Akademika 90(Isu Khas 3), 2020: 103-114

https://doi.org/10.17576/*akad-2020-90IK3-08*

Impact of Language Learning Software on Hearing-Impaired Students' Language Skills

Impak Perisian Pembelajaran Bahasa terhadap Kemahiran Bahasa Murid Pendidikan Khas Pendengaran

Rubashini Ramakrishnan, Norshidah Mohamad Salleh & Aliza Alias

ABSTRACT

This paper discusses the impact of language learning software that was developed for hearing-impaired students for the Malay Language. The software was developed using Microsoft PowerPoint on a topic of reinforcement words with sign language. This study conveyed an experimental research design using pre-test and post-test of 8 hearing-impaired year 6 students that were selected randomly for this study. The study was conducted at one of the primary schools in Hulu Langat in Selangor. The pre and post-test analysis were based on the mean score value. The mean score value increased from 10.3% to 86.4% for multiple-choice questions and increased from 4.2% to 91.7% for sentence structure questions for the post-test analysis. The finding of this study found that students were able to choose appropriate reinforcement words for multiple-choice questions. The study also showed that students were able to construct sentences using appropriate reinforcement words. The implications of the study showed that learning software with interactive elements using sign language and attractive visuals can help hearing-impaired students to improve their understanding on reinforcement words. The usage of technology in various aspects of multimedia along with sign language video also helps to enhance the language skills of hearing-impaired students especially for those who practise visual learning styles. In conclusion, studies that focus on teaching using learning software with exciting elements are encouraged in the future.

Keywords: Language learning software; hearing-impaired students; language skills; reinforcement words; technology

ABSTRAK

Kajian ini membincangkan impak perisian pembelajaran bahasa yang dibangunkan untuk murid pendidikan khas pendengaran bagi mata pelajaran Bahasa Melayu. Perisian ini dibangunkan dengan menggunakan Microsoft PowerPoint mengenai topik kata penguat dengan mengintegrasikan bahasa isyarat. Kajian ini menggunakan kaedah eksperimen berasaskan ujian pra dan ujian pos. Subjek kajian terdiri daripada 8 orang murid pendidikan khas pendengaran tahun 6 yang dipilih secara rawak. Kajian ini dijalankan di sebuah sekolah rendah di daerah Hulu Langat di negeri Selangor. Analisis ujian pra dan ujian pos adalah berdasarkan nilai skor min. Nilai skor min meningkat daripada 10.3% kepada 86.4% untuk soalan jenis aneka pilihan. Bagi pembinaan soalan juga wujudnya peningkatan daripada 4.2% kepada 91.7%. Hasil dapatan kajian mendapati murid dapat memilih kata penguat yang bersesuaian dan tepat bagi soalan aneka pilihan. Malahan dapatan kajian turut mendapati murid mampu membina ayat dengan menggunakan kata penguat yang sesuai. Implikasi kajian menunjukkan perisian pembelajaran yang mempunyai elemen interaktif menggunakan bahasa isyarat dan visual yang menarik dapat membantu murid pendidikan khas pendengaran dapat meningkatkan pemahaman terhadap topik kata penguat. Penggunaan teknologi dengan pelbagai aspek multimedia berserta dengan video bahasa isyarat juga membantu dalam peningkatan kemahiran bahasa murid pendidikan khas pendengaran khususnya dalam kalangan murid yang mengamalkan gaya pembelajaran visual. Kesimpulannya, kajian yang memberi fokus kepada pengajaran yang menggunakan perisian pembelajaran yang mempunyai elemen yang menarik adalah digalakkan pada masa akan datang.

Kata kunci: Perisian pembelajaran bahasa; murid pendidikan khas pendengaran; kemahiran bahasa; topik kata penguat; teknologi

INTRODUCTION

Hearing loss have an impact on the ability to hear and also ability to speak. It affects a child's development of speech and language skills. According to Hallahan, Kauffman and Pullen (2014) the definition of hearing loss in hearing-impaired children are too broad with the level of loss ranges from mild to profound. However, according to *Kementerian Pendidikan Malaysia* (2015), students with hearing-impaired are known as students with hearing disabilities. Apart from that, Safani and Mohd Hanafi (2009) argued that people with hearing disabilities are those with hearing loss from 71-91 (dB) and above based on the scale set by the National University Hospital of Malaysia. The term deaf is used when these individuals have hearing impairment which can affect their understanding of speech, hearing and auditory amplification (Leigh and Andrews 2016).

Hand Code of Malay Language (*Kod Tangan Bahasa Melayu, KTBM*) in Malaysia is the sign language used by teachers and hearing-impaired students in the process of teaching and learning. The codes in KTBM are used as the basis for learning the language in schools (Syar Meeze, Mohd Hanafi and Noraidah 2019). Globally, individuals with hearing impairment use the American Sign Language (ASL) in their daily life to share feelings, beliefs and experiences (Sass-Lehrer 2016). However, they are not mute as they can speak and communicate with others (Leigh and Andrews 2016).

Professionals used the term of hearing-impaired for the children or adults who have a profound hearing loss of 91 decibels (dB) or more than that (Leigh and Andrews 2016). According to *Kementerian Pendidikan Malaysia* (2015), the hearing loss is measured by decibels at 4 levels which are mild (25-40 dB), moderate (41-60 dB), severe (61-90 dB) and profound (91 dB and above). Despite the latest technology upgrades, such as digital hearing aids and cochlear implants or even an early diagnosis and management of deaf-born or hard-to-hearing, these hearing-impaired students continue to remain behind when it comes to reading skills compared to their hearing friends (Harris, Terlektsi and Kyle 2017).

