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CONTENTS

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The Design of A Speech Delay Screening Mobile Application for Malaysian Parents

Siti Asma Mohammed*
Nur Faizah Azahari**
Wan Nur Shahirah W.A Sayuti***

Abstract: Some children may face some developmental problems in one or more areas of their developmental milestones. One of them is speech delay. To date, a screening tool for speech delay early detection among children is still lacking, especially in Malaysia. Parents do not know where to refer and which organisation can help them especially for first-time parents. The objective of this paper is twofold. First, this paper analyses existing screening system or application for speech delay in children. Second, this paper proposes a mobile application designed for Malaysian parents to help them detect speech delay in their children. A qualitative expert review was used to design and build the application. The screening application proposed is for early detection and to urge parents to seek for early intervention through appropriate assessments. In conclusion, early detection in speech delay is critically important to increase the chances for improving speech and communication skills. Thus, a speech delay screening tool is needed for parents to seek proper treatment for their children

Keywords: mobile application, speech delay

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* Assistant Professor, Kulliyyah of Information and Communication Technology, International Islamic University Malaysia (IIUM). Email: siti_asma@iium.edu.my. Corresponding Author
**Postgraduate Student, Kulliyyah of Information and Communication Technology, International Islamic University Malaysia (IIUM). Email: nurfaizahazahari94@gmail.com
*** Postgraduate Student, Kulliyyah of Information and Communication Technology, International Islamic University Malaysia (IIUM). Email: syahieera@gmail.com

Abstrak: Kelewatan bertutur merupakan masalah perkembangan penting yang dihadapi segelintir kanak-kanak. Sehingga kini, alat pengesanan awal dalam kelewatan bertutur dikalangan kanak-kanak amat berkurangan, terutamanya di Malaysia. Ini menyebabkan ibu bapa muda terutamanya, tidak tahu saluran atau organisasi yang betul untuk dirujuk. Oleh itu, kajian ini telah menganalisa sistem penyaringan atau aplikasi kelewatan pertuturan dikalangan kanak-kanak yang sedia ada. Kedua, kajian ini telah mencadangkan aplikasi mudah alih yang direka dalam Bahasa Melayu untuk ibu bapa di Malaysia bagi membantu mereka mengesan kelewatan pertuturan dalam anak-anak mereka. Kajian pakar kualitatif telah digunakan untuk membangunkan aplikasi ini yang bertujuan untuk pengesanan awal dan menggesa ibu bapa untuk berjumpa pakar bagi penilaian lebih lanjut. Kesimpulannnya, pengesanan dan intervensi awal amat penting untuk meningkatkan kemahiran bertutur di kalangan kanak-kanak.

Keywords: aplikasi mudah alih, kelewatan pertuturan

Introduction

Speech delay, also known as *alalia*, refers to a delay in the development or use of the mechanisms that produce speech (Dodd, 2013). Children with speech delay develop speech or language in the correct sequence but at a slower rate than a typical child. A speech delay might be due to an oral impairment, like problems with the tongue or palate (the roof of the mouth). A short frenulum (the fold beneath the tongue) can limit tongue movements for speech production. A delay in speech development may be a symptom of many disorders, including mental retardation, hearing loss, an expressive language disorder, psychosocial deprivation, autism, elective mutism, receptive aphasia and cerebral palsy (Longbottom, 2016).

Speech delay may be secondary to maturation delay or bilingualism. Nowadays, speech delay is the most common developmental problem. The prevalence of speech delay in young children is eight to nine per cent (NIDCD, 2015). By the first grade, roughly five per cent of children have noticeable speech disorders; the majority of these speech disorders have no known cause (NIDCD, 2016). Speech delay has long been a concern for physicians who care for children (Leung and Kao, 1999). Early detection is crucial as a number of developmental problems will eventually accompany the delayed onset of speech and

will have a significant impact on personal, social, academic and, later on, vocational life (NIDCD, 2016). Early identification and appropriate intervention may mitigate the emotional, social and cognitive deficits of this disability and may improve the outcome. Early detection can benefit a lot to children aged 5 years or younger, however screening tools for early diagnostic evaluation is still insufficient (Siu, 2015), especially in Malaysia given that there is a shortage in the number of speech therapists in the country (Bernama, 2016). In addition, Reilly (2015) concluded that evidence of screening tools for children with speech and language delay is not enough in primary care settings. Hence, this paper describes the related work on speech delay, followed by the methodology of designing a speech delay screening tool. In the next section, the proposed system is discussed and finally ends with a conclusion.

