DEVELOPMENT OF I-TALK PISMEN FOR STUDENTS WITH VISUAL IMPAIRMENT

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Software to be developed as a teaching and learning aid (TLA) for visually impaired students is unique since it requires a specific design to fit their special needs. Hence, this research investigates the specific principles and design for developing a software known as I-TALK PISMEN. It is a software that embeds the syllabus adapted from the National School Islamic Education Book, which is a textbook used among primary schools in Malaysia for the Islamic Education subject. Although designed for students with visual impairment it can also be accessed by typical teachers and students. This research uses qualitative approach which combines document and interview analysis. Document analysis was conducted to identify the development and design principles of the software. Meanwhile, interviews were conducted with three experts: two visually impaired personnel and one typical Islamic Education teacher. The aim was to gather more detailed and precise information on the software development and design; hence come up with the design proposal for the visually impaired. Findings from the study showed that fundamental theory and guidance are essential in designing and developing TLA, mainly for those with special needs, such as those with visual impairment. It is hoped that this study would be a guidance and reference to other researchers who are developing TLA software for students with special needs, particularly for those with visual impairment.

Keywords: Teaching and learning aid, software, I-TALK PISMEN, teaching and learning, visually impaired, Islamic Education

INTRODUCTION

Invention of various new technology is relevant to the Industrial Revolution 4.0. It has given new challenges to every aspect of human's daily life, forcing mankind to make changes to align with the digital transformation and maintain competitiveness in the modern world (Sharita et al., 2018). Special Education is transformed by new technological development as well. The process of teaching and learning (T&L) is seen as an important force or motivation to mould human

capital. Dynamic and systematic T&L management that aligns with the Industrial Revolution 4.0, is able to expand the scientific culture, new knowledge, initiation of creative and innovative ideas, sustainable development of human potential, and information dissemination (Jantan, 2016). It also gives impact to other TLA development including the aspects of developing a specific TLA for students with visual impairment.

This matter aligns with the National Education Policy (Special Education); supporting the principle of Education for All, in order to ensure the potential students with disabilities are given the opportunity to be inclusively placed in mainstream classes (Kementerian Pelajaran Malaysia, 2012). Moreover, the Malaysian Government has opened the education allocation to students with disabilities through the Accessibility and Education Policy via the Disabled Citizens Policy strategy. This policy will further encourage provision of disabled-friendly facilities and access to information and communications technology (ICT), and increasing access of students with disabilities to education at all levels (Malaysia Education Blueprint 2013-2025).

Usage of TLA among school teachers enhances both the student's academic performance and the teacher's teaching method. Previous studies have shown existence of positive effects based on the study by Jasmi et al. (2011) and Ilias et al. (2013). Both of the studies show that using TLA enables students to focus on what is being taught during the teaching and learning process. Apart from that, interactive multimedia technology has the ability to function in various aspects of educational programme and simultaneously fulfil the requirements of the 21st century (Muhammad Nazir et al., 2017; Norizan, 2003). Significant to TLA for the visually impaired, Rumiza Abdul Rahman (2010) suggested that specific TLA for them numerously increased. This is because these TLA would help in the information transfer process. Thus, T&L process for the visually impaired could run parallel with that for typical students.

Based on the aspects of TLA development, design of the teaching module is the key and important element in the success of T&L process of a particular subject. It is defined as the science to create detailed teaching practice; in terms of the expansion, evaluation and maintenance of the learning situation, which assists the learning of even a unit in the lesson (Noornajihan, 2017; Richey, 1986; Zaidatun Tasir, 2001). Many studies show that interactive multimedia software successfully improved students' performance and motivation toward subjects (Nor Azan et al., 2009; Salman Firdaus Sidek, 2014). However, the most suitable instructional designs must be identified in terms of developing the most appropriate multimedia application for the target audience. This is because each student has his or her own individual approach in learning, based on their own individual knowledge acceptance ability; especially for students with visual impairment or any students with disabilities in general (Kamaruddin et al., 2013; Noornajihan, 2017).

Therefore, the existence of this interactive multimedia software, which is based on specific design for the visually impaired, will enable students to understand certain subjects even more. In the context of this study, the respective interactive multimedia software is I-TALK PISMEN dedicated for the Form 1 Islamic Education subject.

