

Mobile Learning Model for Children with Special Learning Needs

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ABSTRACT

The mobile learning developed for children with special learning needs have limited users even within the same learning disability because severity in learning disability varies greatly even within a specific learning disability. Mobile learning developed for these children currently uses the same model used by any mobile application development where it caters for the masses rather than focusing on personalisation. The objective of this paper is to propose a mobile learning model for children with special learning needs, named APIE. ADDIE model is a generic instructional system design model that consists of processes: Analysis, Design, Develop, Implement and Evaluate. APIE is a modification from the ADDIE model, which makes APIE a mobile learning application development model. APIE iterates the design and develop processes under the Personalisation stage to explore the most suitable way for customisation for individual learning. APIE is applied to the development of a mobile learning for Dyslexic Children to assist the children to read and spell. Through APIE, a mobile learning application, DysleRead is produced. DysleRead integrates two classroom approaches: sight word and phonic where teachers can set and monitor individual learning needs of the children. The teachers find DysleRead helpful to teach the children. This shows that the mobile learning application produced using APIE meets the objective to cater for personalisation within a specific learning need without undermining the role of the teachers. Hypothetically, APIE model is applicable to other special learning needs too.

1. Introduction

Learning disability (LD) is defined as deficits in one or more of several domains, including reading disabilities, mathematical disabilities, and disabilities of written expression (Lyon et al. (2003). For LD such as Dyslexia, when a child is certified with the condition the level of severity can vary from one child with dyslexia to another. These assessments on the level of severity is mostly determined by trained teachers. Only then the teacher will be able to determine the remedial approach to assist the child in learning according to the level of severity; in most cases, the solution is a one-to-one session to learning. Although there have

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been learning tools especially mobile learning apps to accommodate individual learning needs based on the severity, a tool that allows a teacher that is working with multiple children with varying special learning needs, have yet to be developed. When the mobile learning models are studied, these models are limited and not designed to cater for such special learning needs.

A mobile learning model for special learning needs serves as a development guide to produce a usable mobile learning application that covers different range of severities. It also covers learning in a group with different range of severities. The challenge to propose an effective mobile learning model is that this model must be able produce a mobile learning that is effective in the learning for the children with special learning needs. Thus, our proposed model in this paper focuses on dyslexic reading. Shaywitz et al. (2021) stated that dyslexia is a specific learning disability that is neurobiological in origin. A person that suffer from dyslexia might have trouble to read fluently, spell words correctly and learn a second language (Shaywitz & Shaywitz, 2003). There are different ways to help dyslexic individuals to improve their reading such as sight words drills, repeated reading and syllable example. Sight words give a remarkable establishment to reading (McArthur et al., 2015) as high-frequency sight words appear so often in the text that learning to read them on sight will increase children's reading fluency (Joseph et al., 2013). The severity of learning varies greatly between dyslexic children (Olson, 2002), similar to the general problem faced by teachers working with special learning needs children. Dyslexic reading makes a good fit for our proposed mobile learning model.

The objective of this paper is to propose a mobile learning model that allows mobile learning practitioner to use as guidance during learning. This mobile learning app also caters to a wider mass within a special learning need instead of multiple cycles of development. Currently, the scope of the model is within special learning needs in learning disabilities. This paper presents a novel mobile learning model for children with special needs in learning which has been demonstrated to work for dyslexic reading.

2. Literature Review

2.1 Mobile learning for Special Education

Mobile learning has broad definition of being part of e-learning, and due to the extent of the usage, mobile learning is used in both formal and informal settings (Winters, 2007). Mobile learning has been used as an alternative to assistive technology (Ismaili, 2017) because mobile devices are currently widely available at an affordable cost. Mobile learning is linked closely to mobile learning application (app). Hence, the quality of a mobile learning app is important.

