimedia will be used to redesign the information into a non-sequential form .Thus , even instructions, which by their very nature are sequential, can be converted into a non-sequential form. This also promotes inquiry learning. Consequently, progress will be made at the child's own pace which is empowering for the dyslexic child.

5.0 CONCLUSIONS

This paper takes a first step in the direction by laying out the rationale for developing a courseware to teach dyslexics to read in ways that the dyslexic can learn by incorporating picture thinking model and multisensory teaching. It is hoped to be an early intervention approach to help children with the highest risk of reading failure

(dyslexic children) and early enough to prevent it (pre – schoolers).The approach used in this project is to make use of the picture –thinker qualities of a dyslexic learner so that the learner will know what the words look like, what it sounds like and what it means. The multisensory approach is employed as the contents are represented in visual, graphical way using animation, video, and audio and "learn by doing" exercises. The visual, auditory and kinaesthetic elements reinforce each other for optimal learning which benefits dyslexics.

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7.0 REFERENCES

[1] Academy of Orton – Gillingham (2004) What is the Orton Gillingham approach?. Available Online at: http://www.ortonacademy.org/approach.html (accessed 20 May 2006)

[2] Amirin, S. (1990) Mari Mengenal Abjad (Kuala Lumpur, Berita Publications)

[3] Beacham, N. (2006) The potential of multimedia to enhance learning for students with dyslexia. (University of Sheffield and University of Dundee)
Available Online at: http://www.skillsforaccess.org.uk/articles.php?id=150
(accessed 21 May 2006)

[4] Belson, S.I., (2003) Technology for Exceptional Learners: Choosing instructional Tools to meet students' needs (United States of America, Houghton Mifflin Company)

[5] Bradford., John. (2005) Designing web pages for dyslexic readers
Available Online at: http://www.dyslexia-parent.com/mag35.html
(accessed 22 May 2006)

[6] Bright Solutions for Dyslexia (1998) The Orton Gillingham Multisensory Method.
Available Online at: http://www.dys-add.com/teach.html#ogmethod
(accessed 20 May 2006)

[7] Dyslexia Association of Singapore (2004) Pilot programme for dyslexics in Malaysia.
Available online at : http://www.das.org.sg/news/malaysiapilotprogramme.htm
(accessed 25 May 2006)

[8] Henry. K. M. (2000) International Dyslexia Association: Multisensory Teaching.
Available Online at:
http://www.interdys.org/fact%20sheets/M.%20Teaching%20FS%20N.pdf
(accessed 19 May 2006)

[9] International Dyslexia Association (2000) Definition of Dyslexia.
Available Online at: http://www.interdys.org/fact%20sheets/Definition%20N.pdf
(accessed 19 May 2006)

[10]Marshall, A. (1998) Davis Dyslexia Correction – a brief overview.
Available Online at http://members.aol.com/dddyslexia/mag16.html
(accessed 28 May 2006)

[11] Marshall, A (2003) Brain Science and Dyslexia: How the Newest Studies Show why Dyslexics Must Use Unique Strategies for Reading, and How Davis Methods Build those Strategies.
Available online at:
http://www.positivedyslexia.com/reading/article_brain_science.htm
(accessed 1 June 2006)

[12] Pickards, J.(2005) Designing for Dyslexia: How do we help
Available Online at:
http://www.thepickards.co.uk/Articles/Designing_for_Dyslexia.cfm
(accessed 22 May 2006)

[13] Step Into Phonics (2001) The Orton Gillingham Approach
Available Online at: http://www.stepintophonics.com/orton_gillingham.htm
(accessed 4 June 2006)

[14] Zarach, V(2002), Ten Guidelines for Improving Accessibility for People with Dyslexia.
Available Online at :
http://www.cetis.ac.uk/members/accessibility/links/disabilities/documents/dyslexia
(accessed 22 May 2006)