STATEMENT OF PROBLEM

Education nowadays benefits from multimedia software with the interactive learning method application aligned with the Industrial Revolution 4.0. Nevertheless, in terms of designing multimedia learning tools many designers, especially researchers and teachers, do not know about the principles that need to be obeyed to ensure the quality of the tools produced (Rafiza Abdul Razak, 2013). This is because not much guidance is available to act as the guideline for multimedia learning tool designers. Most software developers and designers in the market focus on developing software based on available learning modules, without emphasising aspects of theory, learning principles and individual learning capability differences (Noornajihan et al., 2018; Setiawan et al., 2015). On the other hand, students with visual impairment have specific approach and needs in using multimedia software. This was discussed by Nor Musliza Mustafa (2010), who stated that an organised and systematic software design is very important since it contributes in producing a quality and effective TLA. In other words, theory application is essential in designing a suitable multimedia software based on the knowledge and skills expected to be achieved, and simultaneously celebrating the differences in individual learning capability.

Multimedia software designed based on appropriate principles and theory are able to increase students' overall potential and performance (Madar & Md Yunos, 2003; Md Zohri Saluki, 2006; Noornajihan et al., 2018; Zaidatun Tasir, 2008). Thus, an organised and systematic software design strategy plan is very important in contributing to a quality and effective T&L process. With the right software and interactive learning methods, learning becomes easier and more interesting; students have shown improvement in an effective learning environment respective to their individual potential (Setiawan et al., 2015). Therefore, this study analyses and proposes the design and development principles of I-TALK PISMEN, a specific software on the Form 1 Islamic Education subject for students with visual impairment.

LITERATURE REVIEW

Theoretical Application in the Design of Multimedia Based Teaching and Learning Aid

Seels and Glasgow (1990) stated that design of teaching is one of the knowledge disciplines and is related to research and theories on specifications of teaching, and processes of developing those specifications. Multimedia TLA with high efficiency level are developed based on the combination of learning theory and teaching strategy suitable for the target audience (Baharudin Aris, 2002; Noornajihan et al., 2018). Three learning theories being referred to in designing multimedia software are behaviourism, cognitivism and constructivism (Mustafa et al., 2014; Noornajihan et al., 2018). The usage of these learning theories is crucial in ensuring quality teaching.

Four main characteristics of instructional design based on Seels and Glasgow (1990) are: 1) Selection of content based on field data, 2) Teaching strategies based on theory and research, 3) Data testing based on standard performance level, and 4) Usage of technology to optimise effectiveness, efficiency and cost. Behaviourism theory is suitable for application in multimedia-based TLA since it highlights aspects of students' observable and measurable outputs. Despite that, students' level of knowledge still needs to be determined in deciding the content to be taught. The content must emphasise the fundamental knowledge and use positive consolidation before progressing into much deeper and advanced learning in order to ensure repetitive behaviour.

Behaviourism perspective, in brief, is the theory that focuses on the change of behaviour which is affected by environment (Surina Akmal, 2015). Skinner (1974) and Thorndike (1979) highlighted the aspects of behaviour affirmation in that behaviour will become habit when consistently given comforting affirmation and consolidation. Based on Madar and Yunos (2005), this theory focuses on the process of understanding and gaining knowledge through information processing such as discussion, reasoning, problem solving and brainstorming activities. This theory is also closely related to the information storing process. In contrast, cognitivism psychology stated that learning involves memory usage, motivation and thought; as mentioned by Alzaghoul (2012). Alzaghoul (2012) also stated that software designers must abide by certain rules, such as considering various student learning strategies in the activities embedded in the software. Even the teaching strategies must go through the T&L process, and highlight important information and content (Hung, 2001). Besides that, software designers must integrate new information, and current information available from long-term memory, to activate the current cognitive capability. Learning contents are divided into several small lessons to avoid cognitive load. Linear lessons, non-linear lessons, spider map, and mind map should be prepared if there are more than five or six items expected to be learned (Anderson & Elloumi, 2004).

Constructivism theory is based on self-experience which focuses on the students' active process in creating new knowledge and concepts. Jonassen et al. (1995) in Yusup and Razmah (2006) mentioned four principles to create constructive learning environment which are: (a) context, (b) knowledge construction, (c) collaboration, and (d) discussion. Based on this theory, the learning environment being created is the real learning environment (Mahmud et al., 2007). This is because the correct learning environment is important in the learning process and students are the main focus based on constructivism theory. Moreover, several factors ensure the learning theories are being applied in electronic learning, of which the instructor must prepare online instructions allowing students to create their own knowledge. If instructors provide samples and case studies of the theoretical information, then learning would be even more meaningful for the students (Alzaghoul, 2012; Noornajihan et al., 2018).