Adebisi et al. (2015) highlighted the need to select the most relevant technology for children with disabilities in order for them to maximise learning while still having an enjoyable learning experience. In their review, teachers utilise existing text to speech tools such as the one commonly available in Microsoft Words, tape recorder and speech synthesis tools to read out for the children. However, these tools require more extensive participations of the teachers to assist the children. Furthermore, Adebisi et al. (2015) listed out criterion when selecting the right technology for these special children where finance remained an issue for both the teachers and parents. The criteria are:

- i. Determine the Child's Specific Problem. Identify the Child's Strengths.
- ii. Identify the Child's Strengths.
- iii. Involve the child in the selection process.
- iv. Choose the types of technology that are helpful and based on the child's strengths and weaknesses.
- v. Determine the specific settings for the technology.
- vi. Choose technologies that work together.
- vii. Choose technologies that are easy to learn and operate.

They also highlighted the importance of role of the teachers. When a teacher understands the child, the child's needs should be matched with the necessary technology rather than matching available tools to student needs. Although technology should be designed with minimal training, when it comes to children with dyslexia, they would require some form of training in the beginning. The task of training these special children would normally be teachers trained to teaching children with special needs however not specialized in ICT. The criterion and guidelines are crucial factors to be considered when transferring effective teaching and learning approaches for children with learning disabilities to mobile learning, which current mobile learning is lacking.

Charlton et al. (2005) had shown educational games can accelerate learning when combined with teacher-instructions, again re-enforcing the role of teachers in guiding children with learning disabilities to read. They emphasise that an important element of learning that should not be overlooked is the fun. Mobile learning should provide independent learning without the children being too dependent on it or the difficulty level is too high that the children lose interest.

2.2 Mobile Learning Models

From a usability point, in developing a mobile learning, Wei et al. (2008) showed that students and content have the highest interactivity followed by teacher-content, student-teacher and student-student. Interactivity for student-content and teacher-content are useful consideration in developing a mobile learning model however, learning for children with special learning needs is centred around trained teachers. The consideration for student-teacher interactivity in mobile learning is higher in the case for children with special learning needs.

Khaddage et al. (2009) propose mobile learning model for universities. Their model is a combination of online learning and classroom learning experience. The ability to integrate classroom learning experience into mobile learning is what most mobile learning developers target towards but this model is too general to be applicable to mobile learning for children with special learning needs. Koole (2009) proposes Framework for Rational Analysis of Mobile Education (FRAME) where mobile learning is an intersection of the device, learner and social aspects. Although FRAME takes into consideration of the different aspects including information content, teacher is not within the model. Ozdamli and Cavus (2011) listed out the basic elements for mobile learning as teacher, learner, assessment, environment and content. More recent model although considers holistic approach and integration of smart class room (Al-Hunaiyyan et al., 2017), the model does not defer much from the earlier models that focus on mobile learning elements and classroom integration. All these models lack the consideration of the pedagogy strategies in mobile learning.

Kim (2009) proposed a cyclical model when conducting study on mobile learning for underserved children with four distinctive stages (Strategise, Apply, Evaluate and Reflect)

(Figure 1). The first stage of this action research model starts by generating a new question on certain aspect that is required for mobile learning. When studying a certain aspect in mobile learning, the action research model starts at the stage of strategise by deriving new questions on the study. This first stage also investigates the possible action and enhancement to the system design that is under study. The next stage in the model is the apply stage: this stage applies what have been strategized earlier. This is then followed by the evaluation stage where quantitative and qualitative data are collected through interviews and observations. Based on the data, the model moves to the final stage which is reflection. Through comparison and identifying possible problems and opportunities, the model will cycle through the stages again. Although this is an action research model, this model presents a perspective from a mobile learning designer and practitioner. The model serves as a guide to design, test, and enhance a mobile learning model.

