Improving the English literacy skills of Malaysian dyslexic children: The case of culturally responsive mobile multimedia tool

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Abstract

Multimedia tools are becoming convenient and efficient exercise medium for dyslexic children who need to do regular language exercises in order to overcome their neurological learning disability. This study examined a newly developed, culturally responsive mobile multimedia tool for learning English among dyslexic children. The tool is an amalgamation of both cultural and linguistic features in the context of learning English among Malaysian dyslexic children who had different phonological process in utilizing audio capturing tool which hampered the development of their literacy skills. The tool was developed for smartphones and tablets that could run in both Android and IOS platforms. We conducted a test to evaluate the effectiveness of the multimedia tool using quasi experimental method among 20 dyslexic children. The outcomes of the evaluation process revealed that the developed mobile multimedia tool improved both writing and reading capability of the participants compared to traditional training method. This provides evidence that the newly developed culturally responsive multimedia tool could substantially benefit dyslexic Malaysian English learners as well as language instructors who train dyslexic students to acquire literacy skills and attain their better learning capability.

Keywords: culturally responsive, dyslexia, English language, multimedia tool, phonology, orthography

Introduction

Interdys (2011) cited that around 15 – 20% of the world population suffering from language based learning disability. From that population, 70-80% of them have dyslexia which is easily identified as neuro-logical learning disability which impairs someone's ability to write and read. A person who is having dyslexia, needs to do regular language exercises in order to overcome the problem and it is basically put into practice via traditional method that using pencil and paper.

With the current Information and Communication Technology (ICT) development, especially in education sector (Salman et al., 2014); it was shown that multimedia tools are becoming convenient and efficient medium to provide exercises for dyslexic children (Rao & Skouge, 2015). These multimedia tools not only improving the dyslexic children's ability to read and write but the tools also have provided a conducive platform for children with dyslexia to practice reading and writing in a more engaging ways. The main issue in learning English among Malaysian dyslexic children is the phonological aspect of the language. This is because the way the words in English are pronounced by Malaysians are different according to their races and backgrounds (Phoon et al., 2013). In a typical household in Malaysia, the first spoken language varies from Bahasa Melayu, Chinese with different dialects (Mandarin, Hokkien, Cantonese, Hakka, Teochew), Tamil, Hindi, Kadazan-Dusun and Jaku-Iban (Aman et al., 2014). Differences in pronunciations are considered as a key element in the phonological representation in which the language variations could affect the response of dyslexic children towards phonological awareness

(PA) process. The complexity of the phonological process in terms of differences in the pronunciations gives great impact towards mastering basic literacy skills among children with dyslexia (Kuhl et al., 2001).

Gay (2013) cited that culturally responsive education model is defined as using cultural characteristics, experiences and perspectives of ethnically diverse learners into the learning and teaching process. Gay (2014) found that children learn more easily and thoroughly when the delivery of knowledge is situated within the context of lived experiences and frames of references of the children. Therefore, the culturally responsive framework should be taking into account in the design and development of multimedia tool for dyslexic children.

There are many multimedia tools designed to improve literacy skills in English and Malay language for dyslexic children in Malaysia. In the context of multimedia tool to learn English, the Malaysian dyslexic children are highly depend on the UK English learning tool which is not optimized to their level in order to grasp the basic literacy skills due to different way of saying the words between the learning tool and the users. Thus, with this motivation, a culturally responsive multimedia learning tool for learning English among dyslexic children which focuses on audio capturing is developed to overcome the problem of phonological process.

In this study, mobile based multimedia tool for Malaysian dyslexic children 7- 10 years old is designed and build to improve their literacy skills in English language. The tool will be evaluated among 20 children aged 9 years old with dyslexia whom using the tool for ten-weeks. This culturally responsive mobile multimedia tool is pivotal since not many researchers are utilizing the culturally responsive framework to design multimedia learning tool for English language learning especially for dyslexic children. The outcome of the study could give us useful insights on adopting culturally responsive elements in multimedia tool design for use of children with learning disability in multi-cultural and multi-races nation such as Malaysia.

Phonological awareness among dyslexia children

Dyslexia is characterized with poor spelling and decoding abilities due to difficulties with accurate and/or fluent word recognition. It is basically a learning disability which concentrated at neuro-logical part of the brain (Rello et al., 2014). Dyslexia also leads problems towards reading comprehension and reduced reading capability which slow down the growth of vocabulary of a language (Lyon, 2003).