Literature Review

Early detection of any delay in a child's developmental milestone is very crucial so that parents can prepare and plan for early intervention to improve the development of their children. However, some parents do not want their child to be diagnosed and they are in denial that their child is different from other children. On the contrary, some parents need assurance of their children's problem before going to an expert. According to Longbottom (2016), commonly only after four years that parents believe their child might have speech delay and seek to get a proper diagnosis. The lack of information and knowledge about speech delay is also one of the problems faced by parents. Due to that, parents failed to detect speech delay problems among their children. Shortage of speech delay expertise are also one of the factors parents cannot get a proper diagnosis for their child. As reported by Bernama on July, 12th 2016, a UKM study shows that Malaysia needs more speech therapists so that percentage of speech delayed children can be reduced. The study found that some parents especially first-time parents, do not know which channels or organisations to seek in order to get a proper diagnosis for their children.

Currently, there are some available screening tools that parents can use to check their children's speech milestones. In the UK, they use the online progress checker, professional practitioner and other tools developed to help parents check their children's speech delay. Besides,

some countries use the checklist as their tool. In Malaysia, an assessment tool called Malay Preschool Language Assessment Tool (MPLAT) has been developed to assess the areas of receptive language, expressive language and early literacy skills for Malay pre-schoolers (Rogayah, 2018). MPLAT was found to be a valid tool to screen and diagnose language problems among Malay pre-schoolers. However, this study found to date, the screening tool for speech delay early detection designed for Malaysian parents to help them detect speech delay in their children at home before seeking for further assessments with professional speech therapists is still lacking. Based on the survey that has been conducted especially from the Autisme Malaysia Facebook group, in most cases, due to the lack of screening tool for parents to use at home, it deters the decision made to bring their children for appropriate assessment with speech therapists. Some parents might even realise their children are having speech delay problems only at a later stage for example, at seven years old.

Related Works

Home Speech Home offers a speech language screening tests, which are designed to give users a comparison between what a child is currently doing and what he should be doing. The tests are meant to compare the speech and language development of children according to their milestones. They are not meant to diagnose any kind of disorder and are not substitutes to speech/language evaluations by a certified Speech-Language Pathologist. Both screeners provide detailed information that will help users decide if they should be concerned and if users should seek further help.

Nevertheless, there is also Little Bee Speech Articulation Test Centre which has full-featured articulation and phonology tests for iPad designed for Speech Language Pathologists and other speech professionals to assess the articulation and speech production of children and adults of all ages. The application consists of two tests that can be administered, which are the Screener and Full Test.

Finally, there is the Speech Therapy Services site used by both parents and professionals to learn about speech and language development, explore activities, find needed materials, and schedule therapy. This website also provides a free speech language screening tool based on age. Users can simply click on the age and an assessment

will appear. Table 1 shows the advantages and disadvantages of all these available applications. However, still a specific screening tool for Malaysian parents is needed in order to give awareness to the parents on their child's speech developmental milestones.

Table 1 Literature Review Summary

Application	Features						
	Audio	Image Quality	Platform		Animation Quality	Language	
			iOS	Android		Malay	English
Little Bee Speech	✓	✓	✓	X	✓	X	✓
Home Speech Home	X	✓	✓	X	✓	X	✓
Speech Therapy Services	X	X	X	X	X	X	✓
SPEECHY	✓	✓	✓	✓	✓	✓	✓

Methodology

Expert review is carried out in designing and developing SPEECHY based on multiple steps. The first step was in finding a speech therapist expert for collecting requirements on speech delay assessment guidelines and on designing questions that could most benefit the parents and children from the intervention. A qualitative method approach was utilised for eliciting the requirements. A one-to-one face interview is conducted with a Certified Hanen Speech Therapist to gain more understanding about the scope and features to be developed. The semi-structured interview was used for data gathering in order to gain in-depth understanding of the domain and to determine the necessary functions that the tool should have (Boyce and Neale, 2006).

Then, the second step is prototyping the SPEECHY features based on the collected requirements and on a review of related applications already available in the market. A subsequent round of interviews also has been done to make further clarifications of the relative important on the features identified after the first meeting with the expert through email and phone interviews. Data gathered from the interview then were analysed and represented in a use case and activity diagram as the required specification. The use case and activity diagram were

validated for correctness. As a result, a total of eight use cases were created as the main features or functions for SPEECHY screening tool. The description of the use case is presented in Table 2.