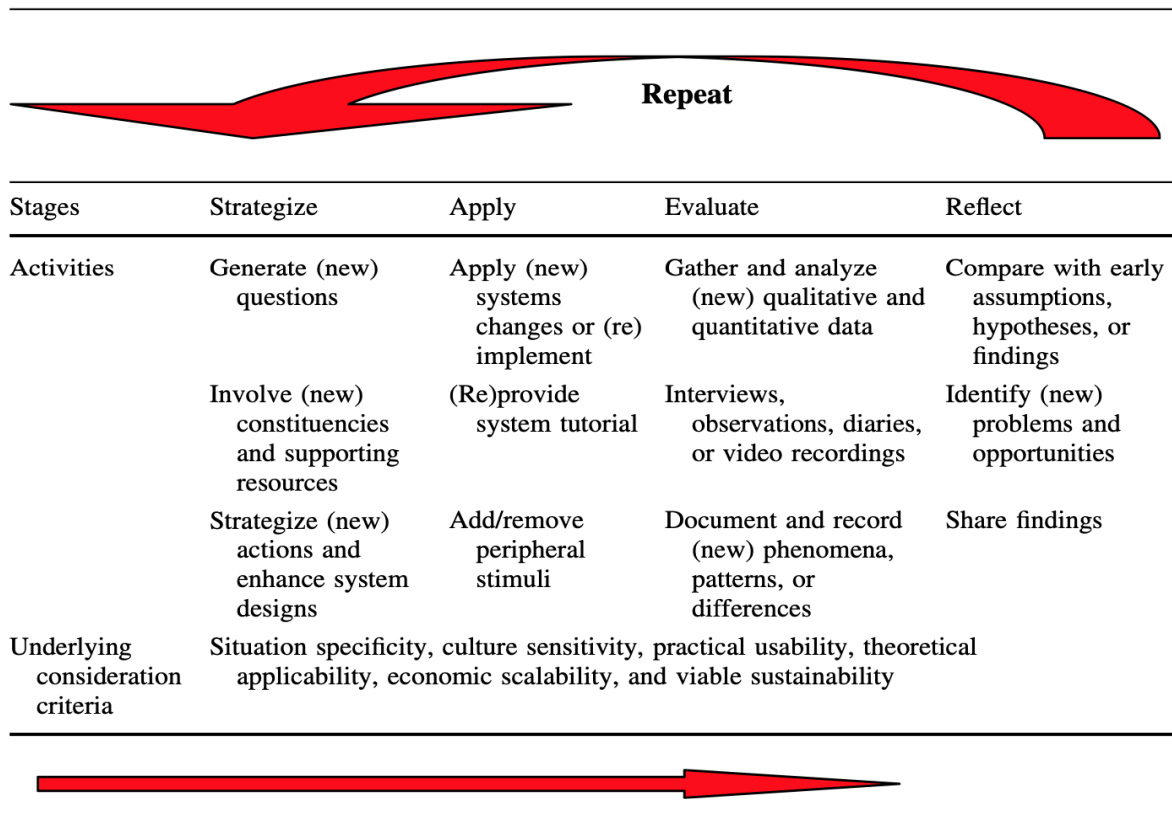


Figure 1: Action research model for mobile learning for the underserved (Kim, 2009)

2.3 Mobile Learning Application Development

The existing mobile learning models (Al-Hunaiyyan et al., 2017; Khaddage et al., 2009; Koole, 2009; Vithani & Kumar, 2014; Wei et al., 2008) do not consider the methodology in the development of the mobile learning application. Most literature in the line of mobile learning applications development focuses on adoption of mobile learning application such as students' attitude and perceptions (Almaiah et al., 2019; Oyelere et al., 2018), cross-platform development (Litayem et al., 2015), flexibility learning (Ally & Tsinakos, 2014; Martono & Nurhayati, 2014), design and development within certain mobile learning aspects such as collaborative learning (Lee & Salman, 2012; Sulisworo et al., 2016) and learning programming (Oyelere et al., 2018; Tamhane et al., 2015). These works focus on either secondary or university students. Work on development methodology for mobile learning

application is almost none existence thus, mobile learning apps are developed similar to the approach used to develop any mobile apps. Due to the nature of special learning needs, there is a need for personalisation, which current model is lacking.

