

Speech Therapy Mobile Application for Speech and Language Impairment Children

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Abstract - Speech and language impairment (SLI) is a communication disorder when a person has difficulties to produce speech sounds correctly and understand others. Children with SLI need speech therapy to help them improve their communication skills in order to communicate effectively with others. Due to the lack of speech therapist in the state, children are mainly waste valuable learning time while waiting for therapy and these speech therapy sessions are usually done only on a one-to-one basis within a block period. Recent studies showed that mobile technologies may work as an educational tool which can help children to learn. Hence, a local prototype of mobile speech therapy application was developed to be appealing for pre-school children of age 3 to 6 with SLI and will be used as a supplementary activity which can be used during a speech therapy session or at home. In this paper, we present the results of a six months intervention experiment with SLI children. We have adapted the heuristic evaluation for evaluating the usability of the local prototype mobile speech therapy application. The results of our study shows those children and their parents gave positive responses towards the mobile application, also helps in improving the children skills in producing correct sounds.

Keywords – mobile application; speech therapy; speech and language impairment (SLI)

I. INTRODUCTION

Speech and Language Impairment (SLI) is a communication disorder that occurs in a person's ability to talk, read, write and understand others. Language impairment is the difficulty in understanding the language and the processes, such as vocabulary or grammar ([1], [2]). Speech is often referred to articulation, and the disorder of speech or articulation problem arises when a child has a difficulty in producing the correct sounds, syllables and words. Children experiencing speech production impairment would impact their articulation and speech intelligibility [3], which risk future reading and communication skills. If unresolved, it could cause difficulties of both learning and socialisation and lasting into adolescence and beyond [4].

Speech therapy will be needed as a treatment programme to help those children with SLI by speech-language pathology (SLP). However, in Malaysia, there is still lack of qualified SLP. This can be found in the updated list of qualified speech and language therapist based on the members' directory kept by Malaysian Association of Speech-Language & Hearing (MASH) [5]. Given that children nowadays are easily accessible and exposed to mobile technology at a younger age. Hence, integrating technology into speech and language therapy can be used as an alternative approach of speech therapy since technology has become more accessible to everyone. This paper will discuss the usability of the first version of local prototype mobile speech therapy application developed based on the results gathered from heuristic evaluation that was conducted with pre-school children with speech delay.

II. WHAT IS SPEECH THERAPY?

Speech therapy is a clinical program conducted by speech therapist or SLP as a treatment programme to help SLI children. As defined by American Speech-Language – Hearing Association (ASHA) in Speech-Language Pathology Medical Review Guidelines [6], SLP helps by providing treatment to those with disorders of speech sound production, resonance, voice, fluency, language, cognition and feeding and swallowing. SLPs aim to implement an efficient treatment programmes to help resolves children's spoken difficulties as well as to prevent later literacy problems [7]. SLP has to go through certain assessments to collect information about the behaviour and progress of the children with SLI. The assessments include understanding of spoken language and body language of the children, children's expression through speaking and body language, production and usage of sounds, their ability to use language in a social context, play skills and eating, drinking and swallowing. The treatment programme approach comprises of therapy manual, involving object-based and paper-based method. This includes a set of pictures or flashcards to represent any single consonants, vowels and words too. Those pictures or flashcards are presented to the children and are asked to produce sounds or words based on the pictures.

However, to choose an appropriate treatment programme is not particularly easy where as little attention has been paid to the effectiveness of specific treatment [8]. Treatment programme requires speech therapy sessions between the SLP and children, and if ignored, it could delay the acquisition of speech skills and phonological awareness. The treatment programme also requires certified SLP to help with their speech and language treatment. In addition, the speech therapy may cost more in terms of money and time and this may be a burden to parents who are traveling from rural and remote areas to the city.

III. MOBILE TECHNOLOGY AS EDUCATION TOOL

Children nowadays are easily accessible and exposed to mobile technology at younger age. Apart from the use for communication and consumption of entertainment, mobile technology can also provide easy-to-use learning strategies for all learners and help to promote learning to read and write for children ([9], [10], [11]). Since mobile technologies has been widely used everywhere by anyone, mobile devices have the potential to help the children with SLI in speech therapy. Sutton and Olivier [11] believed that there are many benefits can be gain when using a mobile-based application within a clinical setting: applications can be motivating, inexpensive, more efficient means of targeting skill and more accessible and engaging resources compared to the paper-based assessment. Despite those benefits, mobile applications are also convenient and lightweight where as traditional paper and object-based resources are bulky and unhandy to carry or use [11].