According to ICLD (1987), there is around 17.5% of population in the US having dyslexia. While in Malaysia, it has been reported that in year 2013, there are as many as 400000 children with dyslexia. It is about 24.7% increment compared to the number children with dyslexia around 314000 in year 2010 (Thanasayan, 2013). Since the number is increasing, the Malaysian government needs to fork out more allocation to train teachers to teach those children with dyslexia (ref.). With the growing number of dyslexic children; the burden of teachers to teach these children is increasing substantially. This problem could be overcome if there is an effective mechanism that could complement teachers to train these dyslexic children.

The ICT tools and applications use the multimedia components to support learning as the multi-sensory approach invoke the interest of the users and motivations especially among the users with learning disabilities (Drigas & Dourou, 2013). Multimedia applications provide powerful tools to dyslexic children in terms of training, assessment and teaching aid (AlRowais et al., 2014). Multimedia language learning tools widely used to train dyslexic children all over the world. Many of these ICT tools and applications offer efficient platform for students with learning disabilities (Drigas & Ioannidou, 2013).

However, there should be an appropriate framework for designing and developing the tools since different children from different countries are bounded with various language and cultural factors. Therefore, not all multimedia tools are suitable for language learning, especially for children with dyslexia.

As the dyslexia regarded as the language based learning disability, reading, writing and spelling are also affected in the context different language orthographies (Elbeheri et al.,2006). AlRowais et al. (2014) cited that readers of English language which has non-transparent orthograph facing more difficulties in the aspect of lexical method compared to other languages such as Greek, German and Spanish. Therefore, the knowledge of phonological awareness (PA) becomes a pivotal element in mastering English language. According to Kennedy et al. (2013); a student with strong PA has the fundamental tools that are necessary for the fast and precise process of decoding words in which it will later assist the student in understanding the text. PA also includes the ability to connect the phonemes with the correct sounds (Snow et al., 2005; Kennedy). Kennedy et al. (2013, pg.42) cited that

> *"...explicit and systematic phonological awareness instruction is crucial to the development of successful readers, and it should be the priority in reading education. This is especially true for students with disabilities related to reading such as dyslexia."*

Language variations due to differences in pronunciations of the words in English among Malaysians are mainly contributed due to influences of mother tongue language and cultural backgrounds. Phoon et al., (2013) found that Malay, Mandarin and Tamil languages have strong influence over speaking and learning English language among Malaysian.

Various ways of saying words due to socio-cultural factors interferes the PA. Moreover, this interferences over PA contributes in the difficulties to master the English language by an individual with dyslexia because dyslexic individual has the problem in responding towards this variation in pronunciations (Ramus et al., 2013).

Culturally responsive framework for multimedia tool

Drigas and Dourou (2013) suggested that framework design for a multimedia tool that bolster learning process among children with dyslexic children must have the followings:
  i.   Implementation of phenomenological approach to learning
  ii.   Learning process that adaptive to dyslexia children
  iii.   Activities that improve reading

Item (i) and Item (ii) as suggested by Drigas and Dourou (2013) give a greater support towards achieving the item (iii) in the context of multi-cultural Malaysian dyslexic children in which it facilitates the amalgamation of culturally responsive into the multimedia tool framework.

Since the PA is the key element in the process of English language literacy among dyslexic children in Malaysia, it is important for us to broaden the dimension of multimedia tool framework via including Malaysian English features and other related Malaysian cultural factors.

This culturally responsive multimedia tool framework could be an efficient framework for learning English among Malaysian dyslexic children.

The proposed framework for the English learning multimedia tool is as shown in Figure 1. The framework contains the following components:
  i.   Linguistic Feature – the way the English words pronounced by Malaysian are different in which it depends on the influence of their mother tongue (Mun et al., 2015). The development of phonological representations come from the language variations, consequently it increases the difficulty and complexity of phonological processes. Hence, because of language variations, dyslexic children especially are less likely to pick up the English language easily or comfortably.
  ii.   Cultural Factors – AlRowais et al. (2014) cited that language is not only a cultural trait but it is also an identification of a community who using different slang from others. In the context Malaysians; the way the English words pronounced is also depends on the cultural background of an individual and influences of adult. An individual who speaks English at home likely to speak

better English with correct phonological representation (Dixon & Chuang, 2012). Thus, an audio capture tool embedded in this tool in order to facilitate the learning process.

iii. Principles of Dyslexia – the elements in building multimedia tool for dyslexic children should be suitable for them and the dyslexic children must able to adopt the learning process which provided through this platform. The materials must suit the pedagogical requirements considering the ability of these dyslexic learners.