2.3.1 ADDIE

One of the more common instructional system design model is analysis, design, development, implementation (ADDIE) (Branch, 2009). When these steps in ADDIE approach are evaluated, these steps are similar to steps in development of a mobile application (Vithani & Kumar, 2014). Sulisworo et al. (2016) used ADDIE approach to develop their mobile learning application that integrated Jigsaw technique, a cooperative learning approach used for scientific collaboration. Although the Framework for Rational Analysis of Mobile Education (FRAME) (Koole, 2009) attempts to address the pedagogical issues, this framework does not integrate teaching pedagogy into mobile learning. From the pedagogy point of view, an effective mobile learning is one that can deliver the instruction to trigger learning. Thus, a mobile learning model should be linked to an instructional design model and ADDIE is the closest match to that although it is still lacking personalisation for children with special learning needs.

2.3.2 Dyslexia

Currently, dyslexic children require a one-to-one reading session with their teachers to learn how to read or spell due to their short span of attention. However, this approach can be time-consuming as the children learn slower without assistance and guidance from an adult. Although Mr. Read attempted to mitigate this problem by integrating sight words approach (Borhan et al., 2015; Borhan et al., 2018). Sight word approach requires teachers to present flashcards manually when the children are reading. However, different dyslexic children would have a different reading pace. For children that have slower reading pace, they would need more cues for reading. The existing application does not have the function that allows the teachers to change the amount of cue for reading.

The current application also does not integrate a phonics approach. Phonic approach had been shown to be effective in teaching reading to children with learning disabilities (Bracey et al., 2006) with (De Graaff et al., 2009) demonstrating the benefits of systematic phonic instruction. When phonics is not integrated in the application teachers will need to pronounce the sound of the letter every time they teach. However, the presence of the phonics function via tapping on the letters, may not be fully beneficial as it may lead to children being dependant on that feature. The reverse will most likely be true also when too little guide will lead to the children losing interest in learning. Teachers play an important role here determining the among of cues needed by the children. The current mobile application available also does not include the role of the teachers. Snowling et al. (2011) further emphasised the role of teachers in identifying children at risk of dyslexia through the phonic approach. When children have different learning needs, the mobile learning must be able to let teachers monitor the individual children's progress. The challenge here is how to transfer personalised learning of sight work and phonic approach into mobile learning that ensures the phonic approach remains an effective teaching approach for the children. Also ensuring that children will not be too dependent on the mobile learning application.

Sight word learning is described as a process for a beginner to gain skill in reading (Ehri, 2011). Ehri L. C. (2011) suggested that when an individual read words by sight, they could access information stored in memory when they read the word in the past. The sight of the word activates its spelling, pronunciation and the meaning immediately. Meanwhile, the phonics approach is a method where the children learn to decode written letters and spoken

sounds (Phajane, 2014). The children are taught the letter-sound and later blend them into words. A study has been done shows that the feature deficit in reading material disability is decoding print into sound-based representation (Liu et al., 2010). These two approaches were considered while designing the application. Three existing applications are reviewed upon designing DysleRead.

Dyslexia Baca is a simple mobile application developed by Daud & Abas (2013). It is to assist the dyslexic children to recognize the alphabets better and to recall the information that they read and learnt (Daud & Abas, 2013). This mobile application was developed in the Malay language. It has an interactive environment that can draw dyslexic children's attention. Unlike Mr. Read v2.0, Dyslexia Baca had applied a phonic reading technique and multisensory approach blended with interactive multimedia. This mobile application focuses on teaching the dyslexic children to learn how to differentiate the similarities between the letters.