Development of Multimedia Model Based TLA

In alignment with the Industrial Revolution 4.0 which is based on information and communications technology (ICT) development, educational development emphasises on cultivating and empowering ICT among students (Muhammad Nazir, 2017). Multimedia-based learning prepares five types of interactive multimedia in the learning environment: text, video, sound, graphic, and animation. Media-based learning modes are interactive and non-linear; both teacher and student are free to choose the next action. Multimedia-Based learning concepts could be applied by using interactive learning software. Referring to Hanis Najwa et al. (2014), multimedia technology usage could be applied to overcome the weaknesses in the T&L process. This is because multimedia-based learning is the information flow between students and their environment via a computer. TLA motivates students, encourages independent learning, and improves the quality of an education programme. Appropriate learning strategies are also important to ensure student understanding on certain topics. Even though many learning strategies are available, the lack of learning software that fulfil the needs of students with various backgrounds, has caused ineffective learning software usage (Ahmad et al., 2010). Therefore, TLA preparation for learning must be equally developed to help improve the knowledge and understanding of the minority students with disabilities (Nurutthoilah, 2018).

The ASSURE model is also popular among software designers or teaching material developers. ASSURE models are based on six steps starting with learners' analysis step, followed by objective statement; method, media and material selection; media and material utilisation; learners' participation requirement; and finally, evaluation and revision (Heinich, 1982). Zaleha and Suhanim (2010) showed that by using the ASSURE model in the website they developed, they managed to produce good materials in terms of content, evaluation, response, self-learning, learning community, interface, pedagogy, and

navigation. Zamri and Nur Aisyah (2011) also developed computer-aided learning software in their study, using the ASSURE model combined with the model by Hanaffin and Peck. They found that the software developed enhanced the classroom teaching process by making it more flexible and effective.

Next, the ADDIE model incorporates five phases which are analysis, design, development, implementation (execution) and evaluation. This model is one of the teaching design models which are systematic in producing user-friendly and effective computerized learning materials (Baharuddin et al., 2002; Noornajihan et al., 2018). Hence, software using the ADDIE model that has been developed by designers, and used as additional learning tools, managed to give positive impact. As an example, Abd. Wahid and Mohammad Faizal (2010) applied the ADDIE design model in their software and found that their software fulfils the interactive multimedia characteristics and met the stated objectives. The same thing happened with the study by Noornajihan et al. (2018) and Megat Aman et al. (2010). The ADDIE model used managed to attract students' attention to the T&L process.

I-TALK PISMEN

I-Talk PISMEN is a software that incorporates and adapts the whole syllabus from the National School Islamic Education Book. This textbook is the main reference book for the Islamic Education subject in primary schools throughout Malaysia. The textbook content is appropriately audiolised in the form of dialogue, singing, storytelling and others. It can be used by both students and teachers and functions as a software-based TLA for students with visual impairment that can be accessed by all typical students (Noornajihan et al., 2018).

The developed software has several unique features such as based on the integration of transmitted and intellectual knowledge (*naqli* and *aqli* respectively); uses one of the 21st century learning methods which is computerised technology; disabled-friendly; and has interactive content presentation (Noornajihan et al., 2018).

METHODOLOGY

This research uses qualitative approach; combining document and interview analysis method. Reading materials related to multimedia software development and design principles were analysed to gain the overall view of the I-TALK PISMEN software design proposal. Researchers even used semi-structured interviews as a data collection method. Therefore, this qualitative approach is appropriate to be used in this study, because the qualitative data collection has evolved design findings, and is able to produce various data from the real setting (Zanaton et al., 2016). In addition, qualitative studies are also influenced

by several factors, such as individual differences in terms of life experiences and different understandings (Crawford & Irving, 2009; Strauss & Corbin, 1998). This refers to the purposive sampling used in this study. It was conducted on three experts including two personnel with visual impairment and a teacher teaching Special Education Secondary School Islamic Education subject. This is because relationships between researcher and research participants are more open through this method because of the minimal number of interviewees. In addition, qualitative design can help the study be carried out thoroughly and in depth as this design mostly generates detailed, open and profound information (Patton, 1990).

Qualitative designs were in the form of words and not numbers (Connaway & Powell 2010; Robson 2011). The selection of this method also looks at the disabilities experienced by the research participants. The interview was conducted to gain their precise and detailed opinion on the I-TALK PISMEN design principles. Interview recordings were re-typed into Microsoft Word. During data analysis, researchers used the short form (RP) when referring to research participants. According to Grosshams and Chelimsky (1999), interviews are suitable to gain detailed data from direct respondents. Based on the responses given by the informant, the researcher would then submit further detailed questions to get more in-depth information as needed. This allows informants to feel free in developing their opinions. The data were analysed using thematic analysis, coding and network analysis assisted by computer software ATLAS.ti.