Table 2 Use Case Description

Use Case	**Descriptions**
Register Profile	Users need to register their child profile to keep the data into the database
Enter Age	Users need to enter their child age to answer the question's category correctly
Answer Test	Users will answer two set of questions, which are Communication Test and Behaviour Test
Get Result	Answer of the question will be showed after users answer all the questions
Get Speech Therapist Location	Admin get all the location of speech therapist centre in KL area
Manage Speech Therapist Location	Admin manages the location, so it can detect the location between the user and the centre
Manage Test	Admin enters the question that need to be display in the test
Export Data	Admin exports the question from the database

The use case of the system is shown in Figure 1. The figure shows that there are two (2) main types of actors involve for the tool, i.e. user (parents) and admin. The requirement was grouped into nine use cases that are (1) Register profile, (2) Log in, (3) Enter child profile, (4) Answer test, (5) Get result, (6) Display result, (7) Get speech therapist location, (8) Update test and (9) Export data. Below, Figure 2 shows the activity diagram of SPEECHY. The flow is starting from the user and other actor and system involved during the process.

Figure 1 Visualization of the Use Case Diagram

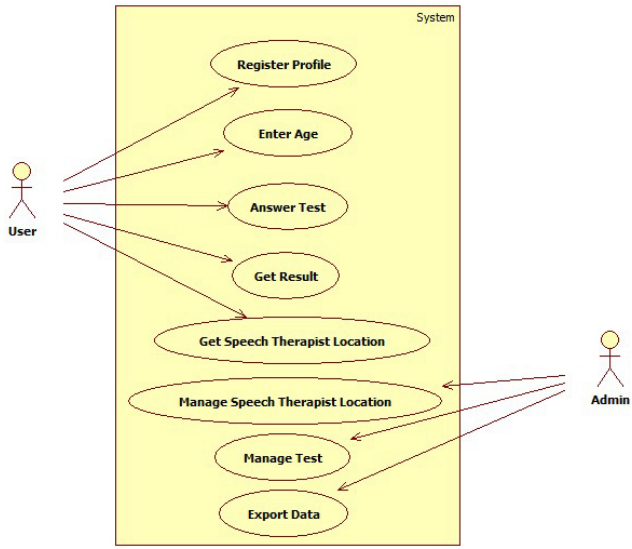


Figure 2 Visualization of Activity Diagram

During the final step, the prototype concept and design were presented to the speech therapist expert in another meeting. Several suggestions were provided by the speech therapist for the improvement of the app features. The SPEECHY prototype was then upgraded to more improved version to ensure the credibility of the content. Lastly, the improved version of the SPEECHY prototype was presented again to the speech therapist expert to confirm content validity.

The Proposed System

Table 3 below shows some of the important features of SPEECHY. The user needs to register their child profile when logging into SPEECHY to enable the system to save the details of the child into the database. The user needs to enter the name and age of the child for the system to keep track of the child's age. The user can add many children's profiles if the user has more than one child. There are two sets of questions the user needs to answer which are related to the communication test and behaviour test. According to the speech therapist being interviewed, the communication test is used to detect the level of speech delay. The behaviour test is used to check on the child's behaviour as behaviour can be an indicator for speech delay problem.

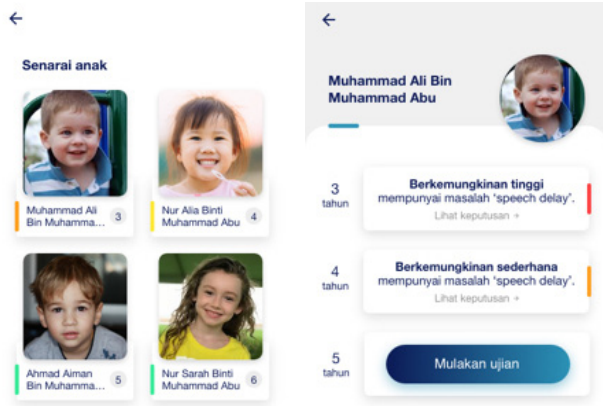
Every test consists of 10 questions, which according to the speech therapist is feasible as children have short attention spans. The test is categorised based on child's age and the questions are generated by following the standard speech developmental milestone (Figure 3). A speech developmental milestone is a standardised list of milestones that speech therapist use as a guideline to track the development of a child based on the child's age. In the speech developmental milestone, the age in years will show the alphabets that the child should be pronouncing at that age. For example, at age 4, the child is supposedly pronouncing the alphabets F, K, G, T, S, Y. Hence, by using the alphabets, we come up with a word so that we can detect the delay when the child pronounces the word that consists of the specific alphabet.