3. Methodology

3.1 Analysis, Personalisation Implementation and Evaluation (APIE)

The proposed mobile learning model consists of Analysis, Personalisation Implementation and Evaluation (APIE) phases (Figure 2). In the Analysis stage, teachers and system analyst work closely to identified specific learning needs for the children. Then this is followed by the personalisation stage. In this stage, teachers will identify the different severity level faced by the children for that learning needs and they will design and develop the teaching and learning approach including the content. The process of design and develop will be iterated to produce the best way for personalisation of learning for the children. Prototypes of the mobile learning application will be produced and tested with the teachers. Once the teachers agreed, the mobile learning application will be implemented in accordance to output from the Personalisation stage. Once the mobile learning application is implemented, in the Implement stage also teachers will implement the mobile learning with the children. How well is the mobile learning including the mobile learning application will be evaluated in the Evaluate. Stage. The evaluate stage should also let the teachers be able to observe the children's progress before and after the mobile learning approach. From mobile learning application point, the evaluation stage will conduct usability testing with the children. This model runs parallel both mobile learning and mobile learning application development.

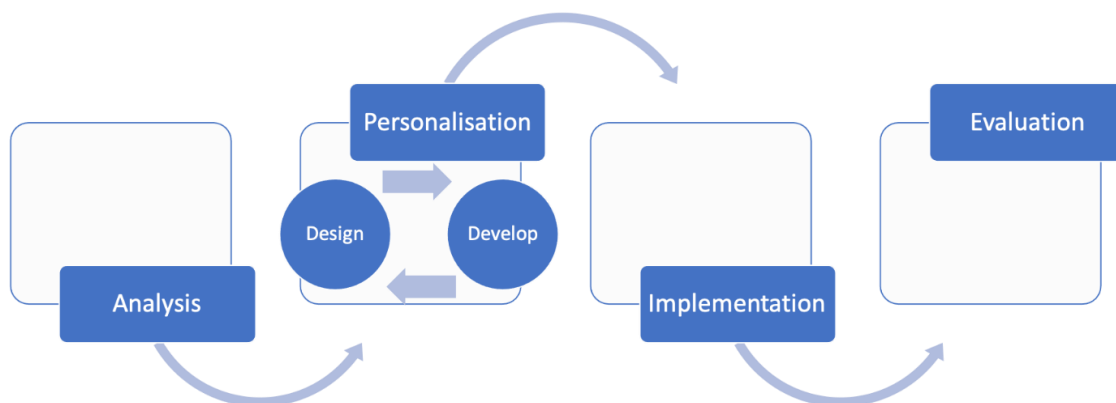


Figure 2: The stages in APIE

3.2 Implementation

As a proof of concept that our proposed mobile learning model for special learning needs, APIE works, this study collaborated with the teachers at the Dyslexia Association of Sarawak Centre to produce a mobile learning for dyslexic children. Analysis is the first phase in APIE. In this stage, the teachers and mobile learning developer analysed the reading and spelling needs. The team/developers identified the problems faced by the teachers and the dyslexic children. The second phase in APIE is Personalisation. In the first round of design and develop processes, the teachers informed that sight word and phonic approaches need to be integrated to the mobile learning. The mobile learning team developed walkthrough screen designs and functions within the application with the teachers. After a few rounds of iterations, teachers and the mobile learning team decided to allow the teachers to manage an amount of cue for the sound of letters during reading (Figure 3) as the best option for personalisation. In this stage also, the team identified scoreboard for the spelling game to keep track of the children's progress. Once the teachers agreed that personalised can be done for the children, APIE moves to Implementation stage. In this stage, the mobile learning application (app) is produced. Once the app is ready, the teachers can set the cue according to the individual needs of dyslexic children. The children are provided with the app to independently learn by allowing them to tap on the letter to listen to the letter-sound while reading (Figure 4 (a) and (b)) rather than relying fully on one-to-one teaching. In the evaluate stage the children are given the spelling game and the scores are recorded for the teachers to monitor them.