iv. Multimedia tool integration – the usage of software and hardware should be suitable for the dyslexic learners. This mobile multimedia tool focusing on children from 7- 10 years old, thus, the multimedia components should be adaptable for the children within this age group.
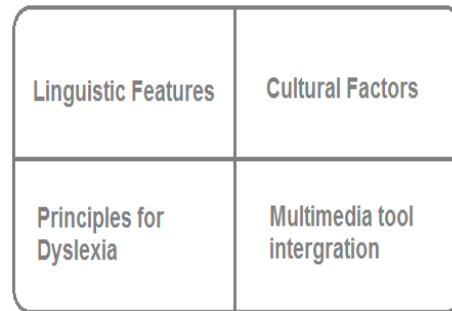
Linguistic Features	Cultural Factors
Principles for Dyslexia	Multimedia tool intergration

Figure 1. *Construction of English learning multimedia tool for dyslexic children in Malaysia*

Multimedia tool development

There are a few key categories of rules for training Malaysian children with dyslexia to English which formulated to cater into completing the learning tool. The key rules are as followings:

Enhance recognition

Every category includes a set of guidelines that could help to assist in completing the goal of the category. Enhance Recognition helps the student's ability in recognizing and memorizing the words or object. It includes twelve guidelines that focused on trainings and guidance that cover the area in helping the children to improve in recognizing and to cover up in the memory sector. Repetitive task, and dual coding theory which covers the input of verbal-cum-visual information to represent a subject (Beacham, 2002). These strategies could positively promote the strength of recalling and recognition information that is being present to the dyslexic student. Multiple repetitions absolutely gave a positive impact on memory (Erickson & Reder, 1998), whereby it refers to improved performance due to past experience that does requires conscious recollection or inputs.

Address diversity and self-advocacy

Second category with is to Address Diversity and Self-Advocacy. This is where the challenges of learning the proper English pronunciation base on the diversity cultural and linguistic of the children. Self-advocacy comes in as a risk that is related to Dyslexia as it affected the children self-support and confidence building (Deibel, 2006). This category generally promotes independency and encourages learner abilities to diversify. When it comes to advocating for special education like Dyslexia, parents and educator may advocate for programs and services for their child who is considered in the category (Cohen, 2014). This is where the multimedia tool comes in as the medium for the children to build and

enhance their strength in learning diversity. The rule include the aid for the student to pick up knowledge independently by not getting help from the teacher or others.

Interactive design

The third category is creating the multimedia content and flow with an Interactive Design, where it involves in making an attractive and interactive environment within the multimedia app to achieve effective learning and related to enhance recognition. The guideline in this category promotes the abilities in visual, audio and kinesthetic (Abdullah et al., 2009) in keeping multisensory approach. A digital environment provides stimuli that are more focused, predictable, and replicable than old methods like books and notes. Children need to be sufficiently engaged to reach the goals of learning games. Delivering educational contents by using digital images, animations, or videos accommodate with audios, it takes advantage on the fact that children with Dyslexia are visual learners who learn best via visual method (Bartoli et al., 2013).

Enhance flexibility

The fourth category is the Enhance flexibility where the multimedia tool is built with rule that stretched the flexibility of the student's strengths as well as their weaknesses to be applied on daily use (Al-Wabi et al., 2010). This rule cover the flexibility in terms of the ability to learn and adapt to the interactive multimedia content. These students who are suffering from Dyslexia tend to get frustrated, whereas others would adjust smoothly to the new environment (Huizinga et al., 2014). Some children resist change or need more time to adjust, while others are excited by the change and readily engage in exploration of new circumstances. Thus, the tool is built in such way, where it stretches the user's reach on their own time.

Match the reality

The fifth category which is Match the Reality, to make sure the content matches to the real world and its existence. The guideline enhances similarity of objects and subjects to the real world. Images or visually accuracy is important at this category because the multimedia content represents the real world as the children would be able to recognize the representation of what they are learning and applied it to daily life. It also must be matching and come from a well-known in daily usage.

Picture features

The sixth category that is the Picture Features, where by the rule is set the way how a picture of the object and subject is provided to assist and enhance the learning experience. The rule in this category would be helping to pronounce a subject via images to be more understandable for a child with dyslexia. Thus, well-shaped and colored objects are provided for a clearer understanding so that it can be reflected from day to day usage (AlSuwaid et al., 2010).

Audio features

The seventh category is the Audio Features, where it covers the clarity and quality of the audio featured from the multimedia tool. A proper and suitable English word pronunciation is given in the audio features to make it a standard of learning for the children (Sampath et al., 2010). This category is consider significant as audio is one of the main focus in this multimedia application. The audio capturing tool is embedded in this application in order to pick up words pronounced in a different phonological by the users but has the similar orthography.