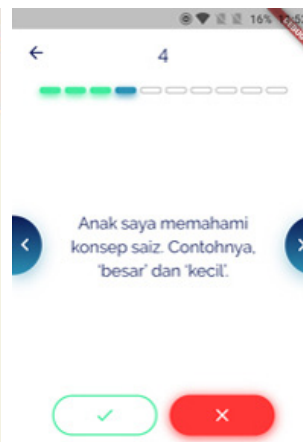
For the communication test, the question contains a picture with related alphabets that need to be tested based on the child's age. Besides, for every question there is an audio sound that pronounces the word which would help the children to hear the correct pronunciation if they do not know how to pronounce the word.

For the behaviour test, a situation-based question is given for users to answer. Users need to answer the questions based on their observation of the child's behaviour and also based on their experiences with the child. The result of the assessment will be displayed when the user finishes answering all the tests. The user may also review his or her answers after getting the result.

SPEECHY is an interactive mobile application that supports users to do an assessment and get the result as well as help them identify whichs problem the children are having. This mobile application also provides google maps features to locate all Speech Therapist Centre around Kuala Lumpur so that the user can refer to the expert immediately after completing the test for further assessment.

Table 3 Important features of SPEECHY

On the left shows the interface that lists the names of the children and the children's age. Users can click on one child's name and another interface will display the history of the test taken based on the child's age.	

This is the interface for the communication test. The question contains a picture that contains the specific alphabet that needs to be tested based on the child's age	 
This is the interface for the behaviour test. The questions are for the parent to answer based on his or her observations and experiences with regards to the child's behaviour and development.	 

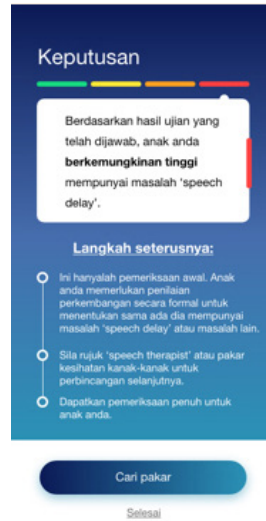
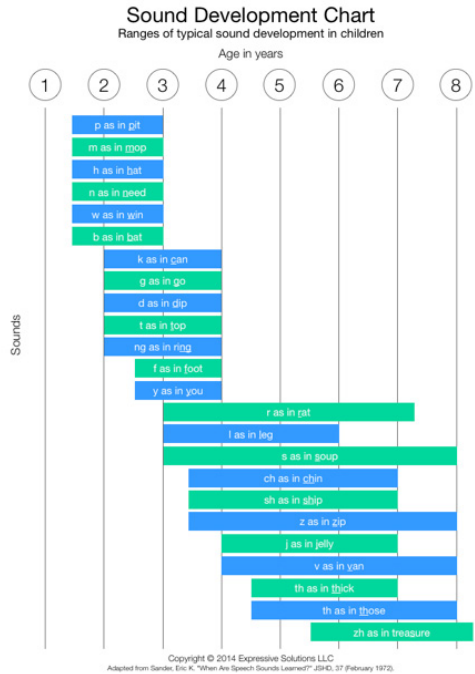
This is the result interface after the user completes all tests.	

Figure 3 Sound Development Chart



Conclusion

This paper has analysed and presented a study on the development of a speech delay screening tool. It furthers the discussion about the need for a screening tool for early detection of speech delay among Malaysian children. Other than that, this paper also discusses the existing screening tools for speech delay children in search of a similar early detection application that can help Malaysian parents. There is the shortage of expertise, expensive cost and the inconvenient process to get treatment and diagnose plus the lack of awareness about speech delay and early diagnosis. Early detection can help the development of children with speech delay as well as their parents. From the research, a new system named SPEECHY was proposed which can help parents get early detection for their child We hope that the SPEECHY application will give benefit for parents as well as for society.

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In This Issue

Note from the Guest Editor

Research Articles

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2289 5639