The inability to hear effectively would not only create problems in communicating, but also affect hearing-impaired students' intellect, social, emotion and behavior (Mohd Hanafi, Safani and Rosman 2012). This hearing disabilities would affect the hearing-impaired students' learning and reading process in the academic achievement in school (Qi and Mitchell 2011; Napoli et al. 2015; Worsfold et al. 2018). According to Qi and Mitchell (2011), these hearing-impaired students also faced problems in writing even after leaving school. On top of that, Worsfold et al. (2018) stated that it is important to maximize the reading skill of the hearing-impaired students in primary school by giving them the best form of education. As it would caused the hearing-impaired students to experience issues in basic learning skills and gave an impression of low understanding of language skills especially in terms of letters, phonology and decoding (Kyle and Harris 2011). Therefore the teachers need to teach language to these students with different teaching strategies compared to the hearing students (Mohd Hanafi, Safani and Nur Ain 2013). To address this problem, the choice of communication for students with hearing impairment depends on the initial intervention of the students so that they would able to learn in class.

Early intervention is needed to avoid language delays (Leigh and Andrews 2016; Sass-Lehrer 2016). In that regard, language and literacy need to be taught equally to improve the language skills. Therefore, to ensure that hearing-impaired students able to learn in class, teachers need to play a greater role by planning the teaching and learning process that would attract the students' attention (Rubashini and Norshidah 2018; Sameer and Adelina 2020). Apart from that, the teachers also need to be innovative and creative and always encourage students' virtuous quality (Rosadah, Manisah and Aliza 2014). Thus, in this study, Information and Communication Technology (ICT) are integrated into the teaching process by developing learning software focusing on a Malay language topic of reinforcement words (*kata penguat)* for hearing-impaired students. This software provides individually learning that assists the students to apply what they have learned from the topic and practise it in their daily lives. Therefore, learning software was developed by taking into account the factors that was a key element in the academic achievement of hearing-impaired students.

LITERATURE REVIEW

The acquisition of language among hearing-impaired students' need to be given attention at

the early stage. This is to address the problems that would arise when the students enter the school. Apart from that, as special education teachers, it is the teachers' responsibility to explore and practise the factors that are fundamental in the innovative and informative teaching. Therefore, the teaching method of hearing-impaired students also needed to be focussed on the terminology of the language and communication development (Harris, Terlektsi and Kyle 2017; Worsfold et al. 2018), and also the assistive technology in teaching (Beal-Alvarez and Cannon 2014; Flórez-Aristizábal et al. 2019; Strassman, Marashian and Memon 2019). Furthermore, teaching method that emphasizes on visual learning styles of hearing-impaired students, should also be applied in the teaching and learning process (Marschark, Sarchet and Trani 2016b; Padidar, Tayebi and Shakarami 2015).

LANGUAGE ACQUISITION

The language acquisition of students with hearing loss can be divided into two categories which are pre-lingual and post-lingual. According to Hallahan, Kauffman and Pullen (2014), pre-lingual hearing problems in children occur at birth or early stage of birth. Even pre-lingual can also occur before a child is exposed to speech. The second category is post-lingual which means that a child has hearing problems after the child has been exposed to the speech. However, children with post-lingual hearing problems can learn the language better than those who have pre-lingual problems. This is because these children have been exposed to speech since birth. They are even better and able to write and speak better than children with pre-lingual hearing problems (Easterbrooks and Stoner 2006).

However, Hallahan, Kauffman and Pullen (2014) argued that people with both hearing problems experience language acquisition problems. This is because these speech skills are closely related to the level of hearing as well as the child's age. These hearing problems have a negative impact on improving language skills as well as to the hearing-impaired students' academics. Easterbrooks and Stoner (2006) found that these students had difficulty to speak in school and even at home. Students with hearing impairment also have problems with grammar and in developing sentences with proper structure. Therefore, parents should play a role in identifying these deficiencies and expose hearing-impaired students to early education as possible. The roles of the teachers are very important in providing a quality education system for these students.

LANGUAGE AND COMMUNICATION DEVELOPMENT

Knoors and Marschark (2014) stated the need for diverse teaching which covers the overall educational aspects of these students. Despite the various teaching and strategic methods used in schools, students with hearing impairment still face difficulties and challenges in understanding the language to communicate correctly (Knoors and Marschark 2014). Napoli et al. (2015) stated that sign language is the first language to be learned by the hearing-impaired students in their first five years of education. Thus, the use of sign language is very important not only for the hearing-impaired students to communicate but also in the teaching and learning process. Loughran (2013) argued that each symbol or form of hand used in sign language contains unique meanings. This communication method allows hearing-impaired students to express their opinions, feelings and ideas of something. The total communication refers to situations where teachers use many ways to enable students to understand the language. Face expression, acting and speech are used. This means that teachers use various media (signals, oral, play) during the learning process to suit the ability of students of varying degrees of hearing (Loughran 2013).

For students with moderate hearing impairment, they were still able to hear some sounds of the language which did not affect much of their learning process while students with a severe problem of hearing loss used sign language in the educational process. They also understand more when teachers used various media during teaching. Vocabulary improvements were might crucial for the students to improve their language and phonological awareness (Harris, Terlektsi and Kyle 2017; Worsfold et al. 2018), by encouragement to language development in early intervention (Worsfold et al. 2018). All these are needed continuously to enhance the ability to learn, read, communicate and use language for the hearing-impaired students from preschool to secondary school. It was not easy to teach language to hearing-impaired students because of the disability in auditory (Mohd Hanafi, Safani and Nur Ain 2013). The teachers should play their role effectively to motivate and support these students to participate more in the learning activities in the

classroom. All the aspects such as various teaching aids, diverse strategic and sign language should be given the highest level of importance by the teachers.