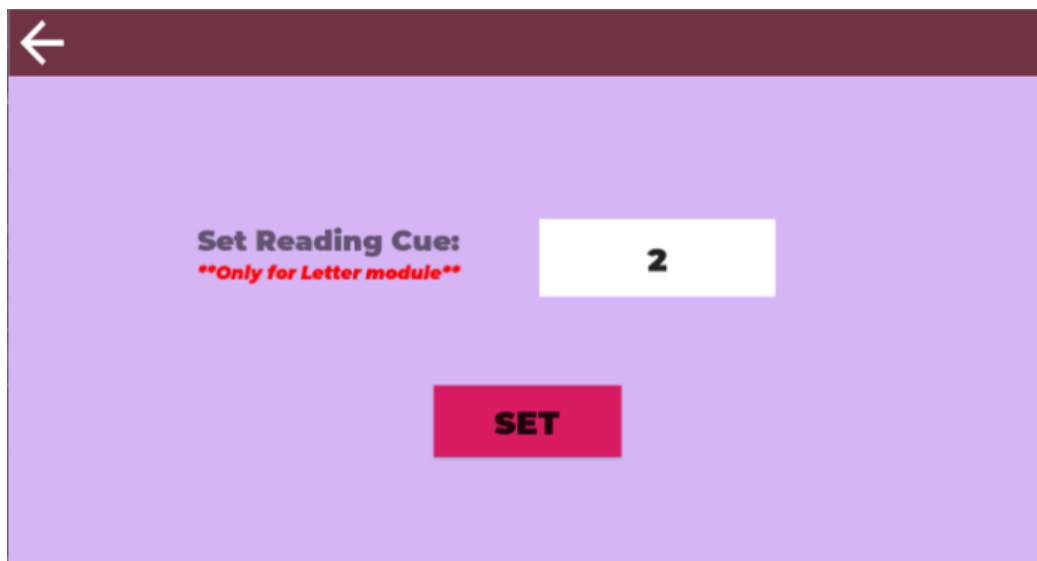


Figure 3: User interface for setting reading cue

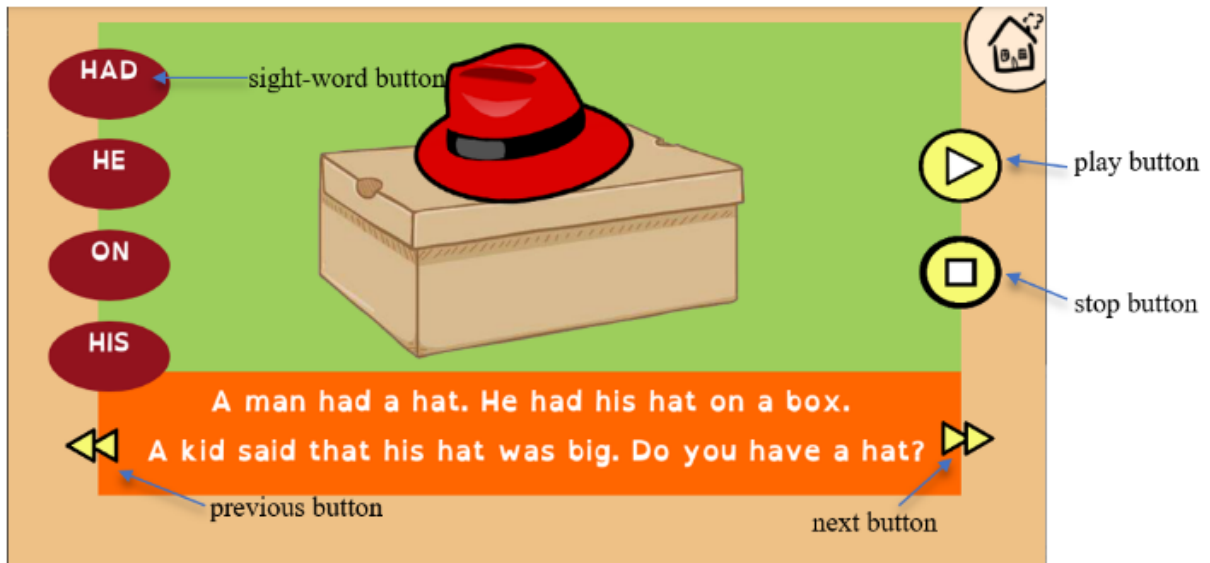


Figure 4 (a): User Interface for Story Module

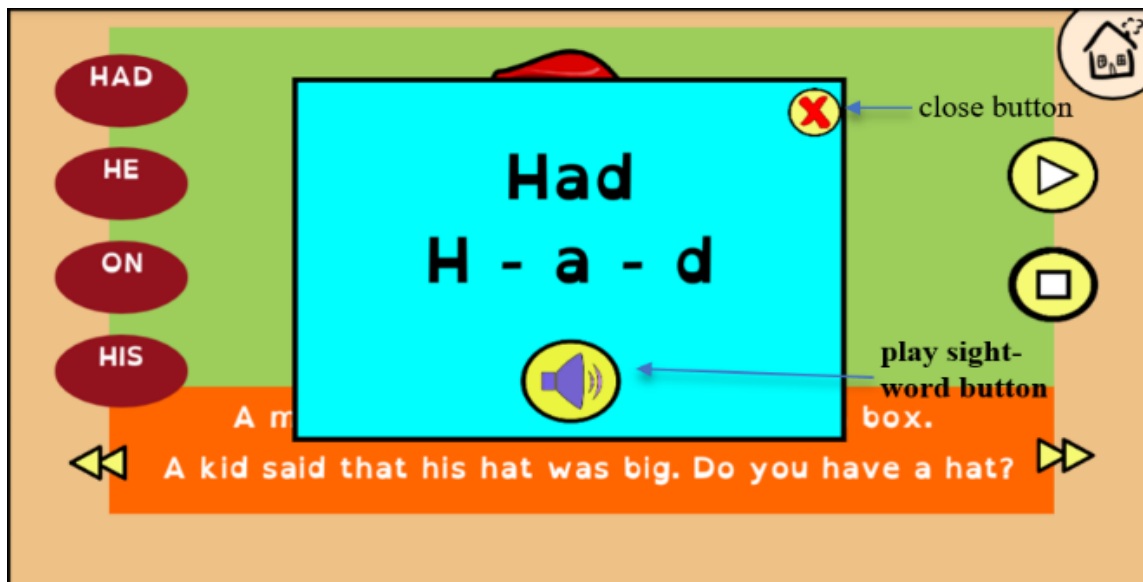


Figure 4 (b): User Interface for Story Module

3.3 Survey, Sampling and Data Analysis

Whether the mobile learning caters for the children's needs is important to determine if APIE mobile learning model can be utilised to create mobile learning for children with special learning needs. In the case of the dyslexic children, the trained teachers are the most suitable ones to give feedback on their progress. The head of the teachers followed through the APIE phases till the production of the mobile learning app. DysleRead was tested by two teachers, other than the head of the teachers, after each of the modules was implemented. A survey was also carried out among the teachers who used DysleRead app to gather their feedback on their experience using the app. Six teachers were selected for the survey including the head of the teachers. These teachers have at least one to ten years of experience working with dyslexic children. The survey consists of 5-Likert scale questions that requires the teachers to answers ranging from strongly disagree to strongly agree. The survey included an open-ended question on how to improve the app further. The result of the questions with 5-Likert scale

are visualized in pie chart (as shown in the Results and Discussions section below). The feedback for the open-ended question is analysed as consideration for future work.

4. Results and Discussions

83% of the respondents agreed that they can set the reading cue for the letter-sound as shown in Figure 5.0 (a). The remaining 17% of the respondents strongly agreed that they can set the reading cue. It can be concluded that this application has successfully helped the teacher to set the reading cue for the letter-sound. It shows that letter-sound are played repeated according to the cue set by the teacher. APIE personalisation stage forced teachers and the mobile learning application developer to think of the best way for personalisation.

Majority of the respondents agree (both strongly agree and agree) that the application is easy to use as shown in Figure 5.0 (b). Only 34% of the respondent chose 'average'. The analysis shows that the application is easy to use.

Figure 5.0 (c) shows that 50% of the respondents agreed that this application has helped them to teach the students. The remaining 50% of the respondents chose average as they said the content of the module in the application is limited. Since all the responses were in the average range and above, it can be concluded that this application has helped the teacher to teach the dyslexic children.

