MyLexic: An Assistive Multimedia Courseware for Teaching and Reinforcing Basic Reading Skills among Dyslexics

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Abstract: One of the most promising areas of education is the development of computer-based teaching materials, especially interactive multimedia programs. Interactive multimedia allows independent and interactive learning, and yet presents the learning information to the learners in newly engaging and meaningful ways. This paper delivers the theoretical concepts and design of a multimedia courseware called 'MyLexic'. 'MyLexic' is the first learning tool to nurture interest on Malay language basic reading among preschool dyslexic children in Malaysia. The theoretical framework proposed in the study is based on research in dyslexia theory with Dual Coding Theory and Scaffolding instructional technique. Demonstration of the courseware prototype is also presented. The courseware is hoped to contribute a significant idea to the development of technology in Malay language education for dyslexics in Malaysia.

Introduction

Interactive multimedia is any package of materials that includes combination of texts, graphics, animation, video, and audio. These materials are packaged, integrated, and linked together in some way to present learning information to learners in ways that make it manageable, approachable, and useful. The use of interactive multimedia in educational programs has enhanced learning opportunities with attention to the specific needs of individual users especially dyslexics. "Dyslexia is a specific learning disability resulting in people experiencing difficulties in reading, writing, spelling or manipulating number, which is not typical of their general level of performance. They may gain some skills in some subjects quickly and demonstrate a high level of ability orally, yet may encounter sustained difficulty in gaining literacy or numeracy skills" (Payne, 1999). Gregor (2000) highlighted the most commonly encountered problems by dyslexics are in term of "number and letter recognition, letter reversals, word recognition, number, letter and word recollection, spelling problems, punctuation recognition, fixation problems, word additions and omissions and finally poor comprehension".

It should be noted that *"over 300,000 or 10 per cent of school children, in both primary and secondary schools, may be suffering from the reading-and-writing disorder in Malaysia"* (Dyslexia Association of Singapore, 2004). This number is alarming and an early intervention is vital. This paper presents the design and development of MyLexic- An e-learning tool designed specifically for the preschool dyslexic children to support Malay language basic reading. The paper is organized as follows: Firstly, we discuss related teaching approaches incorporated into educational courseware for dyslexics. We begin the next section by describing the requirements and design of the courseware. A prototype demonstration of the developed courseware is also presented here. Finally, the conclusions and future works are presented.

The Motivation

The motivation to come up with MyLexic is due to the weaknesses in the current traditional teaching practice addressed by the Dyslexia Association of Wilayah Persekutuan Kuala Lumpur, Malaysia. The traditional teaching method via passive prints and illustrations does not attract the learners' attention especially when some dyslexics just 'do not like books'. The learning materials are in the form of fragile paper worksheets which are mishandled and often get misplaced. Since the current material is only in print, the learner needs someone's guidance when using the book series. Besides, the common teaching method used in Malaysian schools when handling dyslexics is using the reading skills used by their non-dyslexic counterparts. Besides, currently, there is no Malay language based-educational courseware in the market to support dyslexics compared to the amount of educational software available in English. Thus, this study is expected to contribute a significant idea to the development of teaching

technology in Malay language education for dyslexic children in Malaysia. Our study is aligned with the project by Ministry of Education Malaysia (MOE) named Dyslexia Pilot Projects (DPP), that was launched in March 2004 and currently being implemented in 30 government aided primary schools throughout the country.

Different Views of the Disability Teaching Process

Effective methods to teach dyslexics are constantly being researched. There are different views of the ways in which dyslexia children learn to read.

According to (Payne, 1999), the generally accepted teaching methods for treating dyslexia currently are *Phonic-based instruction*, *Psycholinguistics approach* and *Whole Word Recognition*. From the phonic perspective, reading is a building-up process. Words are made of letters. Each letter has sound called phoneme. Children learn the phonemes and the rules for combining the phonemes into words. The psycholinguistics approach often called as 'real-book' method. Its basis is that children should be encouraged to read naturally in the same way that they learnt to speak naturally. The Whole Word Recognition referred to as 'Look and Say'. It works on the basis that immediately the child sees the word, they should be able to read it. It is best suited to children whose visual skills are stronger than their hearing or listening skills.

"Studies from the National Institutes of Child Health and Human Development have shown that for children with difficulties learning to read, a *multi-sensory* teaching method is the most effective approach or treatment" (Bradford, 2000). This method helps children to learn by using more than one sense. It employs all pathways of learning at the same time, for instance, seeing, hearing, touching, writing and speaking.

The *Orton-Gillingham* approach is language-based, multi-sensory, structured, sequential, cumulative, cognitive, and flexible. The approach starts with teaching the sounds that letters make: letters make sounds, sounds make words and syllables, words make sentences, and sentences make paragraphs. Children see and write each letter as they say and hear each sound. The lessons are integrated and children read everything they write (Jo Ann, 2000).