ASSISTIVE TECHNOLOGY

Technology is an element that is driving change in all areas including education (Hazita, Sepideh and Zaini 2017). Therefore, the use of technology in this area of education plays an important role in increasing the students' interest in teaching and learning sessions especially in grammar (Kumar et al. 2018). Students can use technology to find new information in the blink of an eye and increase their knowledge. Students can even change their way of learning more actively as they begin to enjoy technology-based learning. Based on the previous studies, technology is a fundamental resource in students that has a positive impact and provides an educational path leading to excellence not only in typical students but also in special needs students with hearing impairment (Beal-Alvarez and Cannon 2014; Flórez- Aristizábal et al. 2019; Strassman, Marashian and Memon 2019).

The study conducted by Flórez-Aristizábal et al. (2019) found that the use of technology helps in improving knowledge of hearing-impaired students. The study also found that students were able to adapt to the learning environment that engaged by typical students in inclusive education programs. With the help of technology, hearing-impaired students could overcome the challenges in education that require them to explore information in various aspects independently. A study conducted by Strassman, Marashian and Memon (2019) also found that students with hearing impairment were influenced by technology that is a key element of education in the current education. Similarly, a study by Beal-Alvarez and Cannon (2014) found that the use of technology could increase the use of grammar among special education students with hearing impairment which impacted greatly on their learning.

STUDENTS' LEARNING STYLES

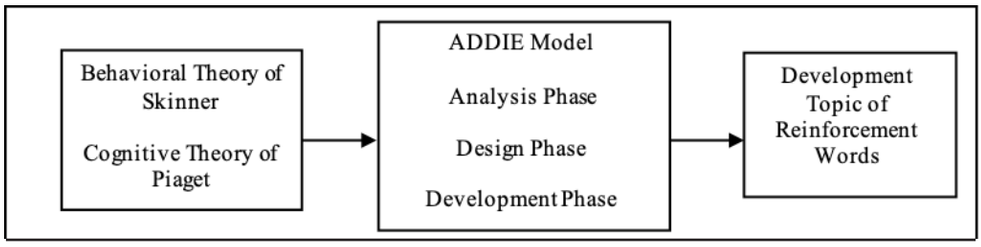
Another factor that is an important element of students' achievement is their learning styles. According to Kazemi, Mahdavi-Zafarghand and Tahriri (2016) the learning styles of students with disabilities were influenced by their language, communication, speech and social development which give a great impact in their achievement. Kazemi, Mahdavi-Zafarghand and Tahriri (2016) also argued that learning style is an important element in students' learning to excel with more confidence. Baggiyalakshmi and Sambathrani (2016) found that there are various combinations of learning styles practiced by hearing-impaired students. The study found that the hearing-impaired students' learning styles were comprised of visual and verbal styles as well as combination of writing, reading and styles that developed through experience. All these styles lead students to think creatively and analytically and to explore and evaluate what they learn in more depth and specificity. Previous studies support that the teaching style of hearing-impaired students through visual learning helps them to achieve better learning outcomes rather than other learning styles (Marschark, Sarchet and Trani 2016b; Padidar, Tayebi and Shakarami 2015).

The study conducted by Marschark, Sarchet and Trani (2016b) proved that hearing-impaired students are students who learn through visual learning styles. Students with hearing-impaired who use the visual learning method found better results in the subjects they studied. Students are even more aware when they use visual in learning because they can visualize what they have learned the whole day in the school. Similarly, the research conducted by Padidar, Tayebi and Shakarami (2015) found that visual factors play an important aspect that recalls what is learned in grammar when hearing-impaired students used visual learning styles.

LEARNING THEORIES

Various learning theories are relevant to the development of hearing-impaired students' education. In this study, two learning theories as a basis to look at the usefulness and importance of this software among the hearing-impaired students were used. The first theory involved in this study was Skinner's theory of behavioral learning. According to this theory, the learning process occurs when there were repeated stimulations and reactions. Skinner argued that a response would be repeated if there was a reward and if the reward was terminated, the response would be abolished (Schunk 2012). Rewards are an emphasis on learning. In this software, the reward is done by giving words of praise or appreciation to a student when he or she has completed an exercise or answered the question correctly. This made the students happy and would strive to master their learning.

The next theory was the cognitive theory pioneered by Piaget (1896-1980). According to Piaget, the theory of cognitive development was a genetic process, which was based on biological mechanisms associated with the nerves system. Piaget believed that a person obtains information through his or her environment. When an individual interacted with others and shared information, that individual would adapt whatever they observed in their daily life (Schunk 2012). In this regard, students would adapt what they have learned from this software through observation. However, teachers need to be aware of each student's abilities because the students' cognitive development is different. Therefore, learning using this software created a social learning environment between students and teachers. Through the learning of the environment, students' cognitive abilities could also be enhanced as teachers taking into consideration of the various cognitive abilities of students. Figure 1 showed the theoretical and conceptual framework of the research.



F1GURE 1. Theoretical and conceptual framework

THE CONTENT OF THE SOFTWARE

This study focused only on the use of total communication, KTBM (*Kementerian Pendidikan Malaysia 2014)*. KTBM is used to teach the vocabulary of Malay Language and Malay grammar correctly in the education system. Simultaneously, the videos on sign language were accompanied by educational slides present in the software. Besides, the grammatical aspects emphasized in this study were a topic of reinforcement words where words or phrases that modify the meaning of an adjective as it is used widely in daily interactions. In this software, only KTBM is used in the videos which can be referred by the hearing-impaired students.