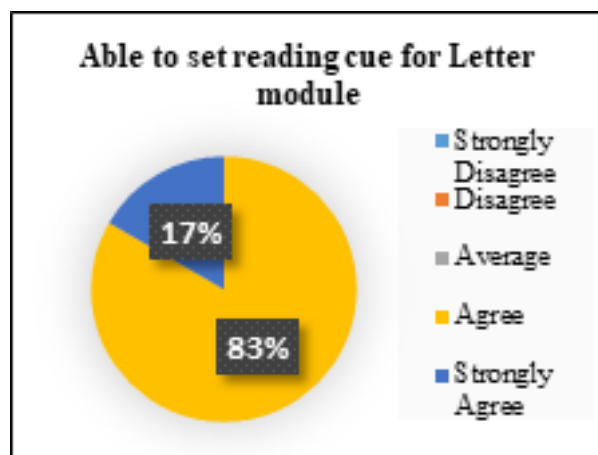


Figure 5.0(a)

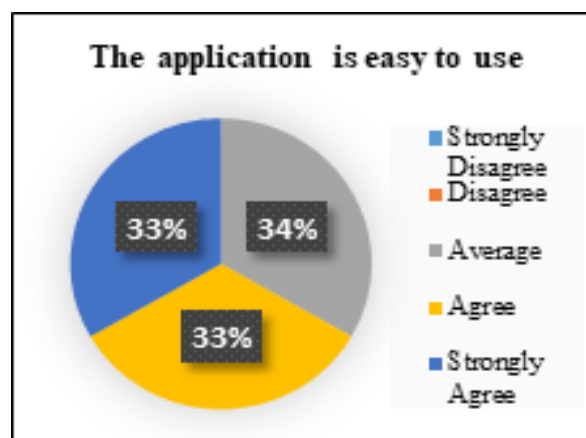


Figure 5.0(b)

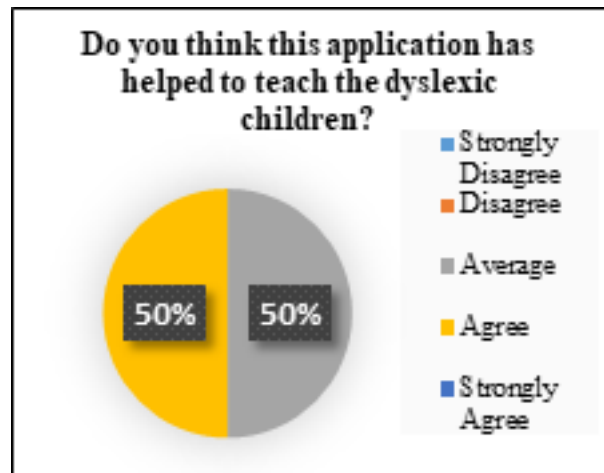


Figure 5.0(c)

Figure 5.0 (a, b and c): Results of the survey with the teachers

Some recommendations suggested by the teachers from the survey done has considered as the future work for this application. An activity where the students can trace the letter shape will be added. The teachers also suggested an activity where the students can blend the letter-sound to form a word. A recording feature will also be added where the teacher can record their voice reading out the reading material. And lastly, the teachers suggested the media used by the application should be 'pre-added' into the application instead of requiring download with internet connection. All these recommendations show that, overall, APIE has helped to produce a mobile learning application suitable for children with special learning needs that accommodate different level of severity which current mobile learning model do not consider.

5. Conclusion

This study shows that integration of classroom learning approaches such as sight word and phonic for children with special learning needs into mobile learning application are feasible using the APIE mobile learning model. Teachers agreed that integration of such classroom approaches can assist them to teach the children where previous app has limited usage. The key aspect of our proposed mobile learning model, APIE is the iteration of design and develop processes to create the best possible way for personalisation for children with different severity level of learning disability. APIE has the potential to be extended to other special learning needs community such as the those with hearing challenge.

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