RESULTS

This study involves an interview with three experts including two personnels with visual impairment and a teacher teaching Special Education Secondary School Islamic Education subject. The details of the research participants are as follows:

Table 1
Research Participants' Details

Research Participant	Gender	Status	Category	Occupation	Working Experience
RP 1	Male	Married	Disabled	Psychology & Counselling Officer JKM	10 years
RP 2	Male	Married	Disabled	Teacher	22 years
RP 3	Female	Married	Disabled	Teacher	23 years

Document and interview analysis of the findings showed that three principles need to be given attention in designing a multimedia software; in this context, I-TALK PISMEN. The main characteristics and design principles relevant to the requirements of a student with visual impairment are discussed.

Principle 1: TEXT

Text usage has long existed in the information communication process and is the key element to assist students with visual impairment in gaining information. This is because organised text could help in information acceptance.

Interviews with research participants (RP) also show that text preparation is the necessary criteria to be considered when preparing multimedia based TLA for students with visual impairment. This includes script preparation of which every script prepared must be analysed accordingly to the requirement and suitability of the content presented. This criteria is based on interview with RP 1 who said: "*skrip yang digunakan perlu memenuhi keperluan isi kandungan yang disampaikan"* (the script used must meet the content requirements of the presented content), while RP 2 gave his opinion that: "*penyampaian yang pelbagai perlu digunakan dalam menyampaikan isi kandungan buku teks*" (a variety of presentation should be used to convey the textbook contents). Meanwhile RP 3 thinks that: "*isi kandungan yang diubah suai penyampaiannya perlu memenuhi objektif buku teks Pendidikan Islam*" (the content after modified presentation should meet the objectives of the Islamic Education textbook). The summary of the interview related to principle 1 (text) is shown in Figure 1.

Principle 2: AUDIO

Audio effect is among the effective ways to attract user attention. Various types of audio in a multimedia system can be used; these include recordings, background voice, music, audio special effects and others. According to Hofstetter (2001), the audio principle is divided into several formats:

a. *WAVE,* which is the digital audio format file, stored in digital form with WAV extension.

b. *Musical Instrument Digital Interface* (*MIDI*), which is the more efficient way of recording music. Compared to WAVE, the data capacity produced is far smaller. MIDI is stored in the MID format.

Then, the audio preparation of content presentation must go through proper recording and editing, to ensure the audio and content is clearly and easily presented. This is because according to RP 1: "*intonasi suara yang dirakam perlu sesuai dengan isi kandungan yang hendak disampaikan"* (the intonation of the recorded voice needs to match with the content to be delivered), while

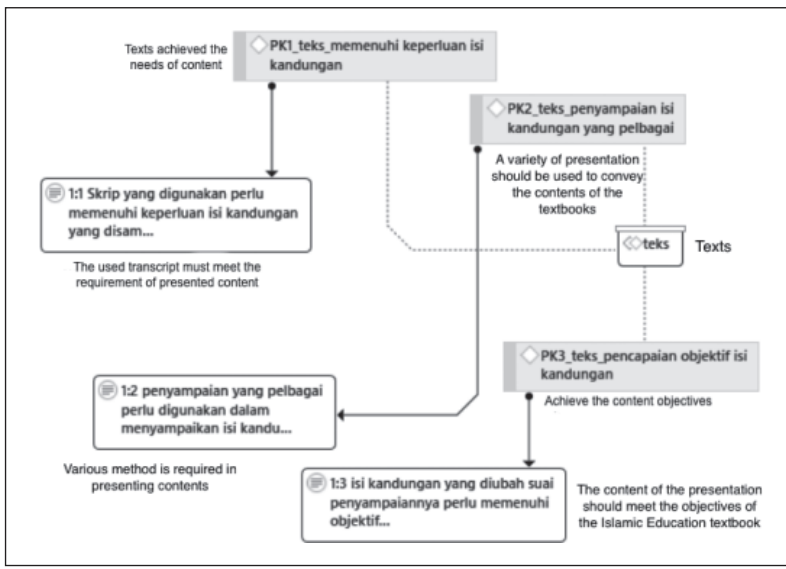

Figure 1. Interview transcript summary.