Next, the software contains an introduction to the Malay Language topic of reinforcement words which was simple and easy to understand. At the same time, the introduction of the adjective was also explained because the reinforcement words consist of adjectives such as 'beautiful', 'clean', 'far' and 'bad'. Next, the introduction of each topic starts with reinforcement words before adjectives, reinforcement words after adjectives and reinforcement words before or after adjectives. Apart from that, the text containing an example of simple sentences for each topic was provided and followed by additional exercises. Finally, self-assessments, as well as summary texts were also provided to make it easier for students to refer to the software if they were still unclear to answer any of the questions asked.

In the design section of the pedagogical structure, the introduction and presentation of information are presented in the form of a graphic image, audio or animated graphic text. Whereas, in the activities and modules section, questions were asked either in the form of assessment or on the content of the subject. The feedback would be given in the form of a stimulus and if there were any mistakes, the student would be asked to repeat the question. This process would be repeated until the student achieved the learning objectives.

Besides, the content of the software was delivered in a structured manner and the amount of content was limited through the tutorial method. This allowed for teaching and learning processes to focus on assessment, such as exercise for the student to do. Students were able to move from one level to another with their own skillset and repeat a topic of reinforcement words at any time. This tutorial concept also taught students the concept of using words of skill or information through previous and current knowledge and enjoyable experience with colourful graphics, suitable audios, sign language videos and interactive animations.

Hearing-impaired students could use this software individually or in groups. They were free to study and review according to their time and abilities. On the main menu screen, there was a headline that

allows the students to choose whether to continue or to leave their learning process. In the main menu, there was also an introductory button that showed the content of the software and the students could determine the direction to explore it. There were three navigation buttons for Module 1, Module 2 and Module 3. In Module 1, reinforcement words that are used before the adjectives were introduced, and Module 2 focused on reinforcement words that are used after adjectives. Meanwhile, in Module 3, students would learn about the reinforcement words that could be used before or after an adjective.

Each learning module contains two sections which were tutorials and exercises. Students would get information through tutorials, and then do the tests given based from the module learned. Additionally, students could choose to go to the next module or the recovery screen if the exercises provided in each module were not answered correctly. Finally, there was a test screen and a summary screen to display an update of the students' achievements. The opening screen was presented with interesting background music. Music was incorporated in this software, even though the students have hearing loss but, there would be hearing teachers and parents used the software. There would also hearing-impaired students with hearing residual or students with cochlear implants. Therefore, background music and sound could attract the students with hearing aids in using the software provided.

Then followed by the introduction screen to the subject of *Bahasa Melayu*, year six and the title screen of grammar lesson of reinforcement words. Learning objectives on the topic of reinforcement words were also provided. Each screen has an end navigation button to help the students to end any slides and a button to return to the previous screen. All screens were also loaded with sign language videos. Students could make slide selections by simply clicking on the buttons. The slides provided would show the title of the software for each screen, as well as the content presented in text, graphics and sign language. Guides on how to use all the links and buttons were well explained in the user-guide screen. The tutorial structure required the students to study the tutorials before trying the quizzes and exercise questions provided.

Next, the students would need to answer the exercises provided in the modules. However, students have the choice to move on to the next module or to the recovery screen to reinforce their understanding. If the student chose to go to the recovery screen, then a brief note on the topic would be displayed and the student has to answer the exercises again. There would be background sounds throughout the lesson. After studying each module, students would go to the exercises section, the Mind Test. There would be questions provided in the Mind Test to test the student's understanding of the whole topic of reinforcement words. Students would be asked to answer these questions carefully and honestly. If the students were not able to answer the question, they have to repeat the test until they fully understand it. Answers would be provided to facilitate students' review.

Microsoft PowerPoint was used to process words, data and other things related to text and multimedia aspects. Adobe Photoshop was used to simplify the process of changing color tones so that graphics were produced more effectively, attractively and realistically. Sonic Foundry Sound Forge was used to mix audio and voice in particular to show the sounds of letters and sentences used in each screen. Macromedia Flash CS was used to create text and illustrations and utilized in conjunction with the Animation Factory to develop the front view. The digital camera was used to record sign language videos and loaded on each screen to facilitate hearing-impaired students to understand the concept of reinforcement words.

DEVELOPMENT OF THE SOFTWARE

Figure 2 showed the process of the ADDIE Model. The study utilized the design and development method using the ADDIE model to develop the learning software. ADDIE model stands for Analysis, Design, Development, Implementation and Evaluation. There were five phases used in the development of the learning software which are contained in the ADDIE model: 1) Analysis Phase, 2) Design Phase, 3) Development Phase, 4) Implementation Phase and 5) Evaluation Phase. The ADDIE model was not only easy to comprehend, but it was also easily practiced by teachers and students (Branch 2009). This model was well-suited for the teaching and learning process of hearing-impaired students as it was easily understood.

The software development involved the use of various media containing user-friendly instructions to facilitate students in interacting with the system

better. Audio and songs were used in presentations, introduction music on every screen, sounds on every movement, and speaker sound. The use of the buttons and the control icon on the menu were the basic instructions to facilitate students to access the software. The buttons were used to give directions by using the main menu icon, sub-menu icon, sub-topic icon and exit directions from the system. The control icons that were designed in the form of arrows are used to implement the instructions either to the main screen, to the modules screen or to the original menu screen.