Developed multimedia tool

This tool is designed and developed to run on mobile platforms which this multimedia tool for learning English among Malaysian dyslexic children catered for both Android and IOS systems.

The multimedia tool consists of a few sections which is the Intro page as shown in Figure 2, Main page as shown in Figure 3, Read pages as shown in Figure 4 and Tutorial page in Figure 5.
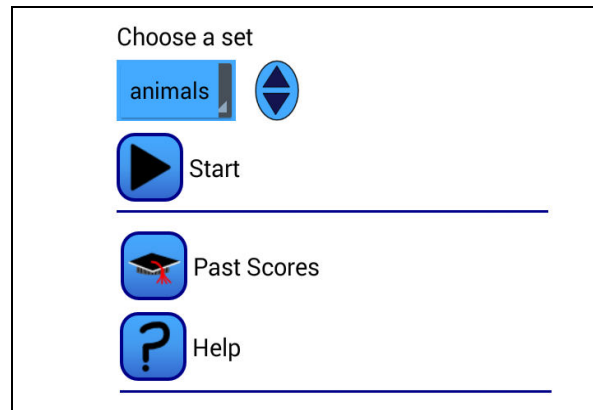

Figure 2. *Intro page*

As for interface, a plain and direct Graphic User Interface has been used as the objective for the multimedia tool is to get it working. Figure 4.1 shows the intro page for the multimedia tool once it is being selected, and user needs to click the button "Choose a set" in order to proceed to the main page. On the intro page there are only four buttons that are the Choose a set, Start, Past scores and Help. The reasons the introduction page is setup are to make use of them to draw user's attention to the applications and it comes with a simple structure with a text and images. When the button "Choose a set" is being chosen, it will drop down a menu as shown in Figure 3, where user can choose any options that are given. These are the categories of exercise that user can select on. Past scores will be appeared to reflect how the user performed. Help button will shows user on how to maneuver around the multimedia tool. This home page provides the detailed information on the whole application.

In the main page or home page which is shown in Figure 3, there will be the preset categories stated as animals, actions, body, colors, emotions, foods, house, kitchen, mature, sky, and transport. It consists of 40 words covering all the categories.

When select any of these preset categories, it will guide the user into another page that is shown in Figure 4, where the page consist of the objective to read or pronounce a word, as well as teaching him or her on the proper spelling. The instruction that says "Tap microphone button and say what you see", when select on it, user would need to speak out the object name that is projected on the screen; it is an Apple in the case of Figure 4.

Figure 3. *Main page of the multimedia tool*

The word and object chosen for this multimedia tool is the words are widely and commonly used in the day to day basis among Malaysians. One of the widely used words is APPLE that the pronunciation of it is being localized into their dialect that will lead to misunderstanding.

A dyslexia student who has issue on recognizing the proper order and arrangement of the English alphabets; here in the words APPLE, the letter P and L come as a challenge. They would have recognized these as letter as inverted. The font used is Arial Bold, as it is commonly used and easy to be recognized. In Figure 5; there is also a question mark button where it will lead the user to tutorial page as shown in Figure 5. In this tutorial page the correct spelling and pronunciation of the words is presented.
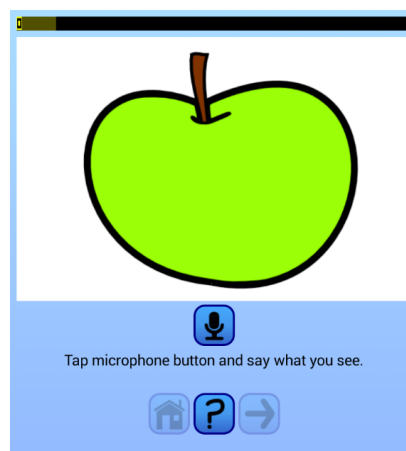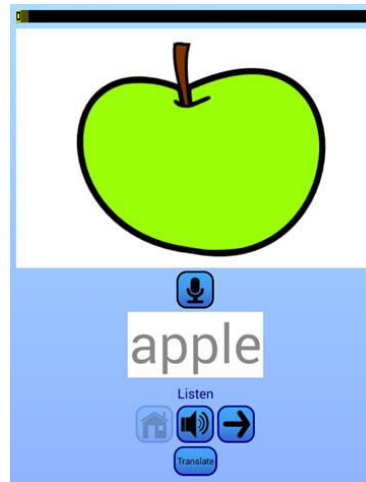

Figure 4. *Read page*

Figure 5. *Tutorial page*

The voice and pronunciation that is recorded has a proper local English dialect, as it will fit to the usability in this project. The standard accent of Standard English from the United Kingdom is not being used as it does not reflect the Malaysian local accent for English. There the dialect of English accent being used in this multimedia tool will be friendlier and understandable by the student.