RP 2 thinks that: *"kejelasan suara sangat penting untuk membantu guru memberi penerangan di dalam kelas"* (Voice clarity is very important to help teachers' explanation in the class). Meanwhile RP 3 also mentioned that: "*suara disertai intonasi yang menarik mampu membuatkan murid lebih berminat mengikuti P&P*" (a voice with compelling intonation can attract students to be more interested in T&L). The summary of the interview findings related to principle 2 (audio) is shown in Figure 2.

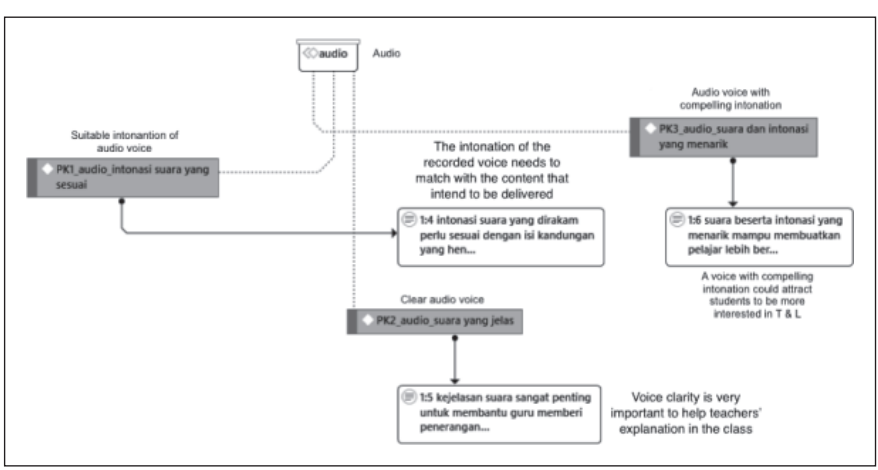

Figure 2. Interview transcript summary.

Principle 3: INTERFACE DESIGN

A good interface design could increase student participation in using software (Faghih et al., 2013; Wang et al., 2010; Zaharias, 2008). This is because interface design plays a major role in improving the look and feel of e-learning and it can influence the way students interact with any software (Reyna, 2009). Apart from that, students' participation could also increase their satisfaction in interacting with a software and further assist in improving their academic performance (Essam & Al-Ammary, 2013). Interface arrangement also plays a key role since users pay full attention when communicating with the software. Arrangement is defined as the layout or positioning of interface elements on interface pages such as images, buttons, icons, links, logo, colour scheme and information architecture (Reyna, 2013; Tomczyk, 2009).

Navigation and interface design preparation of a TLA is essential in making it disabled-friendly, such as using the normal "click" button to help students in the T&L process. This matter is closely related to the opinion given by RP 1: "*reka bentuk navigasi yang konsisten adalah sangat penting bagi membantu OKU penglihatan mengendalikan perisian ini*" (Consistent navigation design is very important to help the visually impaired to operate this software), while RP 2 stated: "*navigasi yang digunakan perlu dibantu oleh kesan bunyi yang sesuai bagi memudahkan murid dalam proses pembelajaran mengikut topik*" (The navigation used should be assisted by appropriate sound effects to facilitate students in the learning process by topic). This is followed by the suggestion by RP 3 that voice navigation must be used: "*butang navigasi yang digunakan dengan rakaman suara membantu memberi arahan yang jelas kepada murid*" (the navigation buttons used with voice recordings help give students clear instructions). Figure 3 shows the summary of the respective interview transcript.

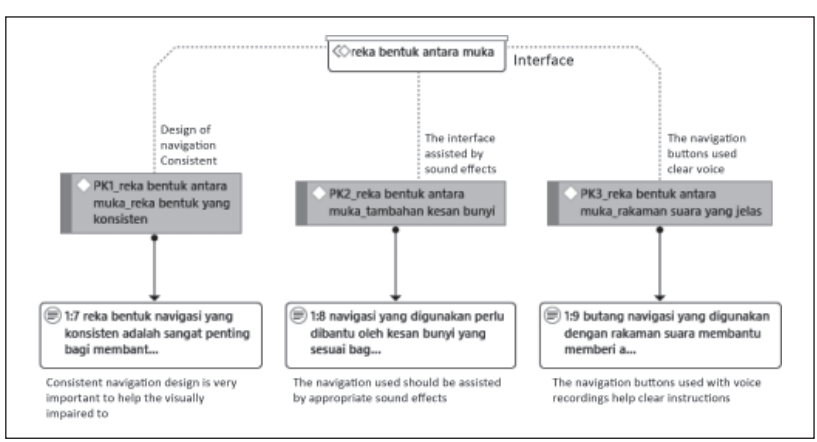

Figure 3. Interview transcript summary.