Related Works

To make full use of computing technology, many researchers have been investigating learning theories and design strategies that can be exhibited in educational computer programs. The following are examples of learning materials that applies teaching approach related to our study.

The *Language Tune-Up Kit (LTK)* from JWor Enterprises is a remedial reading multimedia phonics software program based primarily on the Orton-Gillingham method. The courseware focuses on intensive, systemic and sequential phonics method of teaching language. This courseware is not limited to students with diagnosed learning difficulties. This includes all individuals who need a multi sensory phonics approach and also individual learning English as a second language.

Lexia's Reading Software is based on the proven Orton-Gillingham method of reading remediation. The software build strengths in phonemic awareness, sound-symbol correspondence, decoding, fluency, phonics and vocabulary - areas researchers have identified as essential to comprehension. At each level, students navigate independently through an increasingly complex sequence of engaging, skill-building activities that use age-appropriate graphics and high-quality audio with clear, consistent pronunciation.

The Learning Equation (TLE) is a computer-based multimedia-learning environment that teaches Algebra to Year 9 students (Norton, 2002). Among learning theories and design strategies applied were (i) dual coding theory - to have multiple representations of ideas; and (ii) scaffolding technique - to solve student's cognitive loads. There were thirteen lessons in TLE, and generally each lesson comprised four phases: application or mathematical modeling situations, problems and guided explanations in the forms of text and audio, practice questions, word problems and terminology activities, and finally self test to assess the student's progress.

One very specific and detailed program intended to stimulate dual-coding is called *Visualizing and Verbalizing for Language Comprehension and Thinking (V/V)*. It was created by Nanci Bell of Lindamood-Bell Learning Processes (Bell, 1991). The Visualizing and Verbalizing CD-ROM is a computer program develops concept imagery with sound effects, humor, and original stories. The student begins by verbalizing descriptions of pictures and then progresses, as mastery is achieved, to imaging words, single sentences, multiple sentences, whole paragraphs and finally to entire sections of text. The program improves student's reading comprehension, oral language comprehension and oral language expression

Theoretical Framework

Dual Coding Theory and Instructional Scaffolding formed the basis for designing the methodology for our study. As there is no single theory would be 'one-size-fits-all' situation, the dyslexia theory (multi-sensory phonic teaching) is used to refine the methodology. The following section discusses the adaptation of theories used in this study.

Dual Coding Theory

The *Dual Coding Theory* proposed by Paivio attempts to give equal weight to verbal (linguistic information) and non-verbal (i.e. imagery) processing. "While the two subsystems can be activated independently, the interrelations and connections of the two systems allow the dual coding of information" (Paivio, 1981). "Using only visual or only auditory materials limits the processing capacity that is available, whereas employing both visual and auditory materials provides greater processing capacity and the material can be accessed from two areas of the memory as opposed to only one" (Mayer, 2001). Previous researches by (Lindstrom, 1994) (Lee, 1997) agree that the simultaneous presentation of visual and auditory material allows the individual to make connections between the types of material presented. However, there are also researches inferred that visual and audio integration does not result in increased learning (Koroghlanian, 2004), (Veronikas, 2005). Possible explanation for such results may have been due to the "complexity of the material covered in the multimedia presentation, inadequate sample sizes or extraneous sounds or visual stimuli that are not relevant to the materials" (Yu, 2006). A study by (Beacham, 2003) shows that multi-sensory programs developed specifically for dyslexic children could be constrained by dual coding principles such as the media combinations used at one time. Thus, the providers of e-learning materials should be made more aware of switching between sensory and symbolic modalities and the pace when delivering the learning materials.

Scaffolding Instructional Technique

Defined by Wood (1976), *Scaffolding* is "a process that enables a child or novice to solve a problem, carry out a task, or achieve a goal which would be beyond his [or her] unassisted efforts". "The instructor initially provides extensive assistance to student in building their understanding of new content and process. Once the student's competence increases, they assume full responsibility for controlling the progress of a given task" (Herber, 1993). The following are scaffolding principles defined by (Teo, 2006) that have been considered in MyLexic design process.

i. Begin with what the students can do
   The courseware starts with a pre-assessment module that determines students' prior reading skills and places the student at the appropriate starting section. This allows the learner to be aware of his strengths and to feel good about what he can achieve without help.
ii. Clarify learners' current knowledge point
   The program branching techniques are utilized to deliver tailored instruction to each student.
iii. Begin with small, simple granular tasks
   Each lesson module consists of three levels, starting from simple to complex tasks. This to ensure that learner to experience constant success and a sense of fulfillment and confidence before he embarks on challenging tasks included in the module test.
iv. Frequent Assessment
   Hints will be available on three levels, each one providing more details about the answer to a question. The help will be removed gradually as the learner demonstrates mastery.