Methodology

20 dyslexic children – 9 years old – who are studying in a primary school in Penang, Malaysia were chosen via simple random sampling method to be participated in the evaluation process. Quasi experiment method was used to assess the effectiveness of the developed mobile multimedia tool whereby these 20 children's writing and reading skills were assessed after went through the traditional training and also after used the multimedia tool. The students were allowed to download the developed multimedia tool application into their parents' smartphone or tablets.

In the terms of writing; errors per word rate was gauged whereby the participants of the study were asked to spell the 40 words which included in the tool after attending training using traditional method for 10 weeks and the children were asked to spell the 40 words again after using the tool for another 10 weeks. Similar time frame was given to the respondents in order to avoid any biasness.

For the reading; the respondents were assessed whether they could pronounce the words correctly after showing to them the related picture of the word. One mark will be given for each correct word pronounced. The children were assessed before the writing test which held after attending the traditional training method and after using the developed multimedia tool which both training were conducted for 10 weeks respectively.

Results and discussions

All the participants of this study participated throughout the 20 weeks of training and assessment process. Table 1 shows the results for the writing assessment after going through training sessions for both traditional and using the developed multimedia tool methods. While, Table 2 shows the marks for reading assessment.

Table 1. Writing assessment

Training Method	Average Error Rate (%)
Traditional	30.1
Multimedia Tool	23.5

Table 2. Reading assessment

Training Method	Average Marks
Traditional	24
Multimedia Tool	32

Referring to Table 1; the average error rate that the respondents did during the writing mistakes dropped from 30.1 % - traditional method - to 23.5% - using the developed multimedia tool. This result shows that the multimedia training tool improved the dyslexic children's writing – spelling -performance compared to traditional method. It is also proven that the developed culturally responsive multimedia tool has improved the dyslexic children's writing English words.

At the same time, referring to Table 2; the respondents' performance in reading assessment also improved after using the developed multimedia tool. The improvement of average marks from 24 to 32 marks showed that the multimedia tool has assisted the respondents in improving their English language in terms of phonology. At the same time, the minimum mark obtained by the respondents after went through traditional training was 18, while, the minimum mark gained by the children after used the multimedia tool was 25. It is very clear that the multimedia tool helped the dyslexic children mastering the language.

The flexibility that provided by the multimedia tool to the participants of this study in terms of getting more practice outside classroom with the support of parents and without the presence of teachers may contributed to the good performances of the respondents in both tests. This is in-line with the finding of Lee (2008) who found that continuous training in both classroom and at home improved the level of mastering language among dyslexic children.

After went through the training using the developed multimedia tool, the respondents have improved their capacity in spelling and speaking English words compared to the traditional method. The multimedia tool has assisted the dyslexic children in mastering both phonological and orthography of English language which become a major problem among non-native speakers. Rao and Skouge (2015) found that multimedia tool support learning language among culturally and language diverse children.

The PA problems which occurred among Malaysians due to the differences in pronouncing the words could be overcome with infusion of culturally responsive features in the multimedia tool design framework. The audio capturing method that used in the tool has provided the dyslexic children with sufficient support in obtaining the literacy skills. This method has solved the problem of getting confused with the variations of the words in English pronounced among the dyslexic children.

It is also worth to take note that the improvement in phonology of a language also enhances the orthography capability among dyslexic children in which the complexity of phonological process will give negative impact on mastering orthography that could lead towards slow down the ability to master the language among dyslexic children (Spencer, 1999).

Conclusion

It is pivotal to have an appropriate framework for designing and developing multimedia tools for learning languages that has non-transparent orthography – English - which depends on lexical method. Children from multi-cultural country such as Malaysia are bounded with various language and cultural factors that

influence their phonology process in mastering the literacy skills in English language. Thus, a multimedia tool that embeds culturally responsive framework is needed.

A framework that integrates both cultural factors and linguistics features for English language learners with dyslexia in Malaysia was proposed and it is proven that the developed multimedia tool leveraging the framework has improved the literacy skills among the dyslexic children. The further development of this multimedia tool using the designed framework would substantially benefits Malaysian English learners with dyslexia and also the instructors who train the dyslexia students.

Acknowledgement

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