The following criterion in interface design is the preparation of "*Bookmark*" facility to enable students in handling the software independently. RP 1 mentioned: "*kemudahan "Bookmark" sebagai penanda pelajaran sesudah selesai sesi P&P"* ("Bookmarks" as a lesson guide after the T&L session), while RP 2 supported by saying: "*penggunaan "Bookmark" dalam perisian dapat menjimatkan masa serta melancarkan proses P&P*" (using "Bookmarks" in software can save time and speed up the T&L process). RP 3 also gave her opinion that: *"murid boleh mengulang kaji pelajaran Pendidikan Islam secara kendiri"* (students can revise the Islamic Education lessons independently). Figure 4 shows the summary of the respective interview transcripts.

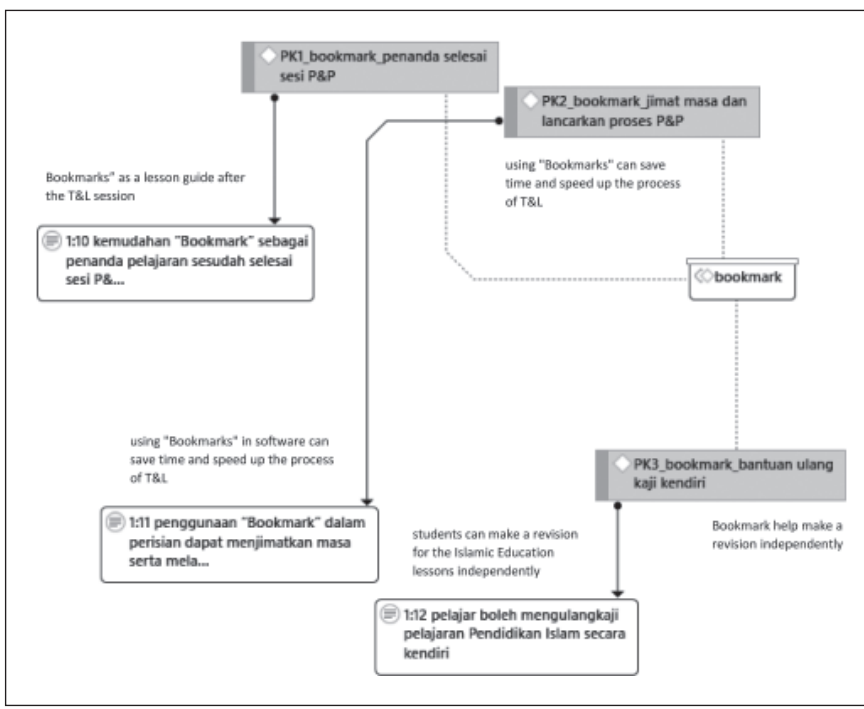

Figure 4. Interview transcript summary.

PROPOSAL OF I-TALK PISMEN PRESENTATION DESIGN

Since it is a medium presented for students with visual impairment, design of the I-TALK PISMEN software was proposed in terms of presentation of text, images, and audio. Presentation design decides the look of the software developed. Display and arrangement of the multimedia elements to be decided involved various aspects such as display size, types of media, display shape

and others. One of the strategies or methods that can be used to draft the students' arrangement and design in an educational software is the nine learning levels by Robert Gagne. Referring to Gagne, the content to be taught must go through each level of information transfer and transformation that happens sequentially in the human mind (Jamalludin Harun & Zaidatun Tasir, 2003). Hence, some of the proposals for the software development are as follows:

Software Front Page

Users, both teacher and students, will be shown a display of Form 1 Islamic Education textbook title and selection display when using I-TALK PISMEN. Using JAWS Screen Reader application, each button in the I-TALK PISMEN audio book represents a specific voice sound. Figure 5 shows the sketch of the users' selection menu.