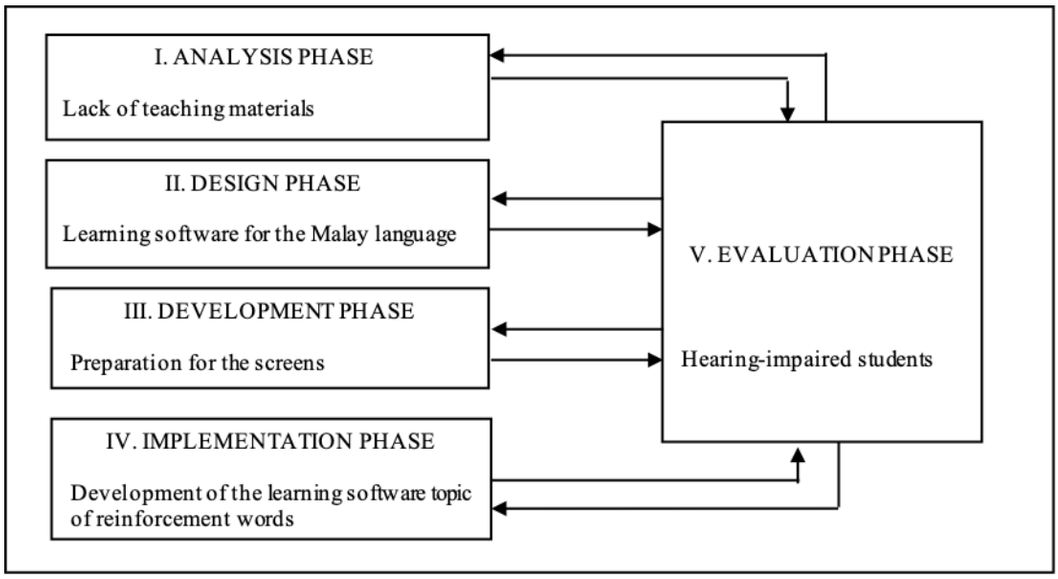


FIGURE 2. ADDIE Model

METHODOLOGY

This study was conducted at a primary school in the state of Selangor, Malaysia. Experimental research design using pre-test and post-test was used in the study. Eight hearing-impaired students aged 12 years old were selected randomly. The sample involved in this study was students of the integration program in mainstream schools. According to the reports provided by the school and teachers, these students' hearing impairment were severe and profound. A student from the study sample had a severe hearing loss while another seven in the profound category. Five students received pre-school education at the same school at the age of 5 and 6. The students were exposed using KTBM before going into year one. For the students who did not have preschool education, they only start learning sign language when they entered year one. All students that were involved in this study, underwent screening and were diagnosed with hearing problems by a medical professional. Table 1 refers to the profile of the sample.

TABLE 1. Profile of the sample

Bil	Gender	Age (years)	Decibel (dB)	Level of hearing loss
S1	Girl	12	> 91	Profound
S2	Girl	12	> 91	Profound
S3	Boy	12	< 91	Severe
S4	Girl	12	> 91	Profound
S5	Girl	12	> 91	Profound
S6	Girl	12	> 91	Profound
S7	Girl	12	> 91	Profound
S8	Boy	12	> 91	Profound

Students with hearing loss were found to have difficulty in understanding the language (Harris, Terlektsi and Kyle 2017; Worsfold et al. 2018). They have difficulty in understanding the language in terms of comprehension as well as in writing. (Abdullah Yusoff 2002; Easterbrooks and Stoner 2006). Abdullah Yusoff (2002) and Easterbrooks and Stoner (2006) also found that students with hearing problems had difficulty in constructing sentences with proper structure and making incorrect interpretations of a word. Consequently, multiple-choice questions and sentence constructions are the main aspects that researchers study. The questions were based on the Year 6 Malay Language. Three teachers rated the questions before the questions used in the modules. These teachers were Malay Language teachers and involved in the special education field too. Furthermore, six teachers from the special education were asked to evaluate four aspects of the software such as sign language, content, language used and multimedia aspects. All the teachers have been in the field of special education for more than five years and expertise in various fields.

There were two sections of assessment which were a set of multiple-choice questions (23 items) from all the modules and a set of test to construct sentences (9 items). The first section consisted of two main phases which were the module and the mind test. The module phase consisted of three modules that included three questions for each module. Students need to answer nine questions in total related to reinforcement words before adjectives, reinforcement words after adjectives and reinforcement words that can be used before or after adjectives. Subsequently, students' understanding and knowledge were also tested using the mind test phase. In the mind test phase, students were required to answer fourteen multiple-choice questions of topic reinforcement words which were more complex compared to the questions answered in the first phase. In the second section, students were required to construct sentences using the nine reinforcement words on their own without the help of the teachers. Hearing-impaired students should use appropriate reinforcement words so as not to interfere with the use of each word with its specific functions and purposes.

FINDINGS

This finding supported by Kumar et al. (2018), who stated that usage of technology in the teaching and learning process would assist the hearing-impaired students to focus in the class. Table 2 displayed the scores of the pre-test and post-test of each student. It showed an increase in the post-test compared to the pre-test. The overall average increased to 76.1% from 8.7% to 86.4% after using the learning software. The findings showed that students have mastered the reinforcement words after using the software.