IV. METHOD AND EXPERIMENT

This experiment aims to look at the usability of speech therapy mobile application developed for pre-school children. We evaluated the prototype based on the two components of heuristic evaluation strategy by Korhonen and Koivisto [12]: Game Usability (GU) and Learning Content (LC). Questionnaires was designed based on the components of GU and LC. Since the developed prototype is a mobile application, we used the term ‘activity’ in the questionnaires instead of ‘game’. TABLE I explained the eight components of GU which concerns more on the interface and game controls. Generally, good interface and usability of a game ensure that the player has interest to keep engaged to the game until the end [12]. The components of LC were explained in TABLE II which concentrated more on the learning content of a game. The learning content of a game should be informative, understandable and useful content to the user [12].

TABLE I. GAME USABILITY COMPONENTS (KORHONEN AND KOIVISTO, 2006)

No.	Game Usability Components	Descriptions
GU1	Audio-visual representation supports the game	The game should look visually appealing. All graphics and audio should support game play and story; consistent and informative to player.
GU2	Screen layout is efficient and visually pleasing	The screen design should present all necessary information to player and follow the general principles of good screen layout design.
GU3	Device UI (user interface) and game UI (user interface) are used for their own purposes	The player interacts properly with the game user interface and device functions. Full-screen mode is preferable.
GU4	Navigation is consistent, logical and minimalist	All buttons and navigations should be organised reasonably, provide more clarity and easy to remember. The navigation should also be intuitive and natural.
GU5	Control keys are consistent and follow standard conventions	Standard control keys can be used since the player already knows from other games played.
GU6	Game controls are convenient and flexible and game was adapted to my screen size	The game controls can be customised. The controls also should be designed based on device's capacities
GU7	The game gives feedback on the player's actions	It is preferred if game user interface has a quick response on player's actions. The feedback can be presented in graphics, audio, or be tactile
GU8	The game contains useful help	The game provides instructions to player for playing the game. It is unnecessary for player to read manuals frequently.

TABLE II. LEARNING CONTENTS COMPONENTS (KORHONEN AND KOIVISTO, 2006)

No.	Learning Content Components	Descriptions
LC1	The content can be learned easily	The game should provide an easy learning content, that is not too complicated as preferable for the intended users.
LC2	The game provides learning content	The game provides learning content, so that the users learn new knowledge from the game. It could be any information that is of interest to the users
LC3	The objective from the game is achieved	The learning objective from the game is achieved after the game ends.
LC4	The content is understandable	The learning content is easy to understand and as expected by the users.

The experiment was piloted with a small sample of recruitments at Institute of Social Informatics and Technological Innovations, Universiti Malaysia Sarawak (UNIMAS) in Sarawak. 10 children between the age of three and six with speech delay were recruited and their parents have consented to allow their children to participate in the experiment. They were referred to the study by the local paediatrician from Borneo Medical Centre, Sarawak. The experiment was conducted with the children on a weekly basis, 2 times a week, for six months. Their parents or caregiver were allowed to joined the children during the session. They were given an hour or less for each session, depending on their emotion or moods. We will have to postpone the session when the children were distracted by other factors such as unhappy, mad or sick.

During the experiment, we let the child to play the mobile application in a closed room to avoid any distraction from the outside. We observed the behaviour and facial expression of the children while playing the mobile application. Their behaviour, expression, body movement, feedback and responses were observed and recorded. At the end of each session, we also conducted an interview with the parents. They were asked about their children progress and comment on how the mobile application impacted the child's interactions with them. The evaluation session was then conducted once the experiment was finished. Since our participants are pre-schoolers with speech delay, they have not yet learned how to read any texts, we distributed questionnaires to their parents or caregivers. The questionnaires were based

on the two components of the heuristic evaluation strategy: Game Usability (GU) and Learning Content (LC). The feedback of the questionnaires was based on a five-point Likert scale (5: Strongly agree, 4: Agree, 3: Neither agree nor disagree, 2: Disagree, 1: Strongly disagree).

V. RESULTS AND DISCUSSION

During the observation session, the children was found to have no difficulties when using the mobile application as they are mobile game users with experience playing mobile applications on mobile devices. They showed excitement while playing the mobile application and able to play the mobile application with minimal guides. We have noticed that they enjoyed animation features included in the mobile application. They would imitate the movement of the animation whenever they saw animations. We also have found that sound effects could attract children's attention. They kept on touching on any images that has sound effects on it. They would also imitate the sound produced. They were able to memorize some of the objects' name and the sound effects from the application. Positive feedback could help to encourage motivation among children when playing the application. Children will clap and raises their hands when get praised. We have also noticed that they are willing to move to the next activity as they feel motivated to finish the each of the activities.