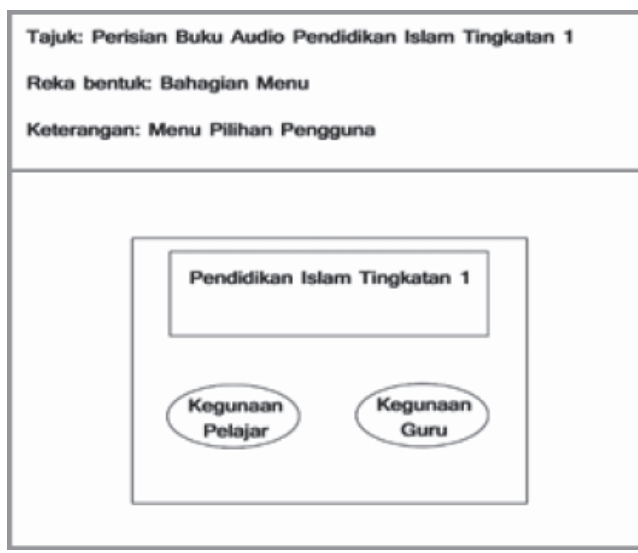

Figure 5. Users' selection menu.

Software Main Menu

Upon selecting user as teacher or student, users will be shown display of I-TALK PISMEN Islamic Education textbook learning menu including Quran, Narrations (*hadith*), Faith, Jurisprudence, Morality, and History. Users can choose to listen to specific sections, with each section containing topics focusing on the lessons to be learned. As an example, the Quran section has nine topics. Users can return to the main menu using the button "*kandungan*" (content). Figure 6 shows the sketch of the main menu.

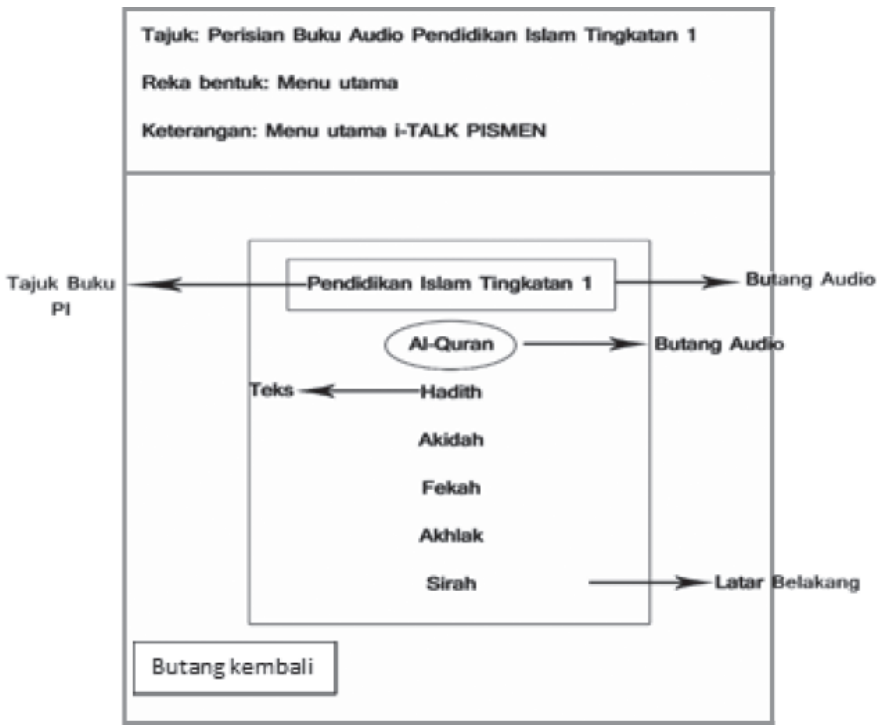

Figure 6. The main menu.

Other than that, buttons used by users fulfil the requirements and differences of the visually impaired. For example, users only need to press the button "enter" to listen to specific topics, with each audio stopping and continuing when the user presses the button "space". Users can press the button "TAB" on the keyboard to change the topics. If users want to quit learning using this software, they can press the "esc" button on the keyboard.

Software Content

The layout sample for each learning section in the Islamic Education book is shown. As an example, the Quran selection menu as shown in Figure 7 has interesting sound effects, which could attract the attention of students with visual impairment to learn even more on Quran. The Quran section has nine small topics, each topic focusing on its own section. Each section has its own presentation, having its own appropriate theme of voice audio and sound effect. Among the approaches used are storytelling, dialogue, poems, and others. Figure 7 shows the sketch of the Quran selection menu.