TABLE 2. Difference of Scores Between Pre-Test and Post-Test (Multiple-Choice Questions)

Students	Scores (%) Pre-Test	Scores (%) Pos-Test
Student 1	8.7	87.0
Student 2	13.0	78.3
Student 3	13.0	78.3
Student 4	13.0	87.0
Student 5	0.0	87.0
Student 6	13.0	91.3
Student 7	13.0	100.0
Student 8	8.7	82.6
Overall Average	10.3	86.4

Based on Table 3, showed an increase in post-test versus pre-test whereby the overall average increased 87.5% from 4.2% to 91.7% for the post-test. Students could construct sentences using correct grammar and sentence structure after using the software for the learning process. The students were more confident to try to construct the correct structure of sentences using reinforcement words.

TABLE 3. Difference of Scores between Pre-Test and Post-Test (Sentences Structure Questions)

Students	Scores (%) Pre-Test	Scores (%) Pos-Test
Student 1	0.0	88.9
Student 2	0.0	88.9
Student 3	0.0	88.9
Student 4	0.0	77.8
Student 5	0.0	88.9
Student 6	11.1	100.0
Student 7	0.0	100.0
Student 8	22.2	100.0
Overall Average	4.2	91.7

DISCUSSION

This study has implications on using learning software in language learning of reinforcement words in the Malay Language for hearing-impaired students. In the context of Malaysia's special education today, the quality level of special education programs for the students has been taken seriously by all parties. This is due to the problem of dropout and illiteracy in today's world of education which is largely associated with the implementation of less effective teaching structures and consequently impacting academic achievement in primary schools, especially in terms of language achievement. The process of improving language skills requires a variety of skills such as cognitive ability that involves memory, skills and visual capabilities that needs help with stimuli. The process of learning a language involves skills such as mastering vocabulary, building knowledge, learning strategies, ability to understand the meaning, interpret and critically thinking. The combination of color, sound, movement and illustration in this software is an attempt to ensure the process teaching and learning was to assist the hearing-impaired students to retain information in the memory and enhance their motivation and achievement in the aspects of grammar. This is reflected in Piaget's theory because what is seen through the environment will be understood and remembered by the students. This also applies to hearing-impaired students when using this software. Students become more enthusiastic when using software that has various aspects of multimedia.

Besides, the teaching contents of the subjects should be focused more on teaching especially to the students with hearing impairment. The teaching contents aspects include the syllabus of the subjects, students' level of performance, individual learning, practice learning from easy to difficult order and these aspects will help the teachers to vary their teaching styles with the usage of the reinforcement words. Research by Kumar et al. (2018) and Flórez-Aristizábal et al. (2019) also emphasized that teaching contents are very important aspect that needs to give attention when teaching students with hearing-impaired. It should be adapted to the students' needs and ability to use the software regularly. Teachers should focus on students' capabilities in developing their language and communication, the usage of technology and their learning style. Praise and encouragement were given by the teachers when students' complete assignments provided in the software increases their motivation. This is the process emphasized in Skinner's theory of behavior.

The sign language used in the reinforcement words software was suitable, clear and easy to understand which helps the students to use the software effectively. Sign language is an extremely important communication tool for deaf and hard hearing students (Naimie et al. 2020). This research found that students with hearing-impaired were able to learn effectively with the assistance of technologies. The use of technology in teaching gives more impact rather than using traditional sign language. Even, Napoli et al. (2015) and Davenport et al. (2017) supported the practice of sign language with correct sentence structures that are very important in the education system. Using sign language is essential during the teaching process besides printed materials like textbooks and extra exercises to the hearing-impaired students. The teachers should be proficient in using sign language in their teaching and learning process. The hearing-impaired students relied fully on sign language to

communicate to each others in the classroom. Apart from that, sign language should be delivered at an average speed to avoid confusion among the special needs students (Davenport et al. 2017). The KTBM sign language was used in the schools in Malaysia in learning the grammatically correct sentence structures. When students repeatedly use sign-language software, students will be more likely to remember what Piaget suggested in cognitive theory. If the student does not understand the content of the reinforcement words, the student can view the video of the sign language contained in the software. The students could watch the sign language section in the modules until they understand the instructions.

The students comprehended the topics well as there are videos using sign language explaining the topics of reinforcement words. Students could easily learn the proper usage of grammar in their daily learning activities by referring to the sign language videos. Grammar mistakes would cause the unclear meaning of the sentences. These findings supported by Strassman, Marashian and Memon (2019) who stated that knowledge of grammar helps the students to convey messages clearly in any situation. Simultaneously, the finding clearly stated that the multimedia elements used in the software were suitable and able to capture the students' interest in learning the reinforcement words. Similar to this finding, Strassman, Marashian and Memon (2019) argued that using interactive multimedia such as combined text, sound, graphics and animation can help the students to understand the topics better. Even Pappas et al. (2018) argued that the combination of a few multimedia aspects in the teaching and learning process would provide a chance to the hearing-impaired students to use their sight to gain knowledge through visualization. This is supported by Beal-Alvarez and Cannon (2014) and Strassman, Marashian and Memon (2019) who discussed the importance of technologies in education, especially among hearing-impaired students. As such, the use of technology in software development based on the ADDIE model was appropriate and in line with global developments that emphasized technology in education.

Pre and post-tests were conducted to identify the impact of the software on the students' achievements. It was shown that a drastic difference in the students' achievement after using the software. For the multiple-choice questions, the result increased by 76.1 % meanwhile 87.5% for the sentence construction. The data taken from the post-test is very important to evaluate the development of the software because of the differences before and after using the software. The software has successfully motivated hearing-impaired students to be actively involved in the learning process. Findings from the post-test on multiple-choice questions have been increased by 76.1% compared to the pre-test which was only 10.3%. It is proven that students were less motivated in learning but then showed interest in learning when they used the software. Pappas et al. (2018) also supported that computer software with grammar give a positive impact on learning vocabularies among hearing-impaired students. These students had also improved their vocabulary and communicated using grammatically corrected sentences.