Quantitative results were obtained from the evaluation sessions which was conducted by distributing questionnaires to the parents or caregivers. There were 20 respondents who have answered all the questionnaires. Fig. 1 shows the average mean for each of game usability components. The overall means for game usability components is 3.98 with the highest mean of 4.65 for GU7 (The activity gives feedback on the player's actions) and GU8 (The activity contains useful help), and the lowest mean of 3.4 for GU1 (Audio-visual representation supports the game). 65% of the respondents were very satisfied with the feedback features in the mobile application prototype. During the interview sessions, they did mention that the feedback feature was very interesting and motivating as their children looks happy whenever they received positive and interactive feedback while playing the mobile application. They were also satisfied with the verbally-based instruction provided in the application since their children have not yet learned how to read any texts. 60% of the respondents claimed that the interface of the mobile application was too simple with lack of attractive graphics. They have also suggested that the interface should be designed with more colourful graphics and funny audio or sound effects to attract children's attention more.

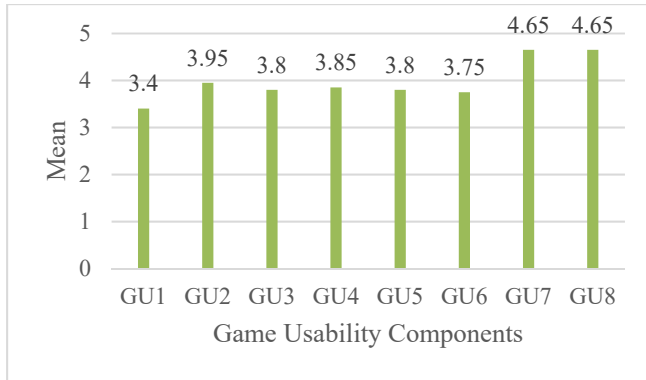


Fig. 1. Average mean for each of game usability components

Fig. 2 shows the average mean for each of learning contents components with the overall mean of 4.15. LC1 (The content can be learned easily) has the highest mean of 4.7 and the lowest mean is 3.7 for LC3 (The objective from the game is achieved). 70% of the respondents were very pleased with the content of the mobile application as they found that the content is easy to learn especially for their children. However, 35% of the respondents claimed that the learning content may not be enough to achieved the learning objective. They believe that their children could learn more by adding more new words in the learning content of the activity.

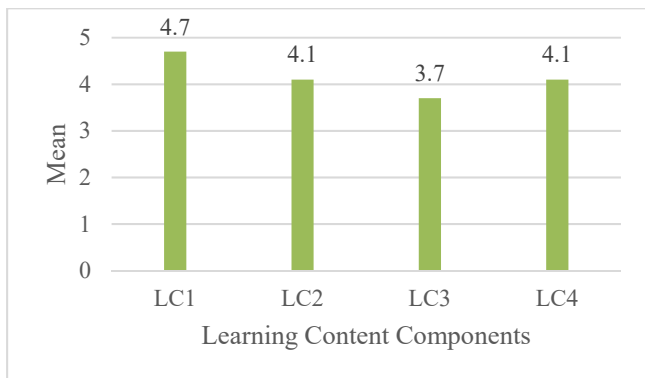


Fig. 2. Average mean for each of learning content components

Based on the results obtained from the observation, interviews and evaluation session, we have noticed that children are more attracted to interactive features such as animation and sound effects. They tend to imitate animation played and show it to their parents or caregivers. Their parents or caregivers have suggested to include more attractive or funny sound effects as their children really enjoys funny animation. We have also found that the children were having no difficulties when playing the mobile application. They managed to imitate or repeat any words from the activity. Their parents or caregivers were very satisfied with the speech production skills as their children are able to produce more words and apply those words in their daily routine.

VI. CONCLUSION AND FUTURE WORK

Appropriately designed mobile application used for speech therapy tool can play a crucial role in helping children with SLI. We found out that it is important to have an appropriate design considerations or guidelines before developing the prototype product. Moreover, the improving product is not only used to encourage engagement but to help SLI children to progress and improve their skills in producing correct sounds in their daily lives. By using the proposed product, they could use the mobile application at any time, any place.

There are some limitations to this study and one of it was due to time constraint. The time duration for one session had to be cut down from 1 hour to less than 30 minutes due to conditions of the children. We had to postpone the session to the next session when the children refused to cooperate. As for the learning content of the mobile application, we will work with our paediatrician and come out with more valuable content in the future. Also our study is limited by the small number of children with speech delay recruited. More samples are needed in future works to study the effectiveness and usefulness of mobile speech therapy application as supplementary tools for SLI children.

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