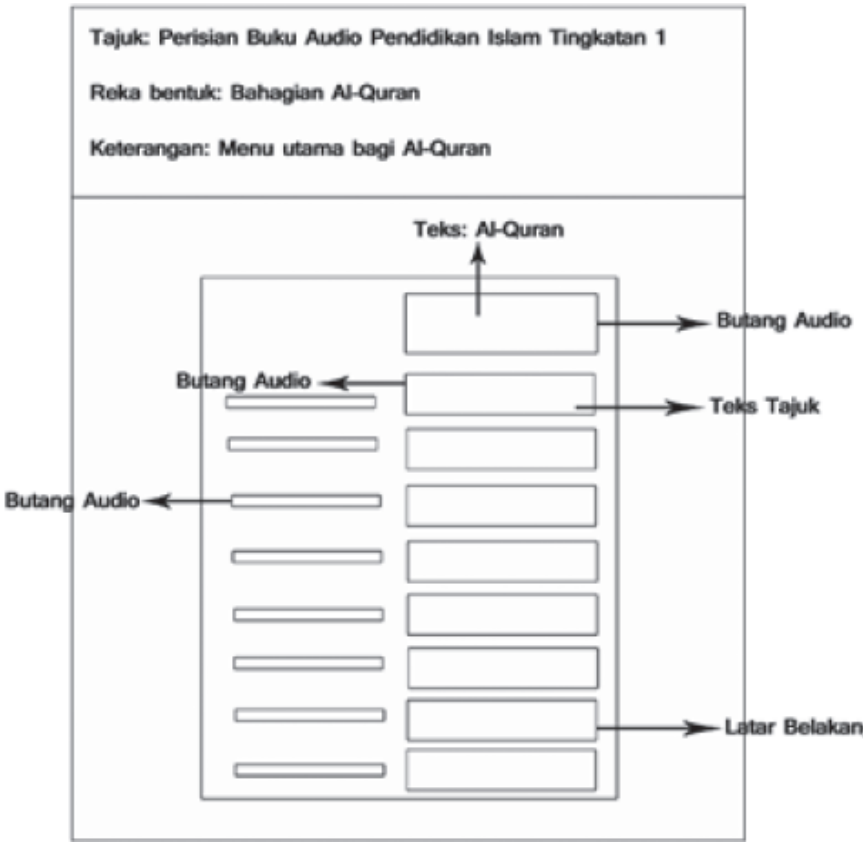

Figure 7. The Qur'an selection menu.

DISCUSSION

This study has identified several principles in developing software based TLA such as text, audio and interface design; specifically for the needs of students with visual impairment. The study is expected to be a huge contribution to al-Quran T&L, especially in the software based TLA that has been developed for students with visual impairment. This is because its multimedia software design theory is suitable and based on individual capability. Appropriate theory application based on individual differences are able to help students in improving their learning performance (Nor Musliza & Mokmin Basri, 2015). As stated by Hamdan and Mohd Yasin (2010), teachers are responsible as educators to educate students according to their background differences and their specific needs, so that students could master the lessons being taught. Basically, TLA

gives an opportunity to students to learn *Pendidikan Islam* subject in other ways besides using Braille textbooks. It is also to convince the students that they can be successful in future. This is because using technology can help students with disabilities to enhance and improve their independence in academic and employment tasks and their participation in classroom discussions, along with helping them to accomplish some difficult academic tasks (Ghaleb Alnahdi, 2014). Thus, they can memorise the content of *Pendidikan Islam* subject. Studies have shown that blind people tend to have ability in memorising something because they can pay more attention than typical persons.

This matter is closely related to the interview conducted with Ustazah Nor Hayati Md Salleh (2017), an Islamic Education teacher from SMKPK Setapak, and Cikgu Zakaria Yahya (2011), President of the Islamic Blind People Society (PERTIS). The findings show that the lack and limitation in reference materials and TLA for students with visual impairment are among the limiting factors in improving the potential of students with visual impairment (Nurutthoilah et al., 2018). Hence, this study could help in preparation of a suitable software design to enhance student performance. Apart from that, this study aligns with the principle of Education for All, supporting the National Education Policy (Special Education) which has been revised to ensure potential students with visual impairment getting the same chance to be inclusively placed in the mainstream classes (Kementerian Pelajaran Malaysia, 2012).

CONCLUSION

In conclusion, this study has proven that the aspects of software design process and requirements of students with special needs, should be strongly considered in developing a software-based TLA. Researchers have found out how crucial the fundamental theories and guidelines are in developing software-based TLA, especially for the visually impaired. This is because it can give a maximum impact in the T&L process, hence assisting the teacher to effectively and attractively transfer knowledge and skills. Therefore, it is hoped that this study could be a guideline and contribute to other researchers in developing even more TLAs in future. This study has added to the literature on TLA for the visually impaired and perhaps will inspire further research in this area; more software-based TLAs are needed to fulfil the students' needs and cater to differences, especially for students with visual impairment and students with disabilities in general.

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