In conjunction with this, students showed their determination to produce grammatically correct sentences in their post-test. The findings of the test showed a drastic improvement which is 4.2% in the pre-test and 87.5% in the post-test. It is a fact that students had failed to construct correct sentences at the beginning but then successfully formed sentences using reinforcement words learned from the software. Three students were able to make nine sentences with all the nine reinforcement words correctly after using the software. Research by Flórez-Aristizábal et al. (2019) and Strassman, Marashian and Memon (2019), also confirmed that technology with multimedia aspects was very important towards the achievement and improvement in grammar because the hearing-impaired students showed their interest in learning when using technologies.

Based on the findings of the study, the hearing-impaired students did not emphasize the correct language before using the learning software. This research parallel with Baggiyalakshmi and Sambathrani (2016) who stated that students' visual learning styles gave them a positive impact on the studies. It was also proven that teaching methods should be diverse to meet the students' learning style and their needs so that they were able to achieve the learning objective (Rubashini and Norshidah 2018). Learning materials with visualization aspects would help more the teaching process and be able to attract students' with hearing impairment to learn especially in the aspects of language (Knoors and Marschark 2014; Napoli et al. 2015). The students' motivation would increase when technology becomes one of the learning activities (Flórez-Aristizábal et al. 2019).

CONCLUSION

Sign language videos with interactive multimedia pedagogy approaches are the independent predictors for the success of the hearing-impaired students. Effective teaching and learning styles among students are closely attached to teachers' responsibilities in preparing lesson plans and teaching styles. Teaching and learning approaches using multimedia should be applied in hearing-impaired students learning processes as they are visual learners. Appropriate teaching methods are needed to cater and encourage the students to be active in the teaching and learning process. Therefore, the problems faced by the hearing-impaired students in learning the language is no longer a barrier as they can build grammatical sentence structures and use it to communicate. From the research, it is found that materials that use multimedia in the teaching and learning process are very useful as an alternative to traditional teaching. The use of technology in teaching and learning equipped with animations, videos, graphics and sign language especially among hearing-impaired students can improve their understanding and memory while motivating them. The use of this multimedia software allows these hearing-impaired students to study individually and make frequent reviews so that they truly understand a topic or subject. Furthermore, this study has the potential to provide practical and empirical implications. Practical implications occur when this study enhances existing teaching by producing learning software that focuses on reinforcement words. This proves that using learning software can help students with hearing impairment in improving language skills. Also, the empirical implications arise when this study aims to provide a product that can be used by the school especially the teachers. Language learning software that emphasizes the topic of reinforcement words which is one of the elements of grammar mastery can be used by teachers in their daily teaching process. Future plans have to be refined and expanded to ensure that this learning software is present in various teaching settings, with different groups of hearing-impaired students and also with new topics. Better use of KTBM and auditory phonemic assessments could be used to enhance the importance of learning software Malay Language topic of reinforcement words for hearing-impaired students.

REFERENCES

Abdullah Yusoff. 2002. *Kecacatan Komunikasi Berkaitan dengan Pendidikan, Bahasa dan Kebahasaan Orang Pekak*. Kuala Lumpur: Dewan Bahasa.

Baggiyalakshmi, J. and Sambathrani. 2016. Learning styles of children with hearing impairment at secondary level. PARIPEX - *Indian Journal of Research* 5(2): 328-329.

Beal- Alvarez, J. and Cannon, J. E. 2014. Technology intervention research with deaf and hard of hearing learners: Levels of evidence. *American Annals of the Deaf* 158(5): 486-505.

Davenport, C. A., Alber-Morgan, S. R., Clancy, S. M. and Kranak, M. P. 2017. Effects of a picture racetrack game on the expressive vocabulary of deaf preschoolers. *Journal of Deaf Studies and Deaf Education* 22(3): 326-335.

Easterbrooks, S. R. and Stoner, M. 2006. Using a visual tool to increase adjectives in the written language of students who are deaf or hard of hearing. *Communication Disorders Quarterly* 27(2): 95-109.

Flórez-Aristizábal, L., Cano, S., Collazos, C. A., Benavides, F., Moreira, F. and Fardoun, H. M. 2019. Digital transformation to support literacy teaching to deaf children: From storytelling to digital interactive storytelling. *Telematics and Informatics* 38(2019): 87-99.

Hallahan, D. P., Kauffman, J. M. and Pullen, P. C. 2014. *Exceptional Learners: An Introduction to Special Education*. Boston: Pearson.

Harris, M., Terlektsi, E. and Kyle, F. E. 2017. Literacy outcomes for primary school children who are deaf and hard of hearing: A cohort comparison study. *Journal of Speech, Language and Hearing Research* 60(3): 701-711.

Hazita Azman, Sepideh Mirzaeifard and Zaini Amir. 2017. Hypermedia literacy: An insight into English as a foreign language online reading processes. *Akademika* 87(1): 207-220.

Kazemi, S., Mahdavi-Zafarghand, M. and Tahriri, A. 2016. The relationship between learning styles and vocabulary recall among sensorineural hearing loss EFL learners. *Journal of Applied Linguistics and Language Research* 3(4): 325-346.

Kementerian Pelajaran Malaysia. 2015. *Buku Panduan Pengoperasian Program Pendidikan Khas Integrasi*. Bahagian Pendidikan Khas: Putrajaya.