Structured Multi-sensory Phonic Teaching

The learning materials included in the MyLexic is outlined by the Subject Matter Expert from Dyslexia Association of Kuala Lumpur (DAKL). The DAKL has implemented the Structured Multi-Sensory Program guidelines issued by the British Dyslexia Association in their teaching program. The courseware supports phonic teaching that based on the concept that sounds correspond to symbols, beginning with the alphabet and building up. The lessons involve as many senses which can be used in learning to read, for instance vision, hearing and touch. The courseware content structured to several section like alphabets, syllables, words, post-assessment, so that each

people related to the others in an organized and planned way. The learners are required to master the basic level before proceed to the next level. Previous work will be continually revisited and reinforced.

A Closer Look at MyLexic

Development Environment

Since selection of suitable multimedia tools is vital for courseware development, it is appropriate to briefly mention the tools used to design and develop the courseware prototype. Macromedia Flash 8 served as development tool while Adobe Photoshop was used for image editing. Sound Forge 8 digital audio editor was used to edit and record narrative audio and sound effects. The Flash Player is required for viewing the courseware. The plug-in is delivered with the courseware CD. Macromedia Captivate is used to deliver video-based help materials.

Interface Design

The efficient use of multimedia elements 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 user interface design of MyLexic is based on guidelines specified in our initial study. Please refer to (Mohd, 2006).

Courseware Structure

The Figure 1 shows the MyLexic navigation design. The course materials are classified into 5 main modules: Pre-assessment, Alphabet, Syllable, Word, and Post-Assessment. The pre-assessment module determines students' reading skills and places the student at the appropriate starting module (alphabet, syllable or word module). The typical learning process begins with the child learns the individual 'alphabets' (Figure 2, 3). The important connection between the sound and the letter is made when the children read. Next, they learn to combine the alphabets (consonants and vowels) to construct 'syllables' (Figure 4), finally they join syllables to form a 'word' (Figure 5).

Overall, the courseware has been structured as building-up process. If the student achieves the mastery objective for the initial module, then the program automatically branches to the next module. If the student does not achieve the mastery objective, then previous section is suggested until mastery is achieved. The post-assessment functions as a 'learn by doing' exercise to recall the knowledge learnt in the all main modules. The activities included in this module are such as Drag and Drop, Jigsaw Puzzle, Sound Match, Word Snip and so on. It is obvious that each part of MyLexic is cumulative as it 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 for.

Figure 1. MyLexic Navigation Structure

Prototype Demonstration

When student starts the MyLexic courseware, the first screen they will see is the Welcoming Page with a login text field. The student required to insert his name in the text field which will be saved in the courseware. Each time the student exits from the any of the modules, the current module will be recorded. When the student logins again to the courseware, the system will display the last module he visited before.
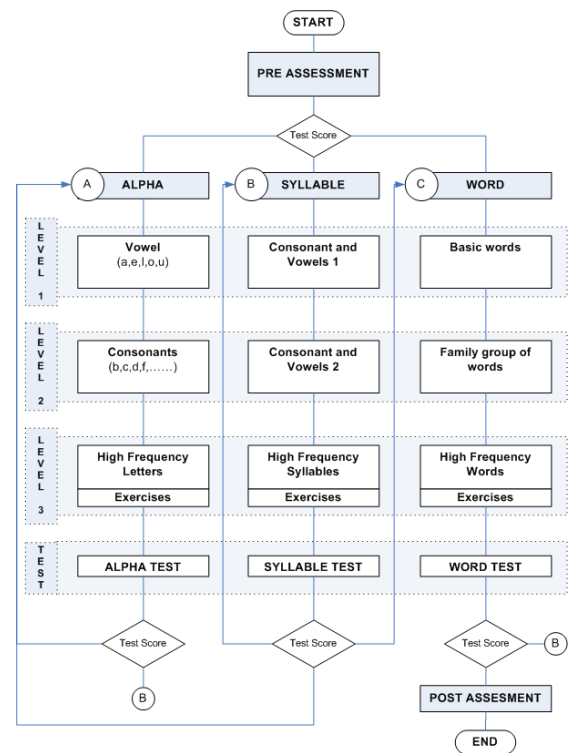
Figure 2. Letter sounds beginning with the vowels

Figure 3. High Frequency Consonant

Figure 4. Syllable Module

Figure 5. Family Group of Words

Conclusion

Currently, MyLexic is in its final development stage. The next stage of the project will be conducting both formative and summative evaluation at chosen dyslexia centers. Throughout this courseware development, a great deal of knowledge has been gained on dyslexia teaching methods, instructional techniques and learning materials design guidelines. The courseware is expected to show how the students with special needs more successfully achieve thinking and basic Malay language reading skills when the learning environment provides variety of media to acquire knowledge. The courseware delivers structured presentation of materials, good navigational assistance and a variety of multimedia options to tap into visual and verbal form to support dyslexics. We have also enriched the courseware with fascinating games and activities in order to create fun learning environment specifically tailored to the children's level of intelligent. To sum up, the courseware has great potentials to be implemented in dyslexia centers in Malaysia with intention to support the current learning methods applied in the remedial classes.

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