Kementerian Pelajaran Malaysia. 2014. *Kod Amalan Pendidikan Murid Berkeperluan Khas*. Bahagian Pendidikan Khas: Putrajaya.

Knoors, H. and Marschark, M. 2014. *Teaching Deaf Learners: Psychological and Developmental Foundations*. New York: Oxford University Press.

Kumar, E. K., Kishore, P. V. V., Sastry, A. S. C. S., Kumar, M. T. K. and Kumar, D. A. 2018. Training for 3-D sign language recognition with color texture coded joint angular displacement maps. *IEEE Signal Processing Letters* 25(5): 645-649.

Kyle, F. E. and Harris, M. 2011. Longitudinal patterns of emerging literacy in beginning deaf and hearing readers. *Journal of Deaf Studies and Deaf Education* 16(3): 289-304.

Leigh, I. W. and Andrews, J. F. 2016. *Deaf People and Society: Psychological, Sociological, and Educational Perspectives*. 2nd edition. New York: Routledge.

Loughran, S. 2013. Cultural identity, deafness and sign language: A postcolonial approach. LUX: *A Journal of Transdisciplinary Writing and Research from Claremont Graduate University* 2(1): 19-26.

Marschark, M., Sarchet, T. and Trani, A. 2016b. Effects of hearing loss and sign language use on working memory. *Journal of Deaf Studies and Deaf Education* 21(2): 148-155.

Mohd Hanafi Mohd Yasin, Safani Bari and Nur Ain Mat Hassan. 2013. Cue speech and language achievement of hearing-impaired children. *Asian Social Science* 9(16): 81-86.

Mohd Hanafi Mohd Yasin, Safani Bari and Rosman Salubin. 2012. Emotional intelligence among deaf and hard of hearing children. *Social Sciences (Pakistan)* 7(5): 679-82.

Naimie Mohd Nawawi, Mohd Khairul Amri Kamarudin, Fuad Mat Jali and Mohd Syaiful Nizam Abu Hassan. 2020. Needs analysis assesment to sign language use for persons with disabilities (PWDs) categories hearing problems. *Akademika* 90 (2): 51-61.

Napoli, D. J., Mellon, N. K., Niparko, J. K., Rathmann, C., Mathur, G., Humphries, T., Lantos, J. D. 2015. Should all deaf children learn sign language? *Paediatrics* 136(1): 170-176.

Padidar, H. A., Tayebi, G. and Shakarami, A. 2015. The relationship between learning styles and vocabulary learning and retention. *Spectrum: A Journal of Multidisciplinary Research* 4(1): 249-263.

Pappas, M., Demertzi, E., Papagerasimou, Y., Koukianakis, L., Kouremenos, D., Loukidis, I. and Drigas, A. 2018. E-Learning for deaf adults from a user-centered perspective. *Education Sciences* 8(206): 3-15.

Qi, S. and Mitchell, R. E. 2011. Large-scale academic achievement testing of deaf and hard-of-hearing students: Past, present, and future. *Journal of Deaf Studies and Deaf Education* 17(1): 1-8.

Rosadah Abd Majid, Manisah Mohd Ali and Aliza Alias. 2014. Teacher character strengths and talent development. *International Education Studies* 7(13): 175-183.

Rubashini Ramakrishnan and Norshidah Mohamad Salleh. 2018. Teacher's self-efficacy: A systematic review. *International Journal of Academic Research in Business and Social Sciences* 8(12): 2379-2402.

Safani Bari and Mohd Hanafi Mohd Yasin. 2009. Ciri-ciri kanak-kanak bermasalah pendengaran. In *Pendidikan Kanak-kanak Berkeperluan Khas: Konsep dan Amalan*, edited by Zalizan Mohd Jelas, 140-163. Bangi: Penerbit UKM.

Sameer Ahmed Boset and Adelina Asmawi. 2020. Mediating effect of work motivation on the relationship between competency and professional performance of EFL teachers. *Akademika* 90(1): 63-75.

Sass-Lehrer, M. 2016. *Early Intervention for Deaf and Hard-Of-Hearing Infants, Toddlers, and Their Families: Interdisciplinary Perspectives*. New York: Oxford University Press.

Schunk, D. H. 2012. *Learning Theories: An Educational Perspective*. Boston: Pearson Education.

Strassman, B. K., Marashian, K. and Memon, Z. 2019. Teaching academic language to d/deaf students: Does research offer evidence for practice? *American Annals of the Deaf* 163(5): 501-533.

Syar Meeze Mohd Rashid, Mohd Hanafi Mohd Yasin and Noraidah Sahari @ Ashaari. 2019. Undergraduate students of special education's readiness towards the use of information and technology (ICT) in teaching and learning the sign language. *Creative Education* 10: 2374-2385.

Worsfold, S., Mahon, M., Pimperton, H., Stevenson, J. and Kennedy, C. 2018. Predicting reading ability in teenagers who are deaf or hard of hearing: A longitudinal analysis of language and reading. *Research in Developmental Disabilities* 30(77): 49-59.

Rubashini Ramakrishnan
Universiti Kebangsaan Malaysia,
43600 Bangi, Selangor
Malaysia
Email: rrruba_83@yahoo.com

Norshidah Mohamad Salleh
Universiti Kebangsaan Malaysia,
43600 Bangi, Selangor
Malaysia
Email: nshidah@ukm.edu.my

Aliza Alias (corresponding author)
Universiti Kebangsaan Malaysia,
43600 Bangi Selangor
Malaysia
Email: eliza@ukm.edu.my

Received: 20 June 2019
Accepted: